

Project Manual

For

Imperial Community College District B600 College Center Expansion

ICCD 380 E Aten Road, Imperial, CA. 92251

Project Specifications

for the

Imperial Valley Community College District
380 E Aten Road, Imperial, CA. 92251

December 8, 2020

PBK Project No.: 20190

DSA Application No.: 04-119487

ICCD B600 Campus Center Expansion

Imperial Community College District

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT

APP: 04-119487 INC:
REVIEWED FOR
SS FLS ACS

DATE: 02/01/2021



Consultants:

Architect:

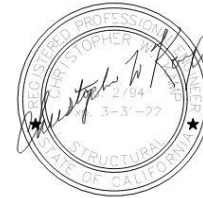
PBK
11455 El Camino Real
Suite 480
San Diego, CA 92130
Phone: (858) 695-0400

Civil:

Latitude 33
9968 Hibert Street
2ND Floor
San Diego, CA. 92131
Phone: (858) 875-1702

Structural:

SDSE Structural Engineers
3838 Camino Del Rio North
Suite 110
San Diego, CA. 92108
Phone: (619) 297-2223



Mechanical/Plumbing:

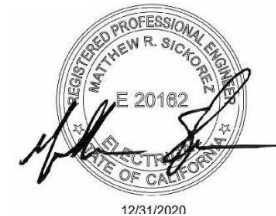
LEAF Engineering
3110 E Guasti Road
Suite 300
Ontario, CA. 91761
Phone: (909) 937-9200

Electrical/Fire Alarm:

LEAF Engineering
3110 E Guasti Road
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Technology:

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SECTION 01 10 00 SUMMARY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Phased construction.
 - 4. Work by Owner.
 - 5. Work under separate contracts.
 - 6. Future Work.
 - 7. Purchase contracts.
 - 8. Owner furnished products.
 - 9. Owner furnished, Contractor installed products.
 - 10. Access to site.
 - 11. Coordination with occupants.
 - 12. Work restrictions.
 - 13. Specification and Drawing conventions.
 - 14. Miscellaneous provisions.

1.3 PROJECT INFORMATION

- A. Project Identification:
 - 1. Project Location: **Imperial Valley College**
380 E Aten Road
Imperial, CA 92251
- B. Owner: Imperial Community College District
 - 1. Owner's Representative: Joe Jackson
- C. Architect: **PBK Architects**
11455 El Camino Real
Suite 480
San Diego, CA 92130
- D. Consultants: Additional design professionals have been retained who have prepared designated portions of the Contract Documents. Refer to "stamp" page this project manual.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
The expansion of the existing Campus Center Building 600.

1.5 WORKSEQUENCE

- A. The Work shall be completed according to the Project schedule set forth below.

- B. Occupancy: The Project may be occupied by District staff as shown below. If so, the premises will be occupied whether or not the Work is completed, regardless of time extensions (if any).
- C. Any Work performed after this date will need to be fully coordinated with District and will be limited to after school hours or on weekends.

1.6 WORK BY OWNER AND UNDER SEPARATE CONTRACTS

- A. The Owner reserves the right to let separate contract for work outside of the scope of this Contract. Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1.7 ACCESS TO SITE

- A. Use of Site:
 - 1. Limit use of Project site to Work in areas and areas within the Contract limits indicated. Do not disturb portions of site beyond areas in which the Work is indicated:
 - a. Limits: The Drawings indicate the limits of the construction operations.
 - b. Driveways, Walkways, and Entrances:
 - 1) Keep driveways, parking areas, student drop off and pick up points, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, the students, and emergency vehicles at all times. Do not use these areas for parking or storage of materials:
 - a) Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b) Schedule deliveries to minimize space and time requirements for storage of materials and equipment onsite.
- B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in weathertight condition throughout construction period. Repair damage caused by construction operations.
- C. COVID-19 Conditions: Contractors must conform, and ensure that all subcontractors and other Project personnel, including but not limited to; workers and site visitors, conform to all regulations, limitations, and requirements as put forth and recommended by Associated General Contractors of California (AGC), State of California Guidance on Outbreak of 2019 Novel Coronavirus (2019-nCoV) in Wuhan, China, and local Health Department agencies.

1.8 COORDINATION WITH OCCUPANTS

- A. Owner Limited Occupancy of Completed Areas of Construction:
 - 1. Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work:
 - a. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
 - b. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
 - c. Before limited Owner occupancy, ensure mechanical and electrical systems are fully operational, and required tests and inspections and start up procedures are

- successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
- d. Upon occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.9 WORK RESTRICTIONS

- A. Work Restrictions: Comply with restrictions on construction operations. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On Site Work Hours: Limit Work in the existing building to normal working hours, Monday through Friday, unless otherwise indicated. Coordinate with Owner when it is necessary to extend working hours or Work on weekends.
- C. Existing Utility Interruptions:
 1. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and after providing temporary utility services according to requirements indicated:
 - a. Notify Owner not less than two (2) weeks in advance of proposed utility interruptions.
 - b. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors:
 1. Coordinate operations that result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner:
 - a. Notify Owner not less than two (2) weeks in advance of proposed disruptive operations.
 - b. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Controlled Substances, Firearms, and Explosive Devices: Use of tobacco products, controlled substances, firearms, and explosive devices on the site is not permitted.
- F. Employee Identification: Provide identification tags for Contractor personnel working on site. Require personnel to use identification tags at all times.
- G. Employee Screening:
 1. Comply with Owner's requirements for drug and background screening of Contractor personnel working on site:
 - a. Maintain list of approved screened personnel with Owner's representative.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content:
 1. The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - a. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - b. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Drawing Coordination:
 1. Requirements for materials and products identified on Drawings are described in detail

in the Specifications. One or more of the following are used on Drawings to identify materials and products:

- a. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
- b. Abbreviations: Materials and products are identified by abbreviations.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 10 00

SECTION 01 25 00 SUBSTITUTION PROCEDURES AND FORM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for substitutions.

1.3 DEFINITIONS

- A. Products: Items purchased for incorporation in the Work, regardless if specifically purchased for the Project or taken from Contractor's previously purchased stock. The term *product* is inclusive for material, equipment, assembly, system, and other terms of similar intent.
- B. Substitutions:
 - 1. Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor:
 - a. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - b. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 SUBMITTALS

- A. Substitution Requests:
 - 1. Submit three (3) copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles:
 - a. Substitution Request Form: Use facsimile of form provided in Project manual.
 - b. Documentation:
 - 1) Show compliance with requirements for substitutions and the following, as applicable:
 - a) Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b) Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, which are necessary to accommodate proposed substitution.
 - c) Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d) Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e) Samples, where applicable or requested.

- f) Certificates and qualification data, where applicable or requested.
 - g) List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i) Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j) Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k) Cost information, including a proposal of change, if any, in the Contract Sum.
 - l) Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m) Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
2. Architect's Action:
- a. If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later:
 - 1) Forms of acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - 2) Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.
- B. Coordination: Revise or adjust affected Work as necessary to integrate Work of the approved substitutions.

PART 2 PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions: Substitutions are considered as changes to the Drawings and shall be submitted to DSA.
- B. Substitutions for Cause:
 - 1. Submit requests for substitution immediately on discovery of need for change, but not later than 30 days prior to time required for preparation and review of related submittals:
 - a. Conditions:
 - 1) Architect will consider Contractor's request for substitution when the following

conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

- a) Requested substitution is consistent with the Contract Documents and will produce indicated results.
- b) Substitution request is fully documented and properly submitted.
- c) Requested substitution will not adversely affect Contractor's Construction Schedule.
- d) Requested substitution has received necessary approvals of authorities having jurisdiction.
- e) Requested substitution is compatible with other portions of the Work.
- f) Requested substitution has been coordinated with other portions of the Work.
- g) Requested substitution provides specified warranty.
- h) If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

C. Substitutions for Convenience:

1. Architect will consider requests for substitution if received prior to the Award of the Contract. Requests received after that time may be considered or rejected at discretion of Architect:

a. Conditions:

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

PART 3 EXECUTION (NOT USED)

REQUEST FOR SUBSTITUTION

Contract Award Date:

To:

Substitution Requested By:

Project Name and Number:

We submit for consideration the following product in lieu of the specified item for the above Project:

| Drawing No. | Specification Section | Paragraph | Specified Item |
|-------------|-----------------------|-----------|----------------|
|-------------|-----------------------|-----------|----------------|

| | | | |
|-------|-------|-------|-------|
| <hr/> | <hr/> | <hr/> | <hr/> |
|-------|-------|-------|-------|

Proposed Substitution:

Request is made during ____ bidding ____ construction period.

Submit in accordance with Section 01 33 00: Submittal Procedures.

1. Technical data, cost, and time information relating to changes to Construction Documents required by proposed substitution.
2. Detailed comparison of proposed substitution and specified product including but not limited to warranty, significant variations, qualifications of manufacturers, and maintenance.
3. Complete technical data, detailed shop drawings, samples, installation procedures, warranty, and substantiating data marked to indicate equivalent quality and performance to that specified. Manufacturer sell sheets are not acceptable submittals.

Cause for Request:

Cost saving realized by Owner:

Does substitution affect adjacent Work, Construction Documents, cost, schedule, quality, and related submittals?

Yes ____ No ____ On separate sheet, explain affects to the Work, documents, schedule, and submittals.

Contractor is responsible for associated costs and additional time of the proposed substitution including costs incurred by the Architect for evaluation of substitution and changes to the documents. Describe costs for changes to design, including engineering and detailing costs caused by the requested substitution.

Warranty: Is the warranty for the requested substitution the same or different? Yes ___ No ___

Explain Differences:

Contractor Certification:

In making a request for substitution, Contractor certifies that:

1. The proposed substitution has been thoroughly researched and evaluated and determined as equivalent or superior to specified product or material, will fit into space provided, and is compatible with adjacent materials.
2. It will provide the same or better warranty for the proposed substitution at no additional cost to the Owner.
3. Cost data is complete and includes related costs under the Contract. Claims for additional costs related to the proposed substitution that may subsequently become apparent are waived.
4. It will assume the responsibility for delays and costs caused by the proposed substitution, if approved, are accepted by Contractor unless delays are and costs are specifically mentioned and approved in writing by the Owner and the Architect.
5. It will assume the liability for the performance of the substitution and its performance.
6. The installation of the proposed substitution is coordinated with the Work and with changes required for the Work.
7. It will reimburse the Owner and Architect for evaluation and redesign services associated with the substitution request and, when required, by approval by governing authorities.

Submitted by:

| | |
|-------------------------|-------|
| Signature of Contractor | Title |
| Firm | Date |

Signature shall be by the individual authorized to legally bind Contractor to the above terms. Failure to provide legally binding signature will result in retraction of approval.

FOR USE BY ARCHITECT:

Accepted Accepted as Noted
 Not Accepted Received Too Late

FOR USE BY OWNER:

Accepted Not Accepted

By: _____ By: _____

Date: _____ By: _____

Remarks: _____ Remarks: _____

END OF SECTION 01 25 00

SECTION 01 26 00 CONTRACT MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Section:
 - 1. Section 01 25 00: Substitution Procedures and Form.
- C. Minor Changes in the Work:
 - 1. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710 *Architect's Supplemental Instructions*.

1.3 PROPOSAL REQUESTS

- A. Owner Initiated Proposal Requests:
 - 1. Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications:
 - a. Work Change Proposal Requests issued by Architect are not instructions either to stop Work in progress or to execute the proposed change.
 - b. Within time specified in Proposal Request after receipt of Proposal Request, submit quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change:
 - 1) Include list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 2) Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 3) Include costs of labor and supervision directly attributable to the change.
 - 4) Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor Initiated Proposals:
 - 1. If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect:
 - a. Include statement outlining reasons for the change and the effect of the change on the Work. Provide complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - b. Include list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - c. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade

discounts.

- d. Include costs of labor and supervision directly attributable to the change.
- e. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- f. Comply with requirements in Section 01 25 00: Substitution Procedures and Form if the proposed change requires substitution of one product or system for product or system specified.
- g. Proposal Request Form: Use AIA Document G709.

1.4 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive:
 - 1. Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order:
 - a. Construction Change Directive contains a complete description of change in the Work and designates the method to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of Work required by the Construction Change Directive. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 26 00

SECTION 01 29 00 PAYMENT PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

- A. Pencil Copy: A copy submitted prior to a final/official.
- B. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination:
 - 1. Coordinate preparation of the schedule of values with preparation of Contractor's Construction Schedule:
 - a. Coordinate line items in the schedule of values with administrative forms and schedules, including the following:
 - 1) Application for Payment forms with continuation sheets.
 - 2) Updated submittal schedule.
 - 3) Items required to be indicated as separate activities in updated Contractor's Construction Schedule.
 - b. Submit the schedule of values to Architect at earliest possible date, but no later than seven (7) days before the date scheduled for submittal of initial Applications for Payment. Contractor's standard form or electronic media printout will be considered but must be approved by Owner.
- B. Format and Content:
 - 1. Use Project manual table of contents as a guide to establish line items for the schedule of values. Provide at least one (1) line item for each Specification Section:
 - a. Identification:
 - 1) Include the following Project identification on the schedule of values:
 - a) Project name and location.
 - b) Name of Architect.
 - c) Architect's Project number.
 - d) Contractor's name and address.
 - e) Date of submittal.
 - 2. Arrange schedule of values consistent with format of AIA Documents G702/G703.
 - 3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of Subcontractor.

- d. Name of manufacturer or fabricator.
- e. Name of supplier.
- f. Change Orders (numbers) that affect value.
- g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent (.01%), adjusted to total 100 percent:
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment rentals.
 - 4) General Conditions:
 - a) Supervisor.
 - b) Submittals.
 - c) Closeout.
 - d) Field Engineering.
 - e) Daily Clean-up.
 - f) Final Clean-up.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed:
 - a. Differentiate between items stored on site and items stored off site. Include evidence of insurance.
6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line item value of unit cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item:
 - a. Temporary facilities and other major cost items that are not direct cost of actual Work in place may be shown either as separate line items in the schedule of values or distributed as general overhead expense.
8. Schedule updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATION FOR PAYMENT

- A. Submit preliminary (pencil) copy of proposed values to PBK Construction Field Representative and Owner for review by the 20th of the month. Allow four (4) days for comments. Schedule review of the pencil copy during bi-monthly site visits.
- B. Once preliminary (pencil) approved, submit four (4) notarized originals of each application on AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet for G702 or other similar form approved by Owner.
- C. Content and Format: Utilize schedule of values for listing items in Application for Payment.
- D. Submit updated construction or recovery schedule with each Application for Payment.
- E. Payment Period: Submit at intervals stipulated in Owner/Contractor Agreement. Include Supplementary Conditions of the Contract.
- F. Only materials stored on the Project site shall be paid for unless the materials are stored in a bonded warehouse agreed upon by Owner. Periodic review of stored item will be required by the inspector of record.
- G. Substantiating Data:

1. When Architect/Engineer requires substantiating information, submit data justifying dollar amounts in question. Items that may be requested by Architect or Owner to substantiate costs include, but are not limited to the following:
 - a. Current Record Documents as specified in Section 01 77 00: Closeout Procedures.
 - b. Labor time sheets, purchase orders, or similar documentation.
 - c. Affidavits attesting to products stored off-site.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 29 00

SECTION 01 29 73 SCHEDULE OF VALUES - SAMPLE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes: Schedule of values listing to be edited by Contractor of description of Work, not scheduled value, Work completed, stored materials, total complete, percentage, balance to finish, and retainage. These parts must remain intact.
- B. Related Sections:
 - 1. Section 01 29 00: Payment Procedures.

1.3 DEFINITIONS

- A. Pencil Copy: A copy submitted prior to a final/official submission on a monthly basis.
- B. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

This is a sample illustration:

| Item No. | Description of Work | Scheduled Value | Work Completed | | Stored Materials | Total Completed | % | Balance To Finish | Retainage |
|----------|--|-----------------|----------------|-----------|------------------|-----------------|---|-------------------|-----------|
| | | | Previous App. | This App. | | | | | |
| | Div. 1 - General Reqs. Site Work General Conditions Supervision Mobilization Bonds & Insurance Permits Contractor's Fee Closeout Documents | | | | | | | | |
| | Div. 1 - Total | | | | | | | | |
| | Div. 2 - Existing Conditions Demolition (As applicable) Erosion Control Div. 2 - Total | | | | | | | | |
| | Div. 3 - Concrete Drill Piers Caps & Beams Slab on Grade Cooling Tower Basin Misc Bldg Conc Floor Sealer Rebar Matl Rebar Labor Lt.Wt.Insul Fill - Materials | | | | | | | | |

| | | | | | | | | |
|---|--|--|--|--|--|--|--|--|
| Lt.Wt.Insul Fill - Labor Submittals/Closeout Documents Supervision Clean-up | | | | | | | | |
| Div. 3 - Total Div 4 - Masonry Brickwork - Labor Brickwork - Matls Concrete Masonry - Labor Concrete Masonry - Materials Str. Glazed Tile-Labor Str. Glazed Tile-Materials Submittals/Closeout Documents Supervision Clean-up | | | | | | | | |
| Div. 4 - Total | | | | | | | | |
| Div 5 - Metals Structural Steel - Labor Structural Steel - Materials Alternating Stairs Misc. Steel - Materials Steel Joists - Materials Lt. Gauge Steel Framing-Labor Lt. Gauge Steel Framing-Matls Metal Decking - Labor Expansion Joint Covers | | | | | | | | |

| Item No. | Description of Work | Scheduled Value | Work Completed | | Stored Materials | Total Completed | % | Balance To Finish | Retainage |
|----------|---|-----------------|----------------|-----------|------------------|-----------------|---|-------------------|-----------|
| | | | Previous App. | This App. | | | | | |
| | Detailing Submittals/Closeout Documents Supervision Clean-up | | | | | | | | |
| | Div. 5 - Total | | | | | | | | |
| | Div. 6 - Wood & Plastics Rough Carpentry - Labor Rough Carpentry - Materials Millwork - Labor Millwork - Materials Submittals/Closeout Documents | | | | | | | | |
| | Div. 6 - Total | | | | | | | | |
| | Div. 7 - Thermal and Moisture Protection Waterpfng / Dampprfng-Matls Waterpfng / Dampprfng-Labor Building Insulation - Labor Building Insulation - Materials Fireproofing - Labor Fireproofing - Materials Metal Roof - Labor Metal Roof - Materials Metal Roof Guarantee Built-up Roofing-Labor Built-up Roofing-Materials Built-up Roofing Guarantee Roof Accessories Building Sheet Metal - Labor Building Sheet Metal - Matls | | | | | | | | |

| | | | | | | | | |
|--|--|--|--|--|--|--|--|--|
| Bldg. Sheet Metal Guarantee Roof Curbs Roof Hatches Sealants Submittals/Closeout Documents Supervision Clean-up | | | | | | | | |
| Div. 7 - Total | | | | | | | | |
| Div. 8 - Doors and Frames Finish Carpentry/Door - Labor Finish Hardware - Matls Thresholds & Seals - Matls+B66 Hollow Metal Doors & Frames - Matls Plastic Faced Doors-Matls Overhead Doors & Grilles- Labor Overhead Doors & Grilles - Matls Alum. Entrances & Store- fronts - Labor | | | | | | | | |

| Item No. | Description of Work | Scheduled Value | Work Completed | | Stored Materials | Total Completed | % | Balance To Finish | Retainage |
|----------|--|-----------------|----------------|-----------|------------------|-----------------|---|-------------------|-----------|
| | | | Previous App. | This App. | | | | | |
| | fronts - Matls Alum. Windows - Labor Alum Windows - Matls Glass & Glazing-Labor Glass & Glazing-Matls Submittals/Closeout Documents Supervision Clean-up | | | | | | | | |
| | Div. 8 - Total | | | | | | | | |
| | Div. 9 - Finishes Lath & Plaster-Labor Lath & Plaster-Matls Gypsum Wallboard Systems - Labor Gypsum Wallboard Systems - Matls Ceramic Tile - Labor Ceramic Tile - Matls Quarry Tile - Labor Quarry Tile - Matls Terrazzo-Labor Terrazzo-Matls Acoustic Ctg. - Labor Acoustic Ctg. - Matls Acoustic Wall Panels Resilient Flooring - Labor Resilient Flooring - Matls Carpet - Labor Carpet - Matls Athletic Flooring - Materials Athletic Flooring - Labor Floor Sealer Painting - Labor Painting - Mtls Submittals/Closeout Documents | | | | | | | | |

| | | | | | | | | | |
|---|--|--|--|--|--|--|--|--|--|
| Supervision Clean-up | | | | | | | | | |
| Div. 9 - Total | | | | | | | | | |
| Div. 10 - Specialties | | | | | | | | | |
| Visual Display Boards & Tackboards - Materials | | | | | | | | | |
| Visual Display Boards & Tackboards - Labor | | | | | | | | | |
| Toilet Partitions - Labor | | | | | | | | | |
| Toilet Partitions - Mats | | | | | | | | | |
| Louvers | | | | | | | | | |
| Aluminum Flag Pole | | | | | | | | | |
| Graphics | | | | | | | | | |
| Lockers | | | | | | | | | |
| Cubicle Curtains & Track | | | | | | | | | |
| Fire Extinguisher Cabinets | | | | | | | | | |
| Demountable Partitions-Labor | | | | | | | | | |

| Item No. | Description of Work | Scheduled Value | Work Completed | | Stored Materials | Total Completed | % | Balance To Finish | Retainage |
|----------|--|-----------------|----------------|-----------|------------------|-----------------|---|-------------------|-----------|
| | | | Previous App. | This App. | | | | | |
| | Demountable Partitions-Matls Shelving Toilet Room Accessories-Matls Toilet Room Accessories-Lbr Submittals/Closeout Documents Supervision Clean-up | | | | | | | | |
| | Div. 10 - Total | | | | | | | | |
| | Div. 11 - Equipment Stage Curtains Misc. Appliances Food Service Eqpt-Labor Food Service Eqpt-Matls Submittals/Closeout Documents Supervision Clean-up | | | | | | | | |
| | Div. 11 - Total | | | | | | | | |
| | Div. 12 - Furnishings Horizontal Blinds Projection Screens Casework - Labor Casework - Matls Science Casework - Labor Science Casework - Matls Submittals/Closeout Documents Supervision Clean-up | | | | | | | | |
| | Div. 12 - Total | | | | | | | | |
| | Div. 13 - Specialties Stage Curtains and Draperies Music Instrument Storage Bleachers Press Box Pre-eng. Metal Bldg. Stadium Seating Submittals/Closeout Documents Supervision Clean-up | | | | | | | | |
| | Div. 13 - Total | | | | | | | | |
| | Div. 14 - Conveying Systems Platform Lifts Elevators Submittals/Closeout Documents Supervision Clean-up | | | | | | | | |
| | Div. 14 - Total | | | | | | | | |
| | Div. 21, 22 - Plumbing Shop Drawings As-Builts/Closeout/ O&M Manuals Sanitary Underground - | | | | | | | | |

| Item No. | Description of Work | Scheduled Value | Work Completed | | Stored Materials | Total Completed | % | Balance To Finish | Retainage |
|----------|---|-----------------|----------------|-----------|------------------|-----------------|---|-------------------|-----------|
| | | | Previous App. | This App. | | | | | |
| | Labor Sanitary Underground - Matts Storm Underground - Labor Storm Underground - Matts Domestic Water - Labor Domestic Water - Matts Plumbing Insulation - Matts Plumbing Insulation - Labor Gas Piping - Matts Gas Piping - Labor Grease Trap Plumbing Fixtures - Matts Plumbing Fixtures - Labor Coordination Drawings Submittals/Closeout Documents Supervision Clean-up | | | | | | | | |
| | Div. 21, 22 Plumbing - Total | | | | | | | | |
| | Div. 23 - Mechanical Shop Drawings As-Builts/Closeout/ O&M Manuals Chillers - Matts Chillers - Labor Cooling Towers - Matts Cooling Towers - Labor Boilers - Matts Boilers - Labor AHU's - Matts AHU's - Labor Fans - Matts Fans - Labor Grilles - Matts Grilles - Labor Ductwork - Matts Ductwork - Labor Pumps - Mtl Pumps - Labor Water Treatment - Labor Water Treatment - Matts Isolation - Labor Isolation - Matts Pipe Flex - Matts Pipe Flex - Labor Connections Sheet Metal - Matts Sheet Metal - Labor Duct Insulation - Matts Duct Insulation - Labor | | | | | | | | |

| Item No. | Description of Work | Scheduled Value | Work Completed | | Stored Materials | Total Completed | % | Balance To Finish | Retainage |
|----------|------------------------------------|-----------------|----------------|-----------|------------------|-----------------|---|-------------------|-----------|
| | | | Previous App. | This App. | | | | | |
| | Pipe Insulation - Matls | | | | | | | | |
| | Pipe Insulation - Labor | | | | | | | | |
| | VAV Boxes - Materials | | | | | | | | |
| | VAV Boxes - Labor | | | | | | | | |
| | Refrigerant Monitor - Matls | | | | | | | | |
| | Refrigerant Monitor - Labor | | | | | | | | |
| | Unit Heaters - Materials | | | | | | | | |
| | Unit Heaters - Labor | | | | | | | | |
| | Startup | | | | | | | | |
| | Controls - Matls | | | | | | | | |
| | Control - Labor | | | | | | | | |
| | Engineer / Submittals | | | | | | | | |
| | Modules / End Devices | | | | | | | | |
| | Low Voltage Wiring | | | | | | | | |
| | Startup | | | | | | | | |
| | Closeout Documents | | | | | | | | |
| | Fire Sprinkler | | | | | | | | |
| | Engineer / Submittals | | | | | | | | |
| | Piping - Materials | | | | | | | | |
| | Piping - Labor | | | | | | | | |
| | Equipment - Materials | | | | | | | | |
| | Equipment - Labor | | | | | | | | |
| | Trimout - Materials | | | | | | | | |
| | Trimout - Labor | | | | | | | | |
| | Pipe, Valves, Fittings - Labor | | | | | | | | |
| | Pipe, Valves, Fittings - Matls | | | | | | | | |
| | Misc. - Matls | | | | | | | | |
| | Insulation - Matls | | | | | | | | |
| | Insulation - Labor | | | | | | | | |
| | Sanitary Above Slab-Labor | | | | | | | | |
| | Sanitary Above Slab-Matls | | | | | | | | |
| | Storm Above Slab - Labor | | | | | | | | |
| | Storm Above Slab - Matls | | | | | | | | |
| | Gas - Labor | | | | | | | | |
| | Gas - Matls | | | | | | | | |
| | Fixtures - Labor | | | | | | | | |
| | Fixtures - Matls | | | | | | | | |
| | Permits | | | | | | | | |
| | Coordination Drawings | | | | | | | | |
| | Submittals/Closeout Documents | | | | | | | | |
| | Supervision Clean-up | | | | | | | | |
| | Div. 23 Mechanical - Total | | | | | | | | |
| | Div. 26 - Electrical | | | | | | | | |
| | Mobilization+B220 | | | | | | | | |
| | Shop Drawings | | | | | | | | |
| | As-Builts/Closeout/ O&M Manuals | | | | | | | | |
| | Underground | | | | | | | | |
| | Conduit - Labor | | | | | | | | |
| | Conduit - Matl | | | | | | | | |
| | Wire - Labor | | | | | | | | |

| Item No. | Description of Work | Scheduled Value | Work Completed | | Stored Materials | Total Completed | % | Balance To Finish | Retainage |
|----------|--|-----------------|----------------|-----------|------------------|-----------------|---|-------------------|-----------|
| | | | Previous App. | This App. | | | | | |
| | Wire - Mats Feeder Wire - Labor Feeder Wire - Mats Switches/Recpt. Switchgear - Labor Switchgear - Mats Temporary - Materials Temporary - Labor Gas Generator - Materials Gas Generator - Labor Fixtures - Labor Fixtures - Mats Communications - Labor Communications - Mats Fire Alarm - Labor Fire Alarm - Mats Security - Labor Security - Mats Low Voltage Ltng Sys-Mats Low Voltage Ltng Sys-Labor Voice System - Materials Voice System - Labor Video System - Materials Video System - Labor Data System - Materials Data System - Labor Master Clock - Materials Master Clock - Labor+B277 Coordination Drawings Submittals/Closeout Documents Supervision Clean-up | | | | | | | | |
| | Div. 26 - Total | | | | | | | | |
| | Divs. 31, 32 and 33 - Earthwork, Exterior Improvements and Utilities | | | | | | | | |
| | Site Clearing & Grubbing Building Pad - Materials Building Pad - Labor Paving Subgrade Signage / Striping Bike Racks Landscaping - Materials Landscaping - Labor Hydro Mulch - Materials Hydro Mulch - Labor Irrigation - Materials Irrigation - Labor Earthwork Finish Grading Stabilization - Materials Stabilization - Labor Site Drainage - Materials Site Drainage - Labor | | | | | | | | |

| Item No. | Description of Work | Scheduled Value | Work Completed | | Stored Materials | Total Completed | % | Balance To Finish | Retainage |
|-----------------------------------|--|-----------------|----------------|-----------|------------------|-----------------|---|-------------------|-----------|
| | | | Previous App. | This App. | | | | | |
| | Chain Link Fence-Materials Chain Link Fence-Labor Paving - Labor Paving - Materials Sidewalks Submittals/Closeout Documents Supervision Clean-up | | | | | | | | |
| Div. 31, 32 and 33 - Total | | | | | | | | | |
| | General Conditions Mobilization Temp. Facilities Final Cleaning Record Documents/Closeout/ O&M Manuals Supervision Permits Bonds Insurance Allowances Alternates (list) Change Orders A. PR# B. PR# C. PR# | | | | | | | | |

END OF SECTION 01 29 73

SECTION 01 31 00 PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - a. General coordination procedures.
 - b. Coordination drawings.
 - c. Pre-installation meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation. Requests for Information (RFI) will not be allowed from Contractor. Contractor shall arrange the necessary meeting in the field with appropriate Architect's field representative(s) to obtain clarification as needed on items that may need interpretation.

1.3 SUBMITTALS

- A. Subcontract List:
 - 1. Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - a. Name, address, and telephone number of entity performing subcontract or supplying products.
 - b. Number and title of related Specification Section(s) covered by subcontract.
 - c. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names:
 - 1. Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and the duties and responsibilities; list address, telephone numbers (home, office, and cellular), and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project:
 - a. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.4 COORDINATION PROCEDURES

- A. Coordinate construction operations to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations that depend on each other for proper installation, connection, and operation:
 - 1. Schedule construction operations in sequence required to obtain the best results

- where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include items as required notices, reports, and list of attendees at meetings:
1. Prepare similar memoranda for Owner and separate contractors if coordination of the Work is required.
- C. Administrative Procedures:
1. Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Administrative activities include, but are not limited to, the following:
 - a. Preparation of Contractor's Construction Schedule.
 - b. Preparation of the schedule of values.
 - c. Installation and removal of temporary facilities and controls.
 - d. Delivery and processing of submittals.
 - e. Progress meetings.
 - f. Pre-installation conferences.
 - g. Project closeout activities.
 - h. Startup and adjustment of systems.
 - i. Coordinating inspections and other jurisdictional requirements.
 - j. Coordinate OFCI equipment.
 - k. Action items and issue logs.
- D. Conservation:
1. Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste:
 - a. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to the Specifications Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 COORDINATION DRAWINGS

- A. Coordination Drawings, General:
1. Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on shop drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity:
 - a. Content:
 - 1) Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a) Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b) Coordinate the addition of trade specific information to the coordination drawings by multiple contractors in sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c) Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

- d) Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e) Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f) Indicate required installation sequences.
 - g) Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization:
- 1. Floor plans and reflected ceiling plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan Drawings with section drawings where required to adequately represent the Work.
 - 2. Plenum space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures, ductwork, piping, and other components.
 - 3. Mechanical rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire-alarm, and electrical equipment.
 - 4. Structural penetrations: Indicate penetrations and openings required for all disciplines.
 - 5. Slab edge and embedded items: Indicate slab edge locations and sizes, and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 - 6. Mechanical and plumbing work - Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts, and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 - 7. Electrical work - Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
 - e. Floor boxes.
 - 8. Fire protection system - Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, sprinkler heads, and inspector test locations.
 - 9. IDF/MDF rooms: Communications and low voltage (security, data, phone, etc.) audio.
 - 10. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
 - 11. Coordination drawing prints: Prepare coordination drawing prints according to requirements in Section 01 33 00: Submittal Procedures.

- C. Coordination Digital Data Files:
 - 1. Prepare coordination digital data files according to the following requirements:
 - a. File preparation format: Same digital data software program, version, and operating system as original Drawings.
 - b. File submittal format: Submit or post coordination drawing files using same format as file preparation.
 - c. BIM file incorporation:
 - 1) Develop and incorporate coordination drawing files into Building Information Model established for Project:
 - a) Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
 - d. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files:
 - 1) Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - 2) Digital data software program: Drawings are available in Revit.
 - 3) Contractor shall execute a data licensing agreement in the form of AIA Document C106.

1.6 PROJECT MEETINGS

- A. Schedule and conduct meetings and conferences at Project site unless otherwise indicated:
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: Architect to prepare the meeting agenda and distribute the agenda to all invited attendees.
 - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
 - 4. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.
 - 5. Issue logs: Documentation element of software project management and contains a list of ongoing and closed issues of the Project.
- B. Kick-off and Preconstruction Conference:
 - 1. Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect:
 - a. Conduct the conference to review responsibilities and personnel assignments.
 - b. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
 - c. Agenda: Discuss items of significance that affect progress.
 - d. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
 - e. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.
- C. Pre-Installation Conferences:
 - 1. Conduct a pre-installation trade conference at site before each construction activity

that requires coordination with other construction trades:

- a. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect and Engineer of Record of scheduled meeting dates.
 - b. Agenda: Contractor to review progress of other construction activities and preparations for the particular activity under consideration.
 - c. Contractor to record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - d. Reporting: Contractor to distribute minutes of the meeting to each party present and to other parties requiring information.
 - e. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
 - f. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.
- D. Project Closeout Conference:
1. Schedule and conduct a Project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion:
 - a. Conduct the conference to review requirements and responsibilities related to Substantial Completion.
 - b. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.
 - c. Agenda: Discuss items of significance that could affect or delay Project closeout.
 - d. Minutes: Entity conducting meeting will record and distribute meeting minutes.
 - e. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.
- E. Progress Meetings:
1. Conduct progress meetings at weekly intervals:
 - a. Coordinate dates of meetings with preparation of payment requests.
 - b. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.
 - c. Agenda:
 - 1) Review and correct or approve minutes of previous progress meeting.
Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of the Project:
 - a) Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - d. Minutes:
 - 1) Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information:

- a) Schedule updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
 - b) Six (6) week look-ahead schedules. This may be altered to three (3) week look-ahead as part of an action item when Architect/District request:
 - i. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.
- F. Coordination Meetings:
- 1. Conduct coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences:
 - a. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with the Project and authorized to conclude matters relating to the Work.
 - b. Agenda:
 - 1) Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of the Project:
 - a) Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b) Schedule updating: Revise combined Contractor's Construction Schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c) Review present and future needs of each contractor present.
 - c. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.
 - d. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 31 00

SECTION 01 32 00 CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 1. Startup construction schedule.
 2. Contractor's Construction Schedule.
 3. Construction schedule updating reports.
 4. Daily construction reports.
 5. Material location reports.
 6. Site condition reports.
 7. Special reports.

1.3 DEFINITIONS

- A. Activity:
 1. A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources:
 - a. Critical activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - b. Predecessor activity: An activity that precedes another activity in the network.
 - c. Successor activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of the project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Float:
 1. The measure of leeway in starting and completing an activity:
 - a. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - b. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - c. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- F. Look-ahead Schedule: Schedule indicating activities scheduled to occur or commence prior

to submittal of next schedule update.

- G. Milestones: Measurable, observable, and serve as progress markers (flags) but, by definition, are independent of time (have zero durations); therefore, no Work or consumption of resources is associated with them.
- H. Recovery Schedule: Submittal of a revised CPM schedule and a written plan.
- I. Resource Loading: The allocation of manpower and equipment necessary for completion of an activity as scheduled.

1.4 SUBMITTALS

- A. Submittal Format:
 - 1. Submit required submittals in the following format:
 - a. Working electronic copy of schedule file, where indicated.
 - b. PDF electronic file.
- B. Startup Diagram: Of size necessary to display entire network for entire construction period. Show logic relationship ties for all activities.
- C. Contractor's Construction Schedule:
 - 1. Initial schedule, of size required to display entire schedule for entire construction period:
 - a. Submit a working electronic copy of schedule labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- D. CPM Reports:
 - 1. Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days:
 - a. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
 - b. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - c. Total Float Report: List of all activities sorted in ascending order of total float.
 - d. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.
- E. Construction Schedule Updating Reports: Submit with Applications for Payment.
- F. Daily Construction Reports: Submit at monthly intervals.
- G. Material Location Reports: Submit at monthly intervals.
- H. Site Condition Reports: Submit at time of discovery of differing conditions.
- I. Special Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

- A. Pre-Scheduling Conference:
 - 1. Conduct conference at site. Review methods and procedures related to the preliminary

construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:

- a. Review software limitations and content and format for reports.
 - b. Verify availability of qualified personnel needed to develop and update schedule.
 - c. Discuss constraints, including phasing, Work stages, area separations, interim milestones, and partial Owner occupancy.
 - d. Review delivery dates for Owner furnished products.
 - e. Review schedule for work of Owner's separate contracts, if any.
 - f. Review submittal requirements and procedures.
 - g. Review time required for review of submittals and resubmittals.
 - h. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - i. Review time required for Project closeout and Owner startup procedures.
 - j. Review and finalize list of construction activities to be included in schedule.
 - k. Review procedures for updating schedule.
- B. Coordination:
1. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports:
 - a. Secure time commitments for performing critical elements of the Work from entities involved.
 - b. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Time is of the essence to Owner. Commence Work immediately upon issuance of the Notice to Proceed. There is a critical need for the Work to be substantially complete within the time frame identified in the Agreement.
- B. Time Frame:
1. Extend schedule from date established for commencement of the Work to date of Substantial Completion and date of final completion:
 - a. Contract completion date shall not be changed by submission of schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Activities:
1. Treat each separate area or story as a separate numbered activity for each main element of the Work. Comply with the following:
 - a. Activity duration: Define activities in terms of number of days anticipated.
 - b. Procurement activities: Include procurement process activities for long lead items and major items requiring a cycle of more than 60 days as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - c. Submittal review time: Include review and resubmittal times indicated in Section 01 33 00: Submittal Procedures in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
 - d. Startup and testing time: Include number of days anticipated for startup and testing.
 - e. Substantial Completion: Indicate completion of all conditions as in advance of date

- established for Substantial Completion and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
- f. Punch list and final completion: Include a maximum of 30 days for completion of punch list items and final completion.
 - g. Inspections required by Authorities Having Jurisdiction (AHJ).
- D. Constraints:
- 1. Include constraints and Work restrictions indicated in the Contract Documents and show how the sequence of the Work is affected:
 - a. Work restrictions:
 - 1) Show the effect of the following items on the schedule:
 - a) Coordination with existing construction.
 - b) Limitations of continued occupancies.
 - c) Uninterruptible services.
 - d) Partial occupancy before Substantial Completion.
 - e) Use of premises restrictions.
 - f) Provisions for future construction.
 - g) Seasonal variations.
 - h) Environmental control.
 - i) Rain days as indicated in Section 01 10 00: Summary.
 - b. Work stages:
 - 1) Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a) Submittals.
 - b) Mockups.
 - c) Fabrication.
 - d) Installation.
 - e) Tests and inspections.
 - f) Adjusting.
 - g) Curing.
- E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
- F. Six (6) Week Look-Ahead Schedule:
- 1. Prepare schedule indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
 - a. Unresolved issues.
 - b. Unanswered Requests for Information.
 - c. Rejected or unreturned submittals.
 - d. Notations on returned submittals.
 - e. Pending modifications affecting the Work and Contract Time.
 - f. Inspections by AHJ.
 - g. Trade pre-installation conference.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
- I. Contract Modifications: For each proposed Contract modification and concurrent with its

submission, prepare a time impact analysis to demonstrate the effect of the proposed change on the overall Project schedule.

- J. Schedule Updating:
1. Concurrent with making revisions to the schedule, prepare tabulated reports showing the following:
 - a. Identification of activities that have changed.
 - b. Changes in early and late start dates.
 - c. Changes in early and late finish dates.
 - d. Changes in activity durations in workdays.
 - e. Changes in the critical path.
 - f. Changes in total float or slack time.
 - g. Changes in Contract Time.

3.2 REPORTS

- A. Daily Construction Reports:
1. Prepare a daily construction report recording information concerning events at the site and submit each month to Architect:
 - a. List of subcontractors at the Project site.
 - b. List of separate contractors at the Project site.
 - c. Approximate count of personnel at the Project site.
 - d. Rental equipment at the Project site.
 - e. Material deliveries.
 - f. High and low temperatures and general weather conditions, including presence of rain or snow.
 - g. Accidents.
 - h. Meetings and significant decisions.
 - i. Unusual events (see special reports).
 - j. Stoppages, delays, shortages, and losses.
 - k. Meter readings and similar recordings.
 - l. Emergency procedures.
 - m. Orders and requests of AHJ.
 - n. Change Orders received and implemented.
 - o. Construction Change Directives received and implemented.
 - p. Services connected and disconnected.
 - q. Equipment or system tests and startups.
 - r. Partial completions and occupancies.
 - s. Substantial Completions authorized.
- B. Material Location Reports:
1. At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from the Project site. Indicate the following categories for stored materials:
 - a. Material stored prior to previous report and remaining in storage.
 - b. Material stored prior to previous report and since removed from storage and installed.
 - c. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report and contact Architect's field representative. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents to Architect's field representative.

- D. Special Reports:
 - 1. Submit special reports directly to Owner within 24 hours of an occurrence. Distribute copies of report to parties affected by the occurrence:
 - a. Reporting unusual events: When an event of an unusual and significant nature occurs at site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, and response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner and Architect in advance when these events are known or predictable.

3.3 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating:
 - 1. At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule with a pencil copy of pay application:
 - a. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - b. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - c. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution:
 - 1. Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and interested parties identified by Contractor with a need-to-know schedule responsibility:
 - a. Post copies in Project meeting rooms and temporary field offices.
 - b. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

SECTION 01 32 33 PHOTOGRAPHIC DOCUMENTATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 1. Pre-construction photographs.
 2. Periodic construction photographs.
 3. Final completion construction photographs.

1.3 SUBMITTALS

- A. Key Plan: Submit key plan of the Project site and building with notation of vantage points marked for location and direction of each photograph or video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Submit image files of digital photographs within three (3) days of taking photographs:
 1. Digital camera: Minimum sensor resolution of eight (8) megapixels.
 2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
 3. Identification:
 - a. Provide the following information with each image description in file metadata tag:
 - 1) Name of the Project.
 - 2) Name and contact information for the photographer.
 - 3) Name of Architect.
 - 4) Name of Contractor.
 - 5) Date photograph was taken.
 - 6) Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - 7) Unique sequential identifier keyed to accompanying key plan.

1.4 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three (3) years.
- B. Usage Rights:
 1. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of eight (8) megapixels, and at an image resolution of not less than 3200 by

2400 pixels.

PART 3 EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted:
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.

- B. Digital Images:
 - 1. Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image editing software:
 - a. Date and time: Include date and time in file name for each image.
 - b. Field office images: Maintain one set of images accessible in the field office at the Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.

- C. Pre-Construction Photographs:
 - 1. Before commencement of the Work, take photographs of site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect:
 - a. Flag construction limits before taking construction photographs.
 - b. Take a minimum of 20 photographs to show existing conditions adjacent to property before starting the Work.
 - c. Take a minimum of 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 - d. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

- D. Periodic Construction Photographs:
 - 1. Take a minimum of 20 photographs monthly, coinciding with cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

- E. Architect Directed Construction Photographs:
 - 1. From time to time, Architect will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

- F. Time Lapse Sequence Construction Photographs:
 - 1. Take a minimum of 20 photographs as indicated, to show status of construction and progress since last photographs were taken:
 - a. Frequency: Take photographs monthly, coinciding with the cutoff date associated with each Application for Payment.
 - b. Vantage Points:
 - 1) Following suggestions by Architect and Contractor, photographer to select vantage points. During each of the following construction phases, take not less than two (2) of the required shots from same vantage point each time to create a time lapse sequence:
 - a) Commencement of the Work, through completion of subgrade construction.
 - b) Above grade structural framing.

- c) Exterior building enclosure.
 - d) Interior work, through date of Substantial Completion.
- G. Final Completion Construction Photographs:
- 1. Take a minimum of 20 color photographs after date of Substantial Completion for submission as Project record documents. Architect will inform photographer of desired vantage points:
 - a. Do not include date stamp.
- H. Additional Photographs:
- 1. Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum:
 - a. Three (3) days' notice will be given, where feasible.
 - b. In emergency situations, take additional photographs within 24 hours of request.
 - c. Circumstances that could require additional photographs include, but are not limited to, the following:
 - 1) Special events planned at the Project site.
 - 2) Immediate follow up when onsite events result in construction damage or losses.
 - 3) Take photographs at fabrication locations away from site.
 - 4) Substantial Completion of a major phase or component of the Work.
 - 5) Extra record photographs at time of final acceptance.
 - 6) Owner's request for special publicity photographs.

END OF SECTION 01 32 33

SECTION 01 33 00 SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Requirements for the submittal schedule and administrative and procedural requirements for submitting shop drawings, product data, samples, and other submittals.
- B. Related Section:
 - 1. Section 01 25 00: Substitution Procedures and Form.

1.3 DEFINITIONS

- A. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- B. Portable Document Format (PDF): An open standard file format used for representing documents in a device and display resolution independent fixed layout document format.
- C. Submittals: Written and graphic information and physical samples that require Architect's responsive action, or are for information and do not require Architect's action.

1.4 SUBMITTALS

- A. Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections:
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's Construction Schedule.
 - 2. Initial submittal: Submit concurrently with construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 - 3. Final submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files:
 - 1. Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals:

- a. Upon request, Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing shop drawings and Project record drawings:
 - 1) Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - 2) Digital drawing software program: The Contract Drawings are available in Revit.
 - 3) Contractor shall execute a data licensing agreement in the form of AIA Document C106, Digital Data Licensing Agreement.
 - 4) The following digital data files will be furnished for each appropriate discipline:
 - a) Floor plans.
 - b) Reflected ceiling plans.
- B. Coordination:
 1. Coordinate preparation and processing of submittals with performance of construction activities:
 - a. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - b. Submit submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - c. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 - d. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination:
 - 1) Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time:
 1. Allow time for submittal review, including time for resubmittals. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals:
 - a. Initial review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - b. Intermediate review: If intermediate submittal is necessary, process in same manner as initial submittal.
 - c. Resubmittal review: Allow 15 days for review of each resubmittal.
 - d. Sequential review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
 - e. Concurrent consultant review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- D. Electronic Submittals:
 1. Identify and incorporate information in each electronic submittal file:
 - a. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 - b. Name file with submittal number or other unique identifier, including revision identifier:

- 1) File name shall use Project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., SLOHSM-06 10 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., SLOHSM-06 10 00.01.A).
 - c. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 - d. Transmittal form for electronic submittals:
 - 1) Use software generated form from electronic project management software acceptable to Owner, containing the following information:
 - a) Project name.
 - b) Date.
 - c) Name and address of Architect.
 - d) Name of Construction Manager.
 - e) Name of Contractor.
 - f) Name of firm or entity that prepared submittal.
 - g) Names of Subcontractor, manufacturer, and supplier.
 - h) Category and type of submittal.
 - i) Submittal purpose and description.
 - j) Specification Section number and title.
 - k) Specification paragraph number or Drawing designation and generic name for each of multiple items.
 - l) Drawing number and detail references, as appropriate.
 - m) Location(s) where product is to be installed, as appropriate.
 - n) Related physical samples submitted directly.
 - o) Indication of full or partial submittal.
 - p) Transmittal number, numbered consecutively.
 - q) Submittal and transmittal distribution record.
 - r) Other necessary identification.
 - s) Remarks.
 - e. Metadata:
 - 1) Include the following information as keywords in the electronic submittal file metadata:
 - a) Project name.
 - b) Number and title of appropriate Specification Section.
 - c) Manufacturer name.
 - d) Product name.
- E. Options: Identify options requiring selection by Architect.
- F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- G. Resubmittals:
 1. Make resubmittals in same form and number of copies as initial submittal:
 - a. Note date and content of previous submittal.
 - b. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - c. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

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

PART 2 PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. Submittal Procedure Requirements:
 1. Prepare and submit submittals required by individual Specification Sections:
 - a. Submit electronic submittals via email as PDF electronic files:
 - 1) Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - b. Submittals: Submit three (3) paper copies of each submittal unless otherwise indicated. Architect will return two (2) copies.
 - c. Certificates and certifications submittals:
 - 1) Provide statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity:
 - a) Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
 - b) Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data:
 1. Collect information into a single submittal for each element of construction and type of product or equipment:
 - a. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as shop drawings, not as product data.
 - b. Mark each copy of each submittal to show which products and options are applicable.
 - c. Include the following information, as applicable:
 - 1) Manufacturer's catalog cuts.
 - 2) Manufacturer's product specifications.
 - 3) Standard color charts.
 - 4) Statement of compliance with specified referenced standards.
 - 5) Testing by recognized testing agency.
 - 6) Application of testing agency labels and seals.
 - 7) Notation of coordination requirements.
 - 8) Availability and delivery time information.
 - d. For equipment, include the following in addition to the above, as applicable:
 - 1) Wiring diagrams showing factory installed wiring.
 - 2) Printed performance curves.
 - 3) Operational range diagrams.
 - 4) Clearances required to other construction, if not indicated on accompanying shop drawings.
 - e. Submit product data before or concurrent with samples.
 - f. Submit product data in PDF electronic file.
- C. Shop Drawings:
 1. Prepare Project specific information, drawn accurately to scale. Do not base shop drawings on reproductions of the Contract Documents or standard printed data:
 - a. Preparation:
 - 1) Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a) Identification of products.

- b) Schedules.
 - c) Compliance with specified standards.
 - d) Notation of coordination requirements.
 - e) Notation of dimensions established by field measurement.
 - f) Relationship and attachment to adjoining construction clearly indicated.
 - g) Seal and signature of professional Engineer if specified.
- b. Sheet size: Except for templates, patterns, and similar full-size drawings, submit shop drawings on sheets size indicated in Specification Section.
 - c. Submit shop drawings in PDF electronic file.
- D. Samples:
- 1. Submit samples for review of kind, color, pattern, and texture for a check of characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed:
 - a. Transmit samples that contain multiple related components, such as accessories, together in one submittal package.
 - b. Identification:
 - 1) Attach label on unexposed side of samples that includes the following:
 - a) Generic description of sample.
 - b) Product name and name of manufacturer.
 - c) Sample source.
 - d) Number and title of applicable Specification Section.
 - e) Specification paragraph number and generic name of each item.
 - c. For projects where electronic submittals are required, provide corresponding electronic submittal of sample transmittal, digital image file illustrating sample characteristics, and identification information for record:
 - 1) Disposition: Maintain sets of approved samples at the Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - 2) Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such samples must be in an undamaged condition at time of use.
 - 3) Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 - d. Submit full size units or samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following:
 - 1) Partial sections of manufactured or fabricated components.
 - 2) Small cuts or containers of materials.
 - 3) Complete units of repetitively used materials.
 - 4) Swatches showing color, texture, and pattern.
 - 5) Color range sets.
 - 6) Components used for independent testing and inspection:
 - a) Number of samples - Submit three (3) sets of samples. Architect will retain two (2) sample sets; remainder will be returned:
 - i. Submit a single sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - ii. If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a sample, submit at least three (3) sets of paired units that show approximate limits of variations.
- E. Product Schedule:

1. As required in individual Specification Section, prepare a written summary indicating types of products required for the Work and their intended locations. Include the following information in tabular form:
 - a. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 - b. Manufacturer, product name, and model number if applicable.
 - c. Number and name of room or space.
 - d. Location within room or space.
 - e. Submit product schedule in PDF electronic file.
- F. Coordination Drawing Submittals: Comply with requirements specified in Section 01 31 00: Project Management and Coordination.
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00: Payment Procedures.
- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 45 23: Testing and Inspecting Services.
- I. Closeout Submittals required for Substantial Completion: Comply with requirements specified in Section 01 77 00: Closeout Procedures.
- J. Maintenance Data: Comply with requirements specified in Section 01 78 23: Operation and Maintenance Data.
- K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that the installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- R. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency,

or on comprehensive tests performed by a qualified testing agency.

- S. Research Reports:
 - 1. Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with the building code in effect for the Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.
- T. Pre-Construction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product for compliance with performance requirements in the Contract Documents.
- U. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- V. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location for compliance with requirements in the Contract Documents.
- W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED DESIGN SERVICES

- A. Performance and Design Criteria:
 - 1. Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated:
 - a. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated Design Services Certification:
 - 1. In addition to shop drawings, product data, and required submittals, submit digitally signed PDF electronic file and three (3) paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional:
 - a. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- C. Incomplete submittals are not permitted, will be considered nonresponsive, and will be returned for resubmittal without review.
- D. Submittals not required by the Contract Documents will be returned by Architect without action.

END OF SECTION 01 33 00

SECTION 01 35 16 ALTERATION PROJECT PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes: Special procedures for alteration Work.

1.3 DEFINITIONS

- A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.
- B. Consolidate: To strengthen loose or deteriorated materials in place.
- C. Design Reference Sample: A sample that represents the Architect's pre-bid selection of Work to be matched; it may be existing work or work specially produced for the Project.
- D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish, as approved by Architect.
- F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.
- G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.
- H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.
- I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.
- J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.
- K. Retain: To keep existing items that are not to be removed or dismantled.
- L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.4 QUALITY ASSURANCE

- A. Coordination:
 - 1. Alteration Work sub-schedule:
 - a. A construction schedule coordinating the sequencing and scheduling of alteration

Work for the entire Project, including each activity to be performed, and based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration Work:

- 1) Schedule construction operations in sequence required to obtain best Work results.
 - 2) Coordinate sequence of alteration Work activities to accommodate the following:
 - a) Owner's continuing occupancy of portions of existing building.
 - b) Owner's partial occupancy of completed Work.
 - c) Other known work in progress.
 - d) Tests and inspections.
 - 3) Detail sequence of alteration Work, with start and end dates.
 - 4) Utility services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
 - 5) Use of elevator and stairs.
 - 6) Equipment data: List gross loaded weight, axle-load distribution, and wheelbase dimension data for mobile and heavy equipment proposed for use in existing structure. Do not use such equipment without certification from Contractor's professional Engineer that the structure can support the imposed loadings without damage.
2. Pedestrian and vehicular circulation: Coordinate alteration Work with circulation patterns within Project building(s) and site. Some Work is near circulation patterns and adjacent to restricted areas. Circulation patterns cannot be closed off entirely and in places can be only temporarily redirected around small areas of Work. Access to restricted areas may not be obstructed. Plan and execute the Work accordingly.
- B. Project Meetings for Alteration Work:
1. Preliminary conference for alteration Work: Before commencing alteration Work, conduct conference at site.
 2. Coordination meetings:
 - a. Conduct coordination meetings specifically for alteration Work at regular intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences:
 - 1) Review items of significance that affect progress of alteration Work:
 - a) Interface requirements of alteration Work with other Project Work.
 - b) Status of submittals for alteration Work.
 - c) Access to alteration Work locations.
 - d) Effectiveness of fire prevention plan.
 - e) Quality and work standards of alteration Work.
 - f) Change Orders for alteration Work.
 - 2) Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.
- C. Materials Ownership:
1. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property:
 - a. Carefully dismantle and salvage each item or object in a manner to prevent damage and protect it from damage, then promptly deliver it to Owner where directed.
 2. Alteration Work sub-schedule: Submit alteration Work sub-schedule within seven (7) days of date established for commencement of alteration Work.
 3. Pre-construction documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be

misconstrued as damage caused by Contractor's alteration Work operations.

4. Alteration Work program: Submit 30 days before Work begins.
5. Fire prevention plan: Submit 30 days before Work begins.

D. Regulatory Requirements:

1. Building code: Comply with the CBC and the IEBC for alteration Work.
2. Fire prevention plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire control devices during each phase or process. Coordinate plan with Owner's fire protection equipment and requirements. Include fire watch personnel's training, duties, and authority to enforce fire safety.
3. Safety and health standard: Comply with ANSI A10.6.
4. Title X requirement: Each firm conducting activities that disturb painted surfaces shall be a *Lead-Safe Certified Firm* according to 40 CFR 745, Subpart E, and use only workers that are trained in lead-safe Work practices.
5. Accessibility requirements:
 - a. Comply with applicable requirements:
 - 1) U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
 - 2) ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
 - 3) Local Authorities.
 - 4) 2019 California Building Code and the Division of the State Architect.

E. Specialist Qualifications:

1. An experienced firm having a minimum of ten (10) years' documented experience that is regularly engaged in specialty work similar in nature, materials, design, and extent to alteration Work specified:
 - a. Field supervisor qualifications:
 - 1) Full time supervisors experienced in specialty work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on site when specialty work begins and during its progress. Supervisors shall not be changed during the Project except for causes beyond the control of the specialist firm:
 - a) Construct new mockups of required Work whenever a supervisor is replaced.

F. Alteration Work Program:

1. Prepare a written plan for alteration Work for the whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole Project alteration Work program with specific requirements of programs required in other alteration Work Sections:
 - a. Dust and noise control:
 - 1) Include locations of proposed temporary dust and noise control partitions and means of egress from occupied areas coordinated with continuing onsite operations and other known Work in progress:
 - a) Debris hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.

1.5 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged Materials:

1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.

2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area designated by Owner.
 5. Protect items from damage during transport and storage.
- B. Salvaged Materials for Reinstallation:
1. Repair and clean items for reuse as indicated.
 2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.
- C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.
- D. Storage:
1. Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures:
 - a. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on Plans, elevations, sections, or photographs by annotating the identifying marks.
 - b. Secure stored materials to protect from theft.
 - c. Control humidity so that it does not exceed 85 percent. Maintain temperatures five (5) degrees F (three [3] degrees C) or more above the dew point.
- E. Storage Space:
1. Arrange for off-site locations for storage, protection, and insurance coverage of salvaged material that cannot be stored and protected onsite.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 FIELD CONDITIONS

- A. Survey of Existing Conditions:
1. Record existing conditions that affect the Work by use of measured drawings and pre-construction photographs:
 - a. Comply with requirements specified in Section 01 32 33: Photographic Documentation.
- B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.
- C. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by 12 inches (300 mm) or more.

3.2 PROTECTION

- A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration Work:
 - 1. Use proven protection methods, appropriate to each area and surface being protected.
 - 2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration Work is being performed.
 - 3. Erect temporary barriers to form and maintain fire egress routes.
 - 4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration Work.
 - 5. Contain dust and debris generated by alteration Work and prevent it from reaching the public or adjacent surfaces.
 - 6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
 - 7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
 - 8. Provide supplemental sound control treatment to isolate demolition work from other areas of the building.

- B. Temporary Protection of Materials to Remain:
 - 1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
 - 2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration Work program.

- C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

- D. Utility and Communications Services:
 - 1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration Work before commencing operations.
 - 2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration Work.
 - 3. Maintain existing services unless otherwise indicated; keep in service and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

- E. Existing Drains:
 - 1. Prior to the start of Work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin Work in an area until the drainage system is functioning properly:
 - a. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration Work.
 - b. Protect drains from pollutants. Block drains or filter out sediments allowing only clean water to pass.

- F. Existing Roofing: Prior to the start of Work in an area, install roofing protection.

3.3 PROTECTION FROM FIRE

- A. Follow Fire Prevention Plan and the Following:
 - 1. Comply with NFPA 241 requirements unless otherwise indicated.
 - 2. Remove and keep area free of combustibles, including rubbish, paper, waste, and

chemicals, unless necessary for the immediate Work:

- a. If combustible material cannot be removed, provide fire blankets to cover materials.
- B. Heat Generating Equipment and Combustible Materials:
1. Comply with procedures while performing Work with heat generating equipment or combustible materials, including welding, torch cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:
 - a. Obtain Owner's approval for operations involving use of open flame or welding or other high heat equipment. Notify Owner at least 48 hours before each occurrence, indicating location of such work.
 - b. As far as practicable, restrict heat generating equipment to shop areas or outside the building.
 - c. Do not perform work with heat generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
 - d. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
 - e. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
 - f. Fire watch:
 - 1) Before working with heat generating equipment or combustible materials, station personnel to serve as a fire watch at each location where work is performed. Fire watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:
 - a) Train each fire watch in the proper operation of fire control equipment and alarms.
 - b) Prohibit fire watch personnel from other work that would be a distraction from fire watch duties.
 - c) Cease work with heat generating equipment whenever fire watch personnel are not present.
 - d) Have fire watch personnel perform final fire safety inspection each day beginning no sooner than 30 minutes after conclusion of Work to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.
 - e) Maintain fire watch personnel at site until 60 minutes after conclusion of daily work.
- C. Fire Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire watch personnel are trained in fire extinguisher and blanket use.
- D. Sprinklers:
 1. Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards:
 - a. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

3.4 PROTECTION DURING APPLICATION OF CHEMICALS

- A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

- B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for the Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration Work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.
- C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.
- D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.
- E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.5 ALTERATION WORK

- A. Have specialty work performed only by qualified specialists.
- B. Ensure that supervisory personnel are present when Work begins and during its progress.
- C. Record existing work before each procedure (pre-construction), and record progress during the Work. Use digital pre-construction documentation photographs or video recordings. Comply with requirements in Section 01 32 33: Photographic Documentation.
- D. Perform surveys of site as the Work progresses to detect hazards resulting from alterations.
- E. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion:
 - 1. Do not proceed with the Work in question until directed by Architect.

END OF SECTION 01 35 16

SECTION 01 40 00 QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated and paid by the District (or refer to Section 01 45 23: Testing and Inspecting Services). These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements:
 - 1. Specific quality assurance and quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and quality control procedures that facilitate compliance with Contract Document requirements.
 - 3. Requirements for Contractor to provide quality assurance and quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions.
 - 4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, experienced means having successfully completed a minimum of five (5) years' documented experience with projects similar in nature, size, and extent; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality Control Testing: Tests and inspections performed onsite for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector:
 - 1. Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform particular construction operations, including installation, erection, application, and similar operations:
 - a. Use of trade specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- D. Mockups:
 - 1. Full size physical assemblies that are constructed onsite. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will

be judged:

- a. Laboratory mockups: Full size physical assemblies constructed at testing facility to verify performance characteristics.
 - b. Integrated exterior mockups: Mockups of exterior envelope erected separately from the building but on the Project site, consisting of multiple products, assemblies, and subassemblies.
 - c. Room mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
- E. Pre-Construction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- H. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include Contract enforcement activities performed by Architect.
- I. Source Quality Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- J. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.4 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two (2) or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 SUBMITTALS

- A. Shop Drawings:
1. Submit Plans, Sections, and elevations, indicating materials and size of mockup construction:
 - a. Indicate manufacturer and model number of individual components.
 - b. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

- B. Contractor's Statement of Responsibility:
 - 1. When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - a. Seismic force resisting system, designated seismic system, or component listed in the designated seismic system quality assurance plan prepared by Architect.
 - b. Main wind force resisting system or wind resisting component listed in the wind force resisting system quality assurance plan prepared by Architect.

- C. Schedule of Tests and Inspections:
 - 1. Prepare in tabular form and include the following:
 - a. Specification Section number and title.
 - b. Entity responsible for performing tests and inspections.
 - c. Description of test and inspection.
 - d. Identification of applicable standards.
 - e. Identification of test and inspection methods.
 - f. Number of tests and inspections required.
 - g. Time schedule or time span for tests and inspections.
 - h. Requirements for obtaining samples.
 - i. Unique characteristics of each quality control service.

1.6 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports:
 - 1. Prepare and submit certified written reports specified. Include the following:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address, and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making tests and inspections.
 - f. Description of the Work and test and inspection method.
 - g. Identification of product and Specification Section.
 - h. Complete test or inspection data.
 - i. Test and inspection results and an interpretation of test results.
 - j. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - k. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - l. Name and signature of laboratory inspector.
 - m. Recommendations on retesting and reinspecting.

- B. Manufacturer's Technical Representative's Field Reports:
 - 1. Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 - a. Name, address, and telephone number of technical representative making report.
 - b. Statement on condition of substrates and their acceptability for installation of product.
 - c. Statement that products at site comply with requirements.
 - d. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - e. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - f. Statement whether conditions, products, and installation will affect warranty.
 - g. Other required items indicated in individual Specification Sections.

- C. Factory Authorized Service Representative's Reports:

1. Prepare written information documenting manufacturer's factory authorized service representative's tests and inspections specified in other Sections. Include the following:
 - a. Name, address, and telephone number of factory authorized service representative making report.
 - b. Statement that equipment complies with requirements.
 - c. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - d. Statement whether conditions, products, and installation will affect warranty.
 - e. Other required items indicated in individual Specification Sections.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.
- E. Trade Pre-Installation Conferences: Meeting minutes to be Contractor provided.

1.7 QUALITY ASSURANCE

- A. Qualifications establish the minimum qualification levels required; refer to individual Specification Sections for additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated and sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated and with record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of California and is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated.
- F. Specialists:
 1. Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated:
 - a. Requirements of authorities having jurisdiction supersede requirements for specialists.
- G. Testing Agency Qualifications:
 1. A NRTL, a NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, documented according to ASTM E329; with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities:
 - a. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - b. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

- H. Manufacturer's Technical Representative Qualifications: An authorized representative of the manufacturer who is trained and approved by the manufacturer to observe and inspect installation of the manufacturer's products.
- I. Factory Authorized Service Representative Qualifications: An authorized representative of the manufacturer who is trained and approved by the manufacturer to inspect installation of the manufacturer's products.
- J. Pre-Construction Testing:
 - 1. Where testing agency is indicated to perform pre-construction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - a. Contractor responsibilities include the following:
 - 1) Provide test specimens representative of proposed products and construction.
 - 2) Submit specimens with sufficient time for testing and analyzing results to prevent delaying the Work.
 - 3) Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - 4) Build site assembled test assemblies and mockups using installers who will perform same tasks for the Project.
 - 5) Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - 6) When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on the Project.
 - 2. Testing agency responsibilities: Submit certified written report of each test, inspection, and similar quality assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
- K. Mockups:
 - 1. Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - a. Build mockups in location and of size indicated, or if not indicated, as directed by Architect.
 - b. Notify Architect a minimum of seven (7) days in advance of dates and times when mockups will be constructed.
 - c. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction.
 - d. Demonstrate the proposed range of aesthetic effects and workmanship.
 - e. Obtain Architect's approval of mockups before starting Work, fabrication, or construction. Allow seven (7) days for initial review and each re-review of each mockup.
 - f. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - g. Demolish and remove mockups when directed unless otherwise indicated.
- L. Integrated Exterior Mockups: Mockup of the exterior envelope erected separately from the building but on the Project site, consisting of multiple products, assemblies, and subassemblies. Mockup, if not specifically shown on the Drawings, shall be minimum eight feet by eight feet (8'x8'). Mockup shall include all major façade elements and at least one (1) window a minimum of two feet by two feet (2'x2') in size. Prior to constructing mockup, verify requirements with Architect. Pre-installation conferences for trades involved in integrated exterior mockup shall be held after mockup is completed.

- M. Laboratory Mockups: Comply with requirements of pre-construction testing and those specified in individual Specification Sections.
- N. Trade Pre-Installation Conferences: Meeting minutes to be Contractor provided.

1.8 QUALITY CONTROL

- A. Owner Responsibilities:
 - 1. Where quality control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform the services:
 - a. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 - b. Costs for retesting and re-inspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities:
 - 1. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality control activities required to verify that the Work complies with requirements, whether specified or not:
 - a. Unless otherwise indicated, provide quality control services specified and those required by authorities having jurisdiction. Perform quality control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - b. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform the quality control services. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - c. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 - d. Where quality control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality control service.
 - e. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - f. Submit additional copies of each written report directly to authorities having jurisdiction when they so direct.
 - g. Provide documentation for construction safety as required by CBC Chapter 33 and CFC Chapter 33. Show representation for construction safeguards through the life of the Project.
- C. Manufacturer's Field Services: Where indicated, engage a factory authorized service representative to inspect field assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00: Submittal Procedures.
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. Retesting/Re-Inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. Testing Agency Responsibilities:

1. Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections:
 - a. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - b. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - c. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
 - d. Submit a certified written report, in duplicate, of each test, inspection, and similar quality control service through Contractor.
 - e. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - f. Do not perform any duties of Contractor.

- G. Associated Services:
 1. Cooperate with agencies performing required tests, inspections, and similar quality control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - a. Access to the Work.
 - b. Incidental labor and facilities necessary to facilitate tests and inspections.
 - c. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - d. Facilities for storage and field curing of test samples.
 - e. Delivery of samples to testing agencies.
 - f. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - g. Security and protection for samples and for testing and inspecting equipment at the Project site.

- H. Coordination:
 1. Coordinate sequence of activities to accommodate required quality assurance and quality control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting:
 - a. Schedule times for tests, inspections, obtaining samples, and similar activities.

- I. Schedule of Tests and Inspections:
 1. Prepare a schedule of tests, inspections, and similar quality control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update as the Work progresses:
 - a. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.9 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections:
 1. Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections, as required by authorities having jurisdiction, as the responsibility of Owner, and as indicated in individual Specification Sections:
 - a. Verifying that manufacturer maintains detailed fabrication and quality control procedures, and reviews the completeness and adequacy of those procedures to perform the Work.
 - b. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - c. Submitting a certified written report of each test, inspection, and similar quality

control service to Architect with copy to Contractor and to authorities having jurisdiction.

- d. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
- e. Interpreting tests and inspections and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
- f. Retesting and re-inspecting corrected Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log:
 1. Prepare a record of tests and inspections. Include the following:
 - a. Date test or inspection was conducted.
 - b. Description of the Work tested or inspected.
 - c. Date test or inspection results were transmitted to Architect.
 - d. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes:
 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 29: Cutting and Patching.
- B. Protect construction exposed by or for quality control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality control services.

END OF SECTION 01 40 00

SECTION 01 42 00 REFERENCES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. General: This Section specifies procedural and administrative requirements for compliance with governing regulations and codes and standards imposed upon the Work. These requirements include the obtaining of permits, licenses, inspections, releases, and similar statements, as well as payments, associated with regulations, codes, and standards.
- B. Governing Regulations:
 - 1. Refer to General and Supplementary Conditions for requirements related to compliance with governing regulations:
 - a. The Division of the State Architect (DSA), State of California provides design and construction oversight for this Project and as such is subject to the rules and regulations.

1.3 DEFINITIONS

- A. Approved: When used to convey Architect's action on Contractor's submittals, applications, and requests, approved is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- B. Basic Contract: Definitions are included in the Conditions of the Contract.
- C. Directed: A command or instruction by Architect. Other terms including requested, authorized, selected, required, and permitted have the same meaning as directed.
- D. Furnish: Supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- E. Indicated: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including shown, noted, scheduled, and specified have the same meaning as indicated.
- F. Install: Operations at the Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- G. Project Site: Space available for performing construction activities. The extent of the Project site is shown on Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- H. Provide: Furnish and install, complete and ready for the intended use.
- I. Regulations: Includes laws, statutes, ordinances, and lawful orders issued by governing authorities, as well as those rules, conventions, and agreements within the construction industry that effectively control the performance of the Work regardless of whether they are

lawfully imposed by a governing authority or not.

- J. Testing Agencies: An independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, to report on and, if required, to interpret results of those inspections or tests.

1.4 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference. Individual Specification Sections indicate which codes and standards Contractor must keep available at the Project site for reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Conflicting Requirements: Where compliance with two (2) or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents specifically indicate a less stringent requirement. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to Architect/Engineer for a decision before proceeding.
- D. Minimum Quantities or Quality Levels: In every instance the quantity or quality level shown or specified is intended to be the minimum for the Work to be provided or performed. Unless otherwise indicated, the actual Work may either comply exactly, within specified tolerances, with the minimum quantity or quality specified, or may exceed that minimum within reasonable limits. In complying with these requirements, the indicated numeric values are either minimum or maximum values, as noted, or as appropriate for context of the requirements. Refer instances of uncertainty to Architect/Engineer for decision before proceeding.

1.5 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations - Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the trade association, standards-producing organization, authorities having jurisdiction, or other entity applicable to the context of the text provision:
 - 1. AABC - Associated Air Balance Council; www.aabc.com.
 - 2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
 - 3. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
 - 4. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
 - 5. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
 - 6. ACI - American Concrete Institute (formerly ACI International); www.concrete.org.
 - 7. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
 - 8. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
 - 9. AGA - American Gas Association; www.aga.org.
 - 10. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
 - 11. AI - Asphalt Institute; www.asphaltinstitute.org.
 - 12. AIA - American Institute of Architects (The); www.aia.org.
 - 13. AISC - American Institute of Steel Construction; www.aisc.org.
 - 14. AISI - American Iron and Steel Institute; www.steel.org.

15. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
16. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
17. ANSI - American National Standards Institute; www.ansi.org.
18. APA - The Engineered Wood Association; www.apawood.org.
19. APA - Architectural Precast Association; www.archprecast.org.
20. API - American Petroleum Institute; www.api.org.
21. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
22. ASCE - American Society of Civil Engineers; www.asce.org.
23. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
24. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
25. ASME - ASME International (American Society of Mechanical Engineers); www.asme.org.
26. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
27. ASSP - American Society of Safety Professionals (The); www.assp.org.
28. ASTM - ASTM International (American Society for Testing and Materials International); www.astm.org.
29. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
30. AWI - Architectural Woodwork Institute; www.awinet.org.
31. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
32. AWPA - American Wood Protection Association (formerly American Wood-Preservers' Association); www.awpa.com.
33. AWS - American Welding Society; www.aws.org.
34. AWWA - American Water Works Association; www.awwa.org.
35. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
36. BIA - Brick Industry Association (The); www.gobrick.com.
37. BICSI - BICSI, Inc.; www.bicsi.org.
38. BIFMA - BIFMA International (Business and Institutional Furniture Manufacturer's Association); www.bifma.com.
39. BOCA - BOCA (Building Officials and Code Administrators International Inc.); (See ICC).
40. CEA - Consumer Electronics Association; www.ce.org.
41. CFFA - Chemical Fabrics & Film Association, Inc.; www.chemicalfabricsandfilm.com.
42. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
43. CGA - Compressed Gas Association; www.cganet.com.
44. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
45. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
46. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
47. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
48. CPA - Composite Panel Association; www.pbmdf.com.
49. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
50. CRRC - Cool Roof Rating Council; www.coolroofs.org.
51. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
52. CSA - Canadian Standards Association; www.csa.ca.
53. CSA - CSA International (formerly IAS - International Approval Services); www.csa-international.org.
54. CSI - Construction Specifications Institute (The); www.csinet.org.
55. CTI - Cooling Technology Institute (formerly Cooling Tower Institute); www.cti.org.
56. CWC - Composite Wood Council; (See CPA).
57. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
58. DHI - Door and Hardware Institute; www.dhi.org.
59. DSA – Division of the State Architect, State of California.

60. ECA - Electronic Components Association; www.ec-central.org.
61. ECAMA - Electronic Components Assemblies & Materials Association; (See ECA).
62. EIA - Electronic Industries Alliance; (See TIA).
63. EIMA - EIFS Industry Members Association; www.eima.com.
64. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
65. ESD - ESD Association (Electrostatic Discharge Association); www.esda.org.
66. ESTA - Entertainment Services and Technology Association; (See PLASA).
67. EVO - Efficiency Valuation Organization; www.evo-world.org.
68. FM Approvals - FM Approvals LLC; www.fmglobal.com.
69. FM Global - FM Global (formerly FMG - FM Global); www.fmglobal.com.
70. FSC - Forest Stewardship Council U.S.; www.fscus.org.
71. GA - Gypsum Association; www.gypsum.org.
72. GANA - Glass Association of North America; www.glasswebsite.com.
73. GS - Green Seal; www.greenseal.org.
74. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
75. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
76. HPW - H.P. White Laboratory, Inc.; www.hpwhite.com.
77. ICBO - International Conference of Building Officials; (See ICC).
78. ICC - International Code Council; www.iccsafe.org.
79. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
80. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
81. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
82. IEC - International Electrotechnical Commission; www.iec.ch.
83. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
84. IES - Illuminating Engineering Society (formerly Illuminating Engineering Society of North America); www.ies.org.
85. IESNA - Illuminating Engineering Society of North America; (See IES).
86. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
87. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
88. IGSHPA - International Ground Source Heat Pump Association;
www.igshpa.okstate.edu.
89. Intertek - Intertek Group (formerly ETL SEMCO; Intertek Testing Service NA);
www.intertek.com.
90. ISA - International Society of Automation (The) (formerly Instrumentation, Systems,
and Automation Society); www.isa.org.
91. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
92. ISFA - International Surface Fabricators Association (formerly International Solid
Surface Fabricators Association); www.isfanow.org.
93. ISO - International Organization for Standardization; www.iso.org.
94. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
95. ITU - International Telecommunication Union; www.itu.int/home.
96. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
97. LMA - Laminating Materials Association; (See CPA).
98. LPI - Lightning Protection Institute; www.lightning.org.
99. MBMA - Metal Building Manufacturers Association; www.mbma.com.
100. MCA - Metal Construction Association; www.metalconstruction.org.
101. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
102. MHIA - Material Handling Industry of America; www.mhia.org.
103. MIA - Marble Institute of America; www.marble-institute.com.
104. MMPA - Moulding & Millwork Producers Association (formerly Wood Moulding &
Millwork Producers Association); www.wmmpa.com.
105. MPI - Master Painters Institute; www.paintinfo.com.
106. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry
Inc.; www.mss-hq.org.
107. NAAMM - National Association of Architectural Metal Manufacturers;
www.naamm.org.

108. NACE - NACE International (National Association of Corrosion Engineers International); www.nace.org.
109. NADCA - National Air Duct Cleaners Association; www.nadca.com.
110. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
111. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
112. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
113. NCMA - National Concrete Masonry Association; www.ncma.org.
114. NEBB - National Environmental Balancing Bureau; www.nebb.org.
115. NECA - National Electrical Contractors Association; www.necanet.org.
116. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
117. NEMA - National Electrical Manufacturers Association; www.nema.org.
118. NETA - InterNational Electrical Testing Association; www.netaworld.org.
119. NFHS - National Federation of State High School Associations; www.nfhs.org.
120. NFPA - NFPA (National Fire Protection Association); www.nfpa.org.
121. NFPA - NFPA International; (See NFPA).
122. NFRC - National Fenestration Rating Council; www.nfrc.org.
123. NHLA - National Hardwood Lumber Association; www.nhla.com.
124. NLGA - National Lumber Grades Authority; www.nlga.org.
125. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
126. NRCA - National Roofing Contractors Association; www.nrca.net.
127. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
128. NSF - NSF International (National Sanitation Foundation International); www.nsf.org.
129. NSPE - National Society of Professional Engineers; www.nspe.org.
130. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
131. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
132. NWFA - National Wood Flooring Association; www.nwfa.org.
133. PDI - Plumbing & Drainage Institute; www.pdionline.org.
134. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
135. RFCI - Resilient Floor Covering Institute; www.rfci.com.
136. RIS - Redwood Inspection Service; www.redwoodinspection.com.
137. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
138. SDI - Steel Deck Institute; www.sdi.org.
139. SDI - Steel Door Institute; www.steeldoors.org.
140. SEFA - Scientific Equipment and Furniture Association; www.sefalabs.com.
141. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
142. SIA - Security Industry Association; www.siaonline.org.
143. SJI - Steel Joist Institute; www.steeljoist.org.
144. SMA - Screen Manufacturers Association; www.smainfo.org.
145. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
146. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
147. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
148. SPIB - Southern Pine Inspection Bureau; www.spib.org.
149. SPRI - Single Ply Roofing Industry; www.spri.org.
150. SRCC - Solar Rating and Certification Corporation; www.solar-rating.org.
151. SSINA - Specialty Steel Industry of North America; www.ssina.com.
152. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
153. STI - Steel Tank Institute; www.steeltank.com.
154. SWI - Steel Window Institute; www.steelwindows.com.
155. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
156. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
157. TCNA - Tile Council of North America, Inc. (formerly Tile Council of America); www.tileusa.com.

158. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
 159. TIA - Telecommunications Industry Association (formerly TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
 160. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
 161. TMS - The Masonry Society; www.masonrysociety.org.
 162. TPI - Truss Plate Institute; www.tpinst.org.
 163. TPI - Turfgrass Producers International; www.turfgrasssod.org.
 164. TRI - Tile Roofing Institute; www.tilerroofing.org.
 165. UBC - Uniform Building Code; (See ICC).
 166. UL - Underwriters Laboratories Inc.; www.ul.com.
 167. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
 168. USAV - USA Volleyball; www.usavolleyball.org.
 169. USGBC - U.S. Green Building Council; www.usgbc.org.
 170. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
 171. WASTEC - Waste Equipment Technology Association; www.wastec.org.
 172. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
 173. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
 174. WDMA - Window & Door Manufacturers Association; www.wdma.com.
 175. WI - Woodwork Institute (formerly WIC - Woodwork Institute of California); www.wicnet.org.
 176. WMMPA - Wood Moulding & Millwork Producers Association; (See MMPA).
 177. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
 178. WPA - Western Wood Products Association; www.wwpa.org.
- B. Standards and Regulations - Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations:
1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
 2. FED-STD - Federal Standard; (See FS).
 3. USAB - United States Access Board; www.access-board.gov.
 4. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- C. Code Agencies - Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the Agency:
1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 2. ICC - International Code Council; www.iccsafe.org.
 3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
- D. State Government Agencies - Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents:
1. CBHF - State of California; Department of Consumer Affairs; Bureau of Electronic Appliance and Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
 2. CCR - California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
 3. CDHS - California Department of Health Services; (See CDPH).
 4. CDPH - California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
 5. CPUC - California Public Utilities Commission; www.cpuc.ca.gov.
 6. CBC – California Building Code (2019 Edition).

7. CEC – California Electrical Code (2019 Edition).
8. CMC – California Mechanical Code (2019 Edition).
9. CFC – California Fire Code (2019 Edition).

1.6 SUBMITTALS

- A. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 42 00

SECTION 01 45 23 TESTING AND INSPECTING SERVICES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements and qualifications including but not limited to:
 - 1. Professional testing and laboratory services.
 - 2. Accessories necessary for the completion of testing and laboratory services.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements:
 - 1. Specific quality assurance and quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and quality control procedures that facilitate compliance with Contract Document requirements.
 - 3. Requirements for Contractor to provide quality assurance and quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions.
 - 4. Specific test and inspection requirements are not specified in this Section.
- C. A Qualified Independent Testing Laboratory and/or Geotechnical Engineering Service Selected and Paid by Owner:
 - 1. Owner will pay for the initial laboratory services of materials that comply with the requirements of the Contract Documents. Contractor shall pay for testing and retesting of materials that do not comply with the requirements of the Contract Documents.
- D. Inspecting agency shall perform inspections and tests in accordance with the rules and regulations of the building code, local authorities, specifications of ASTM, and the Contract Documents.
- E. Materials and workmanship found not in compliance with required standards or performance obligations shall be removed and replaced. Replacement and subsequent testing shall be at Contractor's expense.
- F. Where terms "Inspector" and "Laboratory" are used, it is meant and in reference to an officially designated and accredited inspector of the testing laboratory or geotechnical service engaged by Owner.
- G. Laboratory inspections shall not relieve Contractor or fabricator of his responsibility to furnish materials and workmanship in accordance with the Contract Documents.
- H. Contractor or fabricator shall cooperate with the testing laboratory in matters pertaining to the Work.
- I. Contractor to address deficiency and failed reports.

1.3 SUBMITTALS

- A. Schedule of Tests and Inspections:
 - 1. Prepare a schedule of tests, inspections, and similar quality control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update as the Work progresses:
 - a. Prepare in tabular form and include the following:
 - 1) Specification Section number and title.
 - 2) Entity responsible for performing test and inspection.
 - 3) Description of test and inspection.
 - 4) Identification of applicable standards.
 - 5) Identification of test and inspection methods.
 - 6) Number of tests and inspections required.
 - 7) Time schedule or time span for tests and inspections.
 - 8) Requirements for obtaining samples.
 - 9) Unique characteristics of each quality control service.
- B. Test and Inspection Reports:
 - 1. Prepare and submit certified written reports specified. Include the following:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address, and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making tests and inspections.
 - f. Description of the Work and test and inspection method.
 - g. Identification of product and Specification Section.
 - h. Complete test or inspection data.
 - i. Test and inspection results and an interpretation of test results.
 - j. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - k. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - l. Name and signature of laboratory inspector.
 - m. Recommendations on retesting and re-inspecting.
- C. Submit copies of reports of each inspection and test:
 - 1. Owner, program or project manager, Architect, and each engineer or outside consultants regarding their particular phase of the Project: One (1) copy each.
 - 2. Construction Manager (CM) and Contractor: Two (2) copies each.
- D. In addition to furnishing a written report, notify the CM and Contractor verbally of uncorrected conditions or failures to comply with requirements of the Contract Documents, and immediately fax and email corresponding report to Architect and the engineer.
- E. At completion of each trade or branch of Work requiring inspecting and testing, submit a final certificate attesting to satisfactory completion of Work.
- F. Report full compliance with requirements of the Contract Documents.
- G. Submit copies of test results sealed by a registered engineer to municipal authorities having jurisdiction, as required.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications:

1. The 2019 California Administrative Code (Title 24, Part 1) describes the general administrative requirements for the Project under the jurisdiction of the Division of the State Architect (DSA). These provisions require that a structural test for construction projects under DSA jurisdiction be performed by testing laboratories acceptable to DSA. DSA administers the Laboratory Evaluation and Acceptance Program to evaluate laboratories for structural testing and special inspection services. A NRTL, a NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, documented according to ASTM E329 and ASTM E534, and with additional qualifications specified in individual Sections:
 - n. NRTL: A Nationally Recognized Testing Laboratory according to 29 CFR 1910.7.
 - o. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
 - p. Laboratory Evaluation and Acceptance program to evaluate laboratories acceptable to DSA.
 - q. Testing agencies shall be insured against errors and omissions by a professional liability insurance policy having a minimum limit of liability of \$500,000.00.
- B. Inspection and testing services for the testing agency shall be under the direction of a California Registered Engineer, charged with engineering managerial responsibility, and having a minimum of five (5) years' engineering experience in inspection and testing of construction materials.
- C. Concrete Inspectors: Inspecting personnel monitoring concrete work shall be ACI certified inspectors.
- D. Structural Steel:
 1. Primary inspectors performing structural steel inspection shall be currently certified AWS Certified Welding Inspectors (CWI), in accordance with the provisions of AWS QCI, *Standard and Guide for Qualification and Certification of Welding Inspectors*:
 - a. Inspector may be supported by assistant inspectors who perform specific inspection functions under the direct supervision of the primary inspector. Assistant inspectors shall be currently certified AWS Certified Associate Welding Inspectors (CAWI). Work of assistant inspectors shall be monitored daily by the inspector.
- E. Testing Equipment: Equipment shall be calibrated at intervals not exceeding 12 months by devices of accuracy traceable to the National Bureau of Standards.
- F. Referenced Standards: Latest adopted edition of standards referenced apply to the Work. In the event of conflict between the Contract Documents and referenced standards, the Contract Documents shall govern. In case of conflict between Contract Documents and the California Building Code, the more stringent shall govern.
- G. Owner Responsibilities:
 1. Where quality control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform the services:
 - a. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 - b. Costs for retesting and re-inspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- H. Contractor Responsibilities:
 1. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality control activities required to verify that the Work complies with requirements, whether specified or not:

- a. Refer to individual Specification Sections for specific requirements.
- b. Unless otherwise indicated, provide quality control services specified and those required by authorities having jurisdiction. Perform quality control services required of Contractor by authorities having jurisdiction, whether specified or not.
- c. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform the quality control services. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
- d. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
- e. Where quality control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality control service.
- f. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
- g. Submit additional copies of each written report directly to authorities having jurisdiction when they so direct.
- h. Associated responsibilities and services - Cooperate with agencies performing required tests, inspections, and similar quality control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel:
 - 1) Provide the following:
 - a) Provide access to the Work.
 - b) Deliver of samples to testing laboratory, without cost to Owner, in adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - c) Advise laboratory and Architect sufficiently in advance of construction operations to allow laboratory to complete required inspections or tests and to assign personnel for field inspection and testing as specified.
 - d) Provide facilities for storage and curing of concrete test samples on site for the first 24 hours and for subsequent field curing required by ASTM C31.
 - e) Incidental labor, facilities, and equipment necessary to assist laboratory personnel in obtaining and handling samples at the site.
 - f) Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - g) Provide concrete mix designs in accordance with ACI 301 made by an independent testing laboratory or qualified concrete supplier. Where mix designs by an independent testing laboratory are required, select and pay for laboratory.
 - h) Obtain required inspections or approvals of the building official. Inspection requests and notifications required by building code are responsibility of Contractor.
 - i) Provide current welder certificates for each welder employed.
 - j) Provide fabrication and erection inspection and testing of welds in accordance with AWS D1.1, Chapter 6.
 - k) Use prequalification of welding procedures in executing the Work.
 - l) Security and protection for samples and for testing and inspecting equipment at the Project site.
 - i. Retesting/re-inspecting: Regardless of payment responsibility of the original tests or inspections, provide quality control services, including retesting and re-inspecting, for construction that replaced Work failing to comply with the Contract Documents, code requirements, or what is required from DSA.
- I. Testing Agency Responsibilities:
 1. Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections:
 - a. Notify Architect and Contractor promptly of irregularities or deficiencies observed in

- the Work during performance of its services.
- b. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - c. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
 - d. Submit a certified written report, in duplicate, of each test, inspection, and similar quality control service through Contractor.
 - e. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - f. Do not perform any duties of Contractor.
- J. Authority and Duties of Laboratory Personnel:
1. A representative of the testing laboratory, who has reviewed and is familiar with the Project and Specifications, shall participate in pre-construction conferences. The representative shall coordinate material testing and inspection requirements with Contractor and its subcontractors consistent with the planned construction schedule. The laboratory representative shall attend conferences required or requested to address quality control issues.
 2. Laboratory personnel shall inspect and test materials, assemblies, specimens, and Work performed, including design mixes, methods and techniques, and report the progress to Architect.
 3. If material or Work fails to meet requirements of the Contract Documents, the laboratory inspector shall notify the CM, Architect, engineers, supplier, or Subcontractor providing or preparing the materials or Work being tested of such failure.
 4. Laboratory personnel shall not perform the work of Contractor or act as foremen or superintendents. Work will be inspected as it progresses, but failure to detect defective Work or materials shall not prevent later rejection when a defect is discovered.
 5. Laboratory personnel are not authorized to revoke, alter, relax, enlarge, or release the requirements of the Contract Documents or approve or accept portions of Work, except where approval is specifically specified in the Specifications.
 6. Comply with building code requirements for special inspections.
- K. Testing Laboratory Guidelines and Procedures:
1. Technicians scheduled to perform specific testing services must be qualified to review and perform other services that overlap, i.e. earthwork, foundation inspections, rebar inspection, and concrete when scheduled concurrently at the site.
 2. Technician time for services performed will be reimbursed at a regular time rate. Compensation at the overtime rate will be considered for hours over eight (8) hours spent at the site on a single day, field testing services performed on a Saturday or Sunday, and field services performed on a recognized holiday.
 3. There shall be a three (3) hour minimum for each scheduled testing service. Vehicle charges will be included on a \$25.00 per trip basis.
 4. Cylinder pick up will be controlled by the technician performing test on a scheduled pick up day. If there are no testing services scheduled, the cylinder pick up fee is \$40.00 on week days and \$50.00 on weekends and holidays with no technician or vehicle charge.
 5. Contractor shall bear the responsibility of scheduling the testing services. Contractor and the testing laboratory shall assume full responsibility to coordinate the testing services. Cancellations or failed test shall be reimbursable to the Owner by the responsible party for the cancellations or failure of a test or service.
- L. Coordination:
1. Coordinate sequence of activities to accommodate required quality assurance and quality control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting:
 - a. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log:
 - 1. Prepare a record of tests and inspections. Include the following:
 - a. Date test or inspection was conducted.
 - b. Description of the Work tested or inspected.
 - c. Date test or inspection results were transmitted to Architect.
 - d. Identification of testing agency or special inspector conducting test or inspection.
 - e. Deficiency log.
- B. Maintain log at site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 TESTING AND INSPECTION SERVICES

- A. Testing services shall include, but not be limited to those specified below or which are necessary or required during course of construction to ascertain Specification compliance and which may be deemed necessary by Architect, the engineer, or Owner to ensure the quality of the Work.
- B. Owner reserves the right to add to or delete any or all inspection and testing specified, excluding testing required by the applicable building codes.
- C. If conflicts arise between Drawings and Specifications, notify Architect immediately. The most stringent requirements shall dictate procedure.

3.3 TESTING OF EARTHWORK

- A. Testing Services (as specified or required):
 - 1. References (as applicable for tests required):
 - a. American Society for Testing and Materials (ASTM):
 - 1) D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft³ (600 kN-m/m³).
 - 2) D2922 - Standard Test Method for Density of Soil and Soil-Aggregate In Place By Nuclear Methods (Shallow Depth).
 - 3) D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - b. American Association of State Highway and Transportation Officials (AASHTO):
 - 1) T89 - Determining the Liquid Limit of Soils.
 - 2) T90 - Determining the Plastic Limit and Plasticity Index of Soils.
 - 3) T99 - Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305-mm (12-in) Drop.
 - 4) T238 - Density of Soil and Soil Aggregates In Place By Nuclear Methods (Shallow Depth).
 - 2. Perform sieve analysis to develop grain size distribution curves for materials to be used for subgrade, fill under slab on grade, and backfills.
 - 3. Establish the moisture density relation of soils to be used as fill using the method best suited to the type of fill material.
 - 4. Determine moisture content of all fill materials before placement and advise Contractor when it is or is not suitable to achieve required compaction.
 - 5. Determine Liquid Limit in accordance with ASTM D4318 or AASHTO T89, Plastic Limit

in accordance with ASTM D4318, and Plasticity Index in accordance with ASTM D4318 of all fill material,

6. Perform one (1) in place density test for each 2,500 square feet (280 square yards) of existing subgrade material.
7. Perform Moisture-Density curve in accordance with ASTM D698 or AASHTO T99 for one type of fill material. If the original choice of material does not meet the Specifications, Contractor shall pay for additional testing.
8. Perform in place density tests of each lift of compacted fill at locations adequate to evaluate the degree of compaction of all fill areas. Conduct one test for each 2,500 square feet (280 square yards) of each lift of compacted fill.
9. Perform testing at a frequency of one (1) in-place density and moisture test for each 75 lineal feet or less of utility trench, with a minimum of three (3) tests per lift

B. Reports:

1. Submit reports with the following information:
 - a. Type and condition of soil at footing bottoms.
 - b. Level of water table in the excavated areas.
 - c. Grain size distribution of fill materials (average of three [3] tests).
 - d. Moisture density test results.
 - e. In place density test results with moisture content and relative density of each layer of compacted fill. Include with in place density test results, a plan showing location of each test.
 - f. Notify Architect by telephone within one (1) hour of the discovery of the following conditions and follow up telephone notification with written report:
 - 1) Materials used or degree of soil compaction not meeting specified requirements.
 - 2) Frost and freeze protection requirements for excavation bottoms not being complied with.
 - 3) Water in excavations not being removed prior to Work being performed in excavation.

3.4 INSPECTION OF PIPED SITE UTILITIES

- A. Laboratory representative shall observe and report on the following:
1. Proper alignment and grade of trenches.
 2. Pipe bedding and supports.
 3. Pipe, joints, jointing material, and thrust blocks prior to installation of pipe.
 4. Installation of pipe and joints.
 5. Testing of piped utilities performed by Contractor.

3.5 PAVING

- A. Testing Services:
1. Perform field tests for moisture density properties:
 - a. Provide field testing of the subgrade as specified.
 - b. Paving sub-base: Provide one (1) field test for every 5,000 square feet of area of crushed limestone or caliche sub-base.
 - c. Lime treated subgrade: Provide one (1) field test for every 5,000 square feet of area of lime treated subgrade for content of lime and subgrade compaction.
 - d. Cement soil stabilization: Provide one (1) field test for every 5,000 square feet of area of cement stabilized subgrade for content of cement and subgrade compaction.

3.6 CONCRETE REINFORCING STEEL AND EMBEDDED METAL ASSEMBLIES

- A. Inspect concrete reinforcing steel prior to placing concrete for compliance with Contract Documents and approved shop drawings. Noncompliance with Contract Documents and approved shop drawings shall be immediately brought to the attention of Contractor for correction and, if left uncorrected, reported to Architect.
- B. Laboratory representative shall observe and report on the following:
 - 1. Number and size of bars.
 - 2. Bending and lengths of bars.
 - 3. Splicing.
 - 4. Clearance to forms, including chair heights.
 - 5. Clearance to sides and bottom of trench if soil formed.
 - 6. Clearance between bars or spacing.
 - 7. Rust, form oil, and other contamination.
 - 8. Grade of steel.
 - 9. Securing, tying, and chairing of bars.
 - 10. Excessive congestion of reinforcing steel.
 - 11. Installation of anchor bolts and placement of concrete around such bolts.
 - 12. Fabrication and installation of embedded metal assemblies, including visual inspection of all welds.
 - 13. Visually inspect studs and deformed bar anchors on embedded assemblies for compliance with Contract Documents. Check number, spacing, and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360-degree fillet has not been obtained for a particular stud or bar, such stud or bar shall be struck with a hammer and bent 15 degrees off perpendicular and then bent back into position. Anchors failing this test shall be replaced.
- C. Provide a qualified, experienced inspector to inspect reinforcing steel. Inspector shall have a minimum of three (3) years of experience inspecting reinforcing steel in projects of similar size.

3.7 CONCRETE INSPECTION AND TESTING

- A. Receive and evaluate proposed concrete mix designs submitted by Contractor. If mix designs comply with Drawings and Specifications, the laboratory shall submit a letter to the Architect certifying compliance. Mix designs not complying with Drawings and Specifications shall be returned by the laboratory as being unacceptable. Check the proposed mixes for proportions, water cement ratio, and slump in accordance with ACI 613 and 318.
- B. Comply with ACI 311 *Guide For Concrete Inspection* and ACI *Manual of Concrete Inspection*.
- C. Sample and test concrete placed at the site in accordance with ASTM C172. Each sample shall be obtained from a different batch of concrete on a random basis.
- D. Test concrete:
 - 1. Mold and cure five (5) specimens from each sample:
 - a. For each 50 cubic yards or fraction thereof of structural building concrete.
 - b. For each 100 cubic yards or fraction thereof of nonstructural concrete and site Work paving and sidewalks.
 - c. Laboratory cure two (2) cylinders in accordance with ASTM C192.
 - d. Field cure remaining cylinders in accordance with ASTM C31.
 - 2. Two (2) specimens shall be tested at seven (7) days for information, two (2) shall be tested at 28 days for acceptance.
 - 3. Store one (1) cylinder for testing at 56 days in the event the 28-day strength tests do not meet strength requirements.

- E. Deviations from the requirements of ASTM specifications shall be recorded in the test report. Test concrete specimens in accordance with ASTM C39.
- F. Specimens for pumped concrete shall be taken at the discharge end of pumping equipment.
- G. Supervise curing and protection provided for test specimens in field and transportation from the field to laboratory. Test cylinders shall be stored in the field for 24 hours and then carefully transported to laboratory and cured in accordance with ASTM C31.
- H. Make one (1) strength test (four [4] cylinders) of each mix design of concrete placed in any one (1) day.
- I. Make one (1) slump test for each set of cylinders following procedural requirements of ASTM C143 and ASTM C172. Make additional slump tests whenever consistency of concrete appears to vary. Slump tests corresponding to samples from which strength tests are made shall be reported with strength test results. Other slump tests need not be reported.
- J. Determine total air content of air entrained normal weight concrete sample for each strength test in accordance with ASTM C231.
- K. Determine air content and unit weight of lightweight concrete sample for each strength test in accordance with ASTM C173 and ASTM C567.
- L. Determine temperature of concrete sample for each strength test.
- M. Inspect each batch of concrete and monitor addition of mixing water to assure uniform consistency from truck to truck. Check mixing form mixers before mix begins to set and within time limits set forth in ASTM C94:
 - 1. Monitor addition of water and high range water reducer to concrete at job site and length of time concrete is allowed to remain in truck during placement.
- N. Testing agency shall furnish and maintain a competent inspector at the mixing plant at the start of each day's mixing. Inspector shall examine concrete materials for compliance with Specifications and approved mix design, weighing and measuring devices, proportioning and mixing of materials, water and cement content of each batch, general operation of the plant, and transportation of concrete to jobsite. Inspector shall verify that the amount of free surface moisture contained in fine and course aggregate has been properly accounted for in the concrete mixing to achieve required consistency and water cement ratio.
- O. Testing laboratory shall monitor addition of water to concrete at the jobsite and the length of time concrete is allowed to remain in the truck before placement. Inspector shall compare mixture with criteria on the approved mix design and report any significant deviation to Architect, Contractor, and concrete supplier. Do not permit addition of water that will exceed maximum water/cement ratio for the mix as given on the approved mix design.
- P. Observe placing of concrete except nonstructural slabs on grade and site Work. Observe and report on placing method, consolidation, cold joints, length of drop, and displacement of reinforcement. Report deficiencies to Contractor immediately for corrective action. Inspections may be reduced to a periodic basis when all procedures have been deemed satisfactory by the laboratory.
- Q. Test reports shall include but not be limited to the following information:
 - 1. Date of concrete placement.
 - 2. Concrete mix identification number or proportion of ingredients.
 - 3. Truck ticket number.

4. Time test was made.
 5. Time of batching.
 6. Location of each placement.
 7. Slump, unit weight, water content (microwave test), and air content of concrete sampled.
 8. Date and results of strength test.
- R. Report promptly to Architect all details of reasons for rejection of any and all quantities of concrete. Give all information concerning locations of the concrete pours, quantities, date of pours, and other pertinent facts concerning concrete represented by the specimens.
- S. Testing laboratory shall certify each delivery ticket indicating class of concrete delivered (or placed), amount of water added and time at which cement and aggregate were dispensed into the truck, and time at which concrete was discharged from the truck.
- T. Evaluation and Acceptance:
1. If measured slump or air content of air entrained concrete falls outside specified limits, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, concrete shall be considered to have failed to meet the requirements of the Specifications, and shall not be used in the structure.
 2. Strength level of concrete will be considered satisfactory if the averages of sets of three (3) consecutive strength test results are equal to, or exceed, specified strength and no individual test result (average of two [2] cylinders) is below specified strength by more than 500 psi.
 3. Completed concrete work will be accepted when requirements of ACI 301 Chapter 18 *Specifications for Structural Concrete for Buildings* have been met.
- U. Concrete Test Reports:
1. Reports shall be made and distributed immediately after respective tests or inspections are made:
 - a. Where reports indicate deviations from Contract Documents, they shall also include a determination of the probable cause of deviation and where applicable, a recommendation for corrective action.
- V. Furnish a statistical analysis for each class of concrete placed on the Project in accordance with ACI 214 and ACI 318. Information shall be updated and distributed once a month as directed by the Architect. Information shall include, but not be limited to, the following:
1. Strength tests at seven (7) days.
 2. Strength tests at 28 days of two (2) cylinder averages.
 3. 28-day moving average strength tests of last three (3) test groups.
 4. Standard deviation and coefficient of variation based on 28-day strength tests.
 5. Average strength and number of 28-day tests for most recent month.
 6. Strength test one (1) cylinder at 56 days in the event the 28-day strength tests do not meet strength requirements.
- W. Noncompliant Test Reports: Fax test reports indicating noncompliance immediately to each party on the test report distribution list. Copies shall be on different colored paper.
- X. Inspect application of curing compound and monitor curing conditions to assure compliance with Specification requirements. Report curing deficiencies to Contractor immediately and submit a written report to Architect.

3.8 TESTING OF NONSHRINK GROUT

- A. Make one (1) strength test for all plates grouted and for all grout used in joints between

members.

- B. Each test shall consist of four (4) cubes, two (2) tested at seven (7) days and two (2) at 28 days, made and tested in accordance with ASTM C109, with the exception that grout shall be restrained from expansion by a top plate.

3.9 STRUCTURAL STEEL

- A. Inspect structural steel during and after erection for compliance with Contract Documents and shop drawings. Review and report on fabricator's quality control procedures and capabilities.
- B. Field Inspection:
 - 1. Proper erection of pieces.
 - 2. Proper touch up painting of shop primed structural steel exposed to view or in crawl space.
 - 3. Proper installation of bolts.
 - 4. Plumbness of structure and proper bracing.
 - 5. Proper field painting.
 - 6. Initial inspection of welding process and periodically thereafter as necessary.
 - 7. Visual examination of completed welds.
 - 8. Ultrasonic testing of penetration field welds.
 - 9. Installation of field welded shear studs.
 - 10. Inspect shop fabricated members, upon arrival at the site, for defects incurred during transit and handling.
 - 11. Measure and record camber of beams upon arrival and before erection for compliance with specified camber. Measure lying flat with web horizontal. Return members outside specified camber tolerance to shop for correction.
- C. Qualifications of Welders: Fabricator and erector shall provide the testing laboratory with names of welders employed on Work, along with certification that each welder has passed qualification tests within the past 12 months, using procedures covered in AWS D1.1 *Structural Welding Code - Steel*. Verify welder qualifications.
- D. Inspection of Field Welding shall Include:
 - 1. Visually inspect fillet welds for size, soundness, and proper return around ends. Inspect seams, folds, and delaminations.
 - 2. Visually inspect welds for proper repair of painting.
 - 3. Ultrasonically test penetration welds in accordance with ASTM E164.
 - 4. Inspect surfaces to be welded. Note surface preparations, fit up, and cleanliness of surface. Verify electrodes for size, type, and condition.
 - 5. Welding inspector shall be present during alignment and fit up of members being welded, and shall verify for correct surface preparation of root openings, sound weld metal, and proper penetration in the root pass. Where weld has not penetrated completely, inspector shall order the joint to be chipped down to sound metal, or gouged out, and rewelded. Thoroughly inspect root passes for cracks. Gouge out cracks and rewelded to two inches (2") beyond each end of crack.
 - 6. Inspector shall verify that welds have been marked with welder's symbol and shall mark welds requiring repairs and re-inspection. Inspector shall maintain a written record of welds. Work completed and inspected shall receive an identification mark by the inspector. Identify unacceptable material and Work identified by word *reject* or *repair* marked directly on the material.
 - 7. Testing agency shall advise the Owner and Architect of any shop and/or field conditions that may require further tests and examination by means other than those specified. Additional tests and examinations shall be performed as authorized by the Owner and Architect.

8. Owner reserves the right to use ultrasonic or radiographic inspection to verify adequacy of welds. Testing procedures and acceptance criteria shall be as specified in AWS D1.1.
 9. Weld quality to comply with the American Institute of Steel Construction (AISC) Manual of Steel Construction.
 10. Determine percentage of weld tested by the number of welds that fail the initial testing.
 11. Reweld and retest welds that fail until the welds pass. Test two (2) additional welds for every weld failure.
- E. Inspect bolted construction in accordance with AISC *Specification for Structural Steel Buildings*:
1. Visually inspect bolts ensuring that plies have been brought into snug contact.
 2. Inspect high strength bolt in accordance with Section 9 of the *Specifications for Structural Joints Using ASTM A325 Bolts*.
- F. Inspect stud welding in accordance with AWS D1.1 *Structural Welding Code*:
1. Weld at least two (2) shear studs at the start of each production period to determine correct generator, control unit, and stud welder setting. The studs shall be capable of being bent 45 degrees from vertical without weld failure.
 2. When the temperature is below 32 degrees F, test one (1) stud in each 100 after cooling. Do not weld studs at temperatures below zero (0) degrees F or when surface is wet with rain or snow. If stud fails in the weld, two (2) new studs shall pass the test before resumption of welding.
 3. Visually inspect studs for compliance with the requirements of the Contract Documents. Verify number, spacing, and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360-degree fillet has not been obtained for a particular stud, that stud shall be struck with a hammer and bent 15 degrees off perpendicular in the direction away from the missing weld. Studs failing test shall be replaced.

3.10 METAL ROOF DECK

- A. Field inspection shall consist of:
1. Verify types, gauges, and finishes for compliance with Contract Documents and shop drawings.
 2. Examine the erection of the metal deck, including fastenings at supports and side laps, reinforcing of holes, and miscellaneous deck supports.
 3. Certification of welders.
 4. Visual inspection of at least 25 percent of welds.

3.11 EXPANSION BOLT INSTALLATION

- A. Inspect drilling of each hole and installation of each expansion bolt for compliance with Contract Documents and shop drawings.
- B. Verify installation torque for each expansion bolt for compliance with manufacturer's installation instructions.

3.12 TESTING OF ROOFING

- A. Inspection and Observation Services (As Required):
1. Inspection of roof deck prior to start of Work.
 2. Inspect onsite condition of stored roofing materials.
 3. Inspection during roofing, roof insulation, and sheet metal Work to ascertain compliance with Contract Documents.

4. Observation of roof test cuts performed by Contractor to ascertain that they are properly made.
 5. Observation of patching of roof test cuts to ascertain that they are properly made.
- B. Testing Services (As Required):
1. Perform dissection and analysis on cuts provided by Contractor to confirm number of plies, bonding of plies, weight of bitumen and softening temperature to ascertain compliance with Specifications.

3.13 REPAIR AND PROTECTION

- A. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes:
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 29: Cutting and Patching.
- B. Protect construction exposed by or for quality control service activities.
- C. Repair and protection are Contractor's responsibility regardless of the assignment of responsibility for quality control services.

END OF SECTION 01 45 23

SECTION 01 50 00 TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities, including but not limited to:
 - 1. Water service and distribution.
 - 2. Sanitary facilities, including toilets, wash facilities, and drinking water facilities.
 - 3. Heating and cooling facilities.
 - 4. Ventilation.
 - 5. Electric power service.
 - 6. Lighting.
 - 7. Telephone service (land line)
 - 8. Waste disposal facilities.
 - 9. Field office.
 - 10. Storage and fabrication sheds.
 - 11. Lifts and hoists.
 - 12. Construction aids and miscellaneous services and facilities.
 - 13. Environmental protection.
 - 14. Pest control.
 - 15. Enclosure fence.
 - 16. Security enclosure and lockup.
 - 17. Barricades, warning signs, and lights.
 - 18. Temporary partitions.
 - 19. Fire protection.
 - 20. Accessories necessary for a complete installation.
- B. Use Charges:
 - 1. Installation, removal of, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of the Project, testing agencies, and authorities having jurisdiction.
 - 2. Water and sewer service: Pay sewer service use charges for water used and sewer usage by all entities for construction operations.
 - 3. Electric power service: Pay electric power service use charges for electricity used by all entities for construction operations.

1.3 SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Moisture Protection Plan:
 - 1. Describe procedures and controls for protecting materials and construction from water absorption and damage:
 - a. Describe delivery, handling, and storage provisions for materials subject to water

- absorption or water damage.
 - b. Indicate procedures for discarding water damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged work.
 - c. Indicate sequencing of work that requires water, such as sprayed fire resistive materials, plastering, and tile grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- C. Dust and HVAC Control Plan:
- 1. Submit coordination drawing and narrative that indicates the dust and HVAC control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
 - a. HVAC system isolation schematic drawing.
 - b. Location of proposed air-filtration system discharge.
 - c. Waste handling procedures.
 - d. Other dust control measures.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Accessible Temporary Egress:
 - a. Comply with applicable provisions in the U.S. Architectural and Transportation Barriers Compliance Board ADA-ABA Accessibility Guidelines (ADAAG), ICC/ANSI A117.1, and 2019 California Building Code (CBC) CCR Title 24, Part 2, as adopted and amended by DSA).
- B. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.
- B. Chain Link Fencing: Minimum 2 inches (50 mm), 0.148-inch (3.8 mm) thick, galvanized steel, chain link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts.
- C. Polyethylene Sheet: Reinforced, fire-resistive sheet, ten (10) mils (0.25 mm) minimum thickness, with flame spread rating of 15 or less per ASTM E84.
- D. Dust Control Adhesive Surface Walk-off Mats: Provide mats a minimum of 36 inches by 60 inches (914 mm x 1624 mm).
- E. Insulation: Unfaced mineral fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame spread and smoke developed indexes of 25 and 50, respectively.

- F. Lumber and Plywood: Comply with requirements in Section 06 10 00 Miscellaneous Rough Carpentry.
- G. Gypsum Board: Minimum 1/2-inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; Type X or Type C panels with tapered edges. Comply with Section 09 21 16: Gypsum Board Assemblies.
- H. Paint: Comply with requirements in Section 09 90 00: Painting and Coating.
- I. Tarpaulins: Fire resistive labeled with flame-spread rating of 15 or less.
- J. Water: Potable.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project site documents including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
 - 3. Drinking water and private toilet.
 - 4. Coffee machine and supplies.
 - 5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F
 - 6. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. Drinking Water: Containerized, tap dispenser, bottled water drinking water units, including paper cup supply. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 degrees F to 55 degrees F (7.2 degrees C to 12.7 degrees C).
- C. Electrical Outlets: Properly configured, NEMA polarized outlets to prevent insertion of 110V to 120V plugs into higher voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- D. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may

be nonmetallic sheathed cable.

- E. HVAC Equipment:
 - 1. Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid propane gas or fuel oil heaters with individual space thermostatic control:
 - a. Heating units: Listed and labeled for type of fuel being consumed by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.
 - b. Permanent HVAC system: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction. Clean HVAC system as required in Section 01 77 00: Closeout Procedures and install new filter with MERV 11 or greater.
- F. Air Filtration Units: Primary and secondary HEPA filter equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

3.2 INSTALLATION

- A. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work:
 - 1. Locate facilities to limit site disturbance as specified in Section 01 10 00: Summary.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

- A. Install temporary service. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage:
 - 1. Provide temporary utilities to remove effluent lawfully:
 - a. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities:
 - 1. Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities:
 - a. Disposable supplies: Provide toilet tissue, paper towels, paper cups, and similar

- disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
- b. Wash facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Isolation of Work Areas in Occupied Facilities:
1. Prevent dust, fumes, and odors from entering occupied areas:
 - a. Prior to commencing Work, isolate the HVAC system in area where Work is to be performed according to coordination drawings:
 - 1) Disconnect supply and return ductwork in Work area from HVAC systems servicing occupied areas.
 - 2) Maintain negative air pressure within Work area using HEPA equipped air filtration units, starting with commencement of temporary partition construction and continuing until removal of temporary partitions is complete.
 - b. Maintain dust partitions during the Work. Use vacuum collection attachments on dust producing equipment. Isolate limited Work within occupied areas using portable dust containment devices.
 - c. Perform daily construction cleanup and final cleanup using approved, HEPA filter equipped vacuum equipment.
- G. Ventilation and Humidity Control:
1. Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption:
 - a. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- H. Electric Power Service:
1. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Install electric power service underground unless otherwise indicated:
 - a. Electric distribution - Provide receptacle outlets adequate for connection of power tools and equipment:
 - 1) Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length voltage ratio.
 - 2) Provide warning signs at power outlets other than 110 to 120-V.
 - 3) Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or traffic areas.
 - 4) Provide metal conduit enclosures or boxes for wiring devices.
 - 5) Provide four (4) gang outlets, spaced so 100-foot (30 m) extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.
- I. Lighting:

1. Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions:
 - a. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 - b. Install lighting for Project identification sign.

- J. Telephone Service:
 1. Provide temporary telephone service in common use facilities for use by construction personnel, Architect, and inspection services. Install a minimum of one (1) telephone line(s) for each field office:
 - a. Provide dedicated telephone line for each facsimile machine in each field office.
 - b. At each telephone, post a list of important telephone numbers:
 - 1) Police and fire departments.
 - 2) Ambulance service.
 - 3) Contractor's home office.
 - 4) Contractor's emergency after-hours telephone number.
 - 5) Architect's office.
 - 6) Engineers' offices.
 - 7) Owner's office.
 - 8) Principal subcontractors' field and home offices.
 - c. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

- K. Electronic Communication Service:
 1. Provide a desktop computer and printer/scanner in the primary field office adequate for use by Architect, inspection services, and Owner to access Project electronic documents and maintain electronic communications:
 - a. Internet service: Broadband modem, router, and ISP equipped with hardware firewall.
 - b. Internet security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
 - c. Backup: External hard drive, minimum one (1) terabyte, with automated backup software providing daily backups.

3.4 SUPPORT FACILITIES INSTALLATION

- A. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E136. Comply with NFPA 241:
 1. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities under conditions acceptable to Owner.

- B. Temporary Use of Permanent Roads and Paved Areas:
 1. Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations:
 - a. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 - b. Prepare subgrade and install sub-base and base for temporary roads and paved areas.
 - c. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 - d. Delay installation of final course of permanent pavement until immediately before

Substantial Completion.

- C. Traffic Controls:
 - 1. Comply with requirements of authorities having jurisdiction:
 - a. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - b. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Provide temporary parking areas for construction personnel.
- E. Dewatering Facilities and Drains:
 - 1. Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water:
 - a. Dispose of rainwater in a lawful manner that will not result in flooding the Project or adjoining properties, or endanger permanent Work or temporary facilities.
- F. Project Signs:
 - 1. Provide Project signs as indicated. Unauthorized signs are not permitted:
 - a. Identification signs: Provide Project identification signs as indicated on Drawings.
 - b. Temporary signs:
 - 1) Provide other signs as indicated and as required to inform public and individuals seeking entrance to the Project:
 - a) Provide temporary, directional signs for construction personnel and visitors.
 - c. Maintain and touchup signs so they are legible at all times.
- G. Waste Disposal Facilities: Provide waste collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00: Execution.
- H. Lifts and Hoists:
 - 1. Provide facilities necessary for hoisting materials and personnel:
 - a. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- I. Temporary Elevator Use: Use of elevators is not permitted.
- J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities:
 - 1. Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities to the satisfaction of Owner and Architect.
- B. Environmental Protection:
 - 1. Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

- C. Temporary Erosion and Sedimentation Control:
 - 1. Provide measures to prevent soil erosion and discharge of soil bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of authorities having jurisdiction:
 - a. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree or plant protection zones.
 - b. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - c. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 - d. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- D. Stormwater Control:
 - 1. Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection:
 - 1. Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control:
 - 1. Engage pest control services to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- G. Site Enclosure Fence:
 - 1. Before construction operations begin, provide site enclosure fence to prevent people and animals from easily entering site except by entrance gates:
 - a. Extent of fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
- H. Security Enclosure and Lockup:
 - 1. Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each Work day.
- I. Barricades, Warning Signs, and Lights:
 - 1. Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- J. Temporary Egress:
 - 1. Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- K. Temporary Enclosures:
 - 1. Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather-tight enclosure for building exterior:
 - a. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

- L. Temporary Partitions:
 - 1. Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate occupied areas from fumes and noise:
 - a. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side and fire retardant treated plywood on construction operations side.
 - b. Construct dustproof partitions with two layers of 6-mil (0.14 mm) polyethylene sheet on each side. Cover floor with two (2) layers of 6-mil (0.14 mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire retardant treated plywood. Do not apply tape to finish floor surfaces:
 - 1) Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water dampened foot mats in vestibule.
 - c. Where fire resistance rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 - d. Insulate partitions to control noise transmission to occupied areas.
 - e. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 - f. Protect air handling equipment.
 - g. Provide walk-off mats at each entrance through temporary partition.
- M. Temporary Fire Protection:
 - 1. Install and maintain temporary fire protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program:
 - a. Prohibit smoking in construction areas.
 - b. Supervise welding operations, combustion type, temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - c. Develop and supervise an overall fire prevention and protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - d. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture Protection Plan:
 - 1. Avoid trapping water in finished Work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase:
 - 1. Before installation of weather barriers, when materials are subject to wetting and exposure to airborne mold spores, protect as follows:
 - a. Protect porous materials from water damage.
 - b. Protect stored and installed material from flowing or standing water.
 - c. Keep porous and organic materials from coming into prolonged contact with concrete.
 - d. Remove standing water from decks.
 - e. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase:
 - 1. After installation of weather barriers but before full enclosure and conditioning of

building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

- a. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
- b. Keep interior spaces reasonably clean and protected from water damage.
- c. Periodically collect and remove waste containing cellulose or other organic matter.
- d. Discard or replace water-damaged material.
- e. Do not install material that is wet.
- f. Discard, replace, or clean stored or installed material that begins to grow mold.
- g. Perform Work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Condition Phase of Construction:

1. After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 - a. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 - b. Use permanent HVAC system to control humidity.
 - c. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits and moisture control:
 - 1) Hygroscopic materials that may support mold growth, including wood and gypsum based products, which become wet during the course of construction and remain wet for 48 hours are considered defective and are to be removed and replaced.
 - 2) Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - 3) Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision:

1. Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance:

1. Maintain facilities in good operating condition until removal:
 - a. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover:

1. Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion unless otherwise required and approved by Owner and Architect.

D. Termination and Removal:

1. Remove each temporary facility when need when its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired:

- a. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
- b. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
- c. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 22: Substantial Completion Procedures.

END OF SECTION 01 50 00

SECTION 01 57 23 TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Requirements:
 1. Contractor shall exercise every reasonable precaution to protect channels, storm drains, and bodies of water from pollution.
 2. Schedule and conduct operations to minimize or avoid muddying and silting channels, drains, and waters.
 3. As required, obtain permits for erosion and water pollution control from the appropriate jurisdictional agency before starting Work.
 4. Provide any necessary water pollution control devices to prevent, control, and abate water pollution, and implement good housekeeping pollution control measures to reduce the discharge of pollutants from Work sites to the maximum extent practicable. These water pollution control devices include drains, gutters, slope protection blankets and retention basins, and shall be constructed concurrently with other Work at the earliest practicable time.
 5. Exercise care in preserving vegetation and protecting property to avoid disturbing areas beyond the limits of the Work. Promptly repair any damage caused by Contractor operations.
 6. Comply with the specific requirements based on acreage of disturbed soil.
 7. Penalties: Failure to comply with this Section may result in significant fines and possible imprisonment. The RWQCB or other prosecuting authority may assess fines of up to \$32,500 per day for each violation. Should Owner be fined or penalized as a result of Contractor failing to comply with this Section, Contractor shall reimburse Owner for any and all fines, penalties and related costs.
 8. Notification and report: If pollution occurs in the Work area for any reason or when Contractor becomes aware of any violation of this Section, correct the problem and immediately notify the Inspector. In addition, submit a written report to the Engineer within seven (7) calendar days describing the incident and the corrective actions taken. If either the Inspector or Engineer is first to observe pollution or a violation, Contractor shall also explain in the written report why the Work was inadequately monitored.
 9. The provisions of this Section describe minimum compliance and do not preclude other more stringent stormwater pollution control measures that may be required in the Contract.

1.3 DEFINITIONS

- A. Construction Activity: Operations such as clearing; grading; disturbances to the ground, such as stockpiling; or excavation that results in soil disturbances. If construction activity is part of a larger common plan of development, the amount of disturbed soil is the total land area of disturbed soil that results under the common plan.

1.4 LIABILITIES AND PENALTIES

- A. Payment of penalties for noncompliance by Contractor shall be the sole responsibility of Contractor.

- B. Compliance with the Clean Water Act is the sole responsibility of Contractor. Owner shall recover all costs of any fine against Owner due to noncompliance by Contractor by appropriate Owner Assessment.

PART 2 (NOT USED)

PART 3 EXECUTION

3.1 GENERAL

- A. Construction activity:
 - 1. Comply with the following minimum water quality protection requirements:
 - a. Retain eroded sediments and other pollutants onsite and do not allow transportation from the site by sheet flow, swales, area drains, natural drainage, or wind. Control slope and channel erosion by implementing an effective combination of best management practices (BMPs). Such BMPs include scheduling grading during non-rainy seasons, planting and maintaining vegetation on slopes, and covering erosion-susceptible slopes.
 - b. Protect stockpiles of earth and other construction-related materials from being transported from the site by wind or water.
 - c. Properly store and handle fuels, oils, solvents, and other toxic materials to not contaminate the soil or surface waters, enter the groundwater, or be placed where they may enter a live stream, channel, drain, or other water conveyance facility. Protect all approved toxic storage containers from weather. Clean spills immediately and properly dispose of cleanup materials. Spills shall not be washed into live streams, channels, drains, or other water conveyance facilities:
 - 1) If rain or storm water runoff comes in contact with pollutants (such as soil stabilizers, paint, or fluid from vehicles) report to Inspector immediately. Contractor will be required to sample and remediate contaminated water.
 - d. Do not wash excess or waste concrete into the public way or any drainage system. Retain concrete wastes onsite until they can be appropriately disposed of or recycled.
 - e. Deposit trash and construction-related solid wastes in covered receptacles to prevent contamination of rainwater and dispersal by wind.
 - f. Do not allow sediments and other materials to be tracked from the site by vehicle traffic. Stabilize construction entrance roadways to inhibit sediments from being deposited onto public ways. Immediately sweep up accidental depositions. Do not allow depositions to be washed away by rain or by any other means.
 - g. Contain non-stormwater runoff from equipment or vehicle washing and any other activity at the worksite.
 - h. At completion of the Work, clear the worksite of debris and restore to a condition at least equal to or better than prior to construction.

3.2 MAINTENANCE

- A. To ensure the proper implementation and functioning of control measures, Contractor shall regularly inspect and maintain the construction site. Contractor shall identify corrective actions and time needed to address any deficient measures or reinstate any measures that have been discontinued. Inspections of the construction site shall be conducted by Contractor to identify deficient measures, as follows:
 - 1. Prior to a forecasted storm.
 - 2. At 24-hour intervals during extended precipitation events.
 - 3. After all precipitation that causes runoff capable of carrying sediment from the construction site.

4. Routinely, at a minimum of once every week during the rainy season (October 1st– April 30th) and once every month during the non-rainy season (May 1st – September 30th).
- B. All temporary and/or permanent post-construction control measures shall be maintained and regularly inspected by Project Contractor after all improvements are in place and accepted by Owner. Temporary and/or permanent post-construction landscaping maintenance shall include, but not be limited to, watering, seeding, hydro-seeding, matting, slope stabilization, re-vegetation, and any other maintenance control measures recommended by Owner to insure proper erosion control and plant growth.

END OF SECTION 01 57 23

SECTION 01 60 00 PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products, including but not limited to:
 1. Product delivery, storage, and handling.
 2. Manufacturers' written warranties on products.
 3. Special warranties.
 4. Comparable products.

1.3 DEFINITIONS

- A. Basis of Design Product Specification:
 1. A Specification in which a specific manufacturer's product is named and accompanied by the words *basis of design*, including make, model number, or other designation to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the Specification.
- B. Products:
 1. Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term *product* includes the terms *material*, *equipment*, *system*, *assembly*, and terms of similar intent:
 - a. Named products: Items identified by manufacturer's product name, including make, model number, or other designation shown or listed in manufacturer's published product literature current as of date of the Contract Documents.
 - b. New products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - c. Comparable product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

1.4 SUBMITTALS

- A. Comparable Product Requests:
 1. Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title, and Drawing number(s) and title(s):
 - a. Include data to indicate compliance with the specified requirements.
 - b. Architect's action: If necessary, Architect will request additional information or documentation for evaluation within one (1) week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven (7) days

of receipt of additional information or documentation, whichever is later:

- 1) Form of Approval: As specified in Section 01 33 00: Submittal Procedures.
- 2) Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis of Design Product Specification Submittal:

1. Comply with requirements in Section 01 33 00: Submittal Procedures. Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options:

1. If Contractor is given option of selecting between two (2) or more products for use on Project, select a product compatible with products previously selected, even if previously selected products were also options:
 - a. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - b. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 WARRANTY

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents:

1. Manufacturer's warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Warranties:

1. Prepare a written document that contains appropriate terms and identification, ready for execution:
 - a. Specified form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 - b. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time:

1. Comply with requirements in Section 01 77 00: Closeout Procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original

sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect products on delivery to determine compliance with the Contract Documents, and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

PART 2 PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. Product Requirements:

1. Provide products that comply with the Contract Documents, are undamaged, and unless otherwise indicated, are new at time of installation:
 - a. Provide products complete with accessories, trim, finish, fasteners, and items needed for complete installation and indicated use and effect.
 - b. Standard products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - c. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 - d. Where products are accompanied by the phrase *as selected*, Architect will make selection.
 - e. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

5. Basis of Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and characteristics based on the product named. Comply with requirements for consideration of an unnamed product by one of the named manufacturers.
- C. Visual Matching Specification:
1. Where Specifications require *match Architect's sample*, provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches:
 - a. If no product available within specified category matches and complies with specified requirements, comply with requirements of Section 01 25 00: Substitution Procedures and Form for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase *selected by Architect* or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration:
1. Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
 - a. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - b. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - c. Evidence that proposed product provides specified warranty.
 - d. List of similar installations for completed projects with project names and addresses, and names and addresses of architects and owners, if requested.
 - e. Samples, if requested.

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 60 00

SECTION 01 71 23 FIELDENGINEERING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Layout of the Work.
 - 2. Verification of Work:
 - a. Owner reserves the right to verify any Work that Inspector deems necessary.
 - b. Other Sections that require surveyor to verify or measure installed Work and related item: Surveyor shall perform such verifications or measurements at Contractor's expense. Contractor shall furnish a certification, signed by both surveyor and Contractor, to Inspector.
- B. Related Sections:
 - 1. Section 01 10 00: Summary.
 - 2. Section 01 31 00: Project Management and Coordination.
 - 3. Section 01 33 00: Submittal Procedures.

1.3 SURVEY CONTROLS

- A. Vertical control shall use same benchmark used in the preparation of topographic survey. When Work consists of both onsite and off-site, and benchmarks differ, an equation shall be indicated on Drawings.
- B. Horizontal control for existing structures shall be the property line.

1.4 LAYOUT OF WORK

- A. All work related to staking shall be by a land surveyor, or Civil Engineer, registered with the State of California to perform land surveying and employed by Contractor.
- B. Before commencement of Work, surveyor shall locate all reference points and benchmarks to be used for vertical and horizontal control.
- C. Surveyor shall lay out entire Work, set grades, lines, levels, control points, elevations, grids and positions.

1.5 RECORD DOCUMENTS

- A. Maintain complete and accurate log of all control and survey documentation as work progresses.
- B. Record, by coordinates, all utilities onsite with top of pipe elevations, at major grade and alignment changes, rim, grate, or top of curb and flow line elevations of all drainage structures and sewer manholes.
- C. Indicate reference and control points on record drawings. The basis of elevation shall be

one of the established benchmarks.

- D. Upon Beneficial Occupancy, obtain and pay for reproducible Plans. Deliver Plans to District representative. Clearly indicate all differences between original drawings and completed Work within specified tolerances.

1.6 SUBMITTALS

- A. Surveyor: Submit name, address, and license number to Owner, including any changes as they occur.
- B. Field Notes: Upon request by District representative, submit copies of cut sheets, coordinate plots, data collector printouts, marked-up construction staking plans, and other documentation as available to verify accuracy of field engineering work during and at completion of Project. Submittals to Owner must be signed and sealed by surveyor and counter-signed by Contractor
- C. Statement of Compliance: Contractor shall submit a statement of certification signed and sealed by surveyor, counter-signed by Contractor, indicating compliance with grades and alignment of construction Plans at rough grade, fine grade, and top of rock stages. Inspector shall approve survey submittals for each stage of construction prior to proceeding with work.
- D. Upon Beneficial Occupancy: Contractor shall obtain and pay for reproducible survey drawings (or "As Built").
- E. Completed record drawings shall be signed and certified as correct and within specified tolerances by licensed surveyor. Originals and two (2) sets of blueprints shall be submitted to Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 PREPARATION

- A. Pre-mark areas of excavation in accordance with the requirements of "Dig-Alert." Request locators two (2) days before commencing excavation.
- B. Before commencing Work, establish all horizontal and vertical reference points used in Contract Documents according to existing field conditions.
- C. Preserve established reference lines and benchmarks.
- D. Differentiate school and city datum as applicable.
- E. Relocate benchmarks that may interfere with Work.
- F. Reset and re-establish reference marks damaged or lost during construction.

3.2 SURVEY REQUIREMENTS GENERAL

- A. Establish a minimum of two (2) permanent horizontal and vertical control points on Project site, remote from construction area, referenced to data established by control points.

- B. Indicate reference points, relative to benchmark elevation, on record drawings.
- C. Provide grade stakes and elevations to construct over excavation and re-compaction, rough and final grades, paved areas, curbs, gutters, sidewalks, building pads, landscaped areas, and other areas as required.
- D. Calculate and layout proposed finished elevations and intermediate controls, as required, to provide smooth transitions between spot elevations indicated on Drawings.
- E. Provide stakes and elevations for grading, fill, and topsoil placement.
- F. Provide adequate horizontal and vertical control to locate utility lines, including but not limited to, storm, sewers, water mains, gas and electric, and signal and provide vertical control in proportion to the slope of the line as required for accurate construction. Dry utilities will be based upon adequate horizontal and vertical control layout. Prior to trench closure, survey and record invert and flow line elevations. Survey and record top of curb and flow line elevations on finished concrete or asphaltic concrete (AC), and surfaces at key locations such as beginning-of-curve (BC), end-of-curve (EC), grade breaks, corners, or angle points in sufficient number to demonstrate the Work complies with the intent of the Contract Documents.
- G. Provide horizontal and vertical control for batter boards for drainage, utility, and other onsite structures as required.
- H. Furnish building corner offsets as required to adequately locate building pads. Provide cut and fill stakes within the building pad perimeter adequate to control both over excavation and re-compaction and the final sub-grade elevation of the building pad.
- I. Submit a certification signed by the surveyor confirming the elevations and locations of improvements are in conformance with the Contract Documents. The statement shall include survey notes for the finish floor and building pad, showing the actual measured elevations on the completed sub-grade, recorded to the nearest 0.01 of a foot. Building pad tolerance will be plus or minus 0.1 of a foot.
- J. Establish a minimum of two (2) permanent horizontal and vertical control points on Project site, remote from building area, referenced to data established by survey control points.
- K. Mark boundaries for rights-of-way dedications and easements for utilities prior to marking location of buildings and utilities.
- L. Layout all lines, elevations, and measurements needed for construction or installation of buildings, grading, paving, and utilities according to the following:
 - 1. Identify site boundary and property lines.
 - 2. Provide working benchmarks.
 - 3. Set stakes for Bottom of Excavated Plane (BEP).
 - 4. Set gridlines, radii, working points, etc. for foundation.
 - 5. Set and verify building pad elevations.
 - 6. Set finish floor elevations.
 - 7. Stake location and elevations for exterior ramps and stairs.
 - 8. Set gridlines, radii, working points, etc., for all floors of multi-story buildings.
 - 9. Set storm drain, sanitary sewer inverts, and other utilities as needed at five-foot (5') off-set from building lines.
 - 10. For new facilities, establish permanent onsite benchmark with two-inch (2") diameter brass disk. Location of benchmark to be determined by Owner.

3.3 SURVEY REQUIREMENTS FOR GRADING

- A. Provide grade stakes and elevations as follows:
 - 1. Removal limits (cut lines).
 - 2. Rough grade staking: 60-foot maximum grid plus additional stakes at grade changes and pertinent locations. Flag all grade changes including ridges, flow lines, and grade breaks.
 - 3. Fine grade for top of dirt: 30-foot maximum grid plus additional stakes at grade changes and pertinent locations. Flag all grade changes including ridges, flow lines, and grade breaks.
 - 4. Verify fine grade for top of rock: 30-foot maximum grid plus additional stakes at grade changes and pertinent locations. Flag all grade changes including ridges, flow lines, and grade breaks.
 - 5. Finish grade marks on all buildings, structures, and at pertinent locations.
 - 6. Finish grades and offsets for all concrete work, utilities, landscape areas, and structures.
 - 7. Provide controls and baselines for playground striping.
 - 8. Off-site improvements: Set grades and provide grade sheets as required by local authorities.
- B. Provide a minimum of two (2) permanent horizontal and vertical control points onsite, remote from building area, referenced to data established by survey control points.

3.4 SURVEY REQUIREMENTS FOR UTILITIES

- A. Locate “wet” utility lines and provide vertical control proportionate to slope of line as required for accurate construction. “Dry” utilities shall have adequate horizontal and vertical control layout supplied by others.
- B. Prior to back-filling trench, survey and record invert and flow line elevations. Survey and record top of curb and flow line elevations on finished surfaces at key locations (such as back of curbs, grade breaks, corners, or angle points) in sufficient number to demonstrate Work complies with intent of Contract Documents.
- C. Provide horizontal and vertical control for batter boards for drainage, utility, and other onsite structures as required:
 - 1. Set grades for vaults one inch (1”) higher than adjacent surrounding design grades, unless noted otherwise.
- D. Leave all trenches open until required inspection is completed.

3.5 SURVEY REQUIREMENTS FOR STRUCTURES

- A. Furnish building corner offsets as required to adequately locate building pads. Provide cut and fill stakes within building pad perimeter adequate to control both over excavation and re-compaction and final sub-grade elevation of building pad.
- B. Submit a certification signed by surveyor confirming elevations and locations of improvements are in conformance with Contract Documents. Statement shall include survey notes for finish floor and building pad, showing actual measured elevations on completed sub-grade, recorded to nearest 0.01 of a foot. Building pad tolerance will be plus or minus 0.1 of a foot.

END OF SECTION 01 71 23

SECTION 01 73 00 EXECUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 1. Construction layout.
 2. Field engineering and surveying.
 3. Installation of the Work.
 4. Coordination of Owner-installed products.
 5. Progress cleaning.
 6. Starting and adjusting.
 7. Protection of installed construction.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor or professional Engineer certifying that location and elevation of improvements comply with requirements.
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- C. Certified Surveys: Submit two (2) copies signed by land surveyor.
- D. Final Property Survey: Submit ten (10) copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor legally qualified to practice in the State of California, who is experienced in providing land surveying services of the kind indicated.
- B. Manufacturer's Installation Instructions: Obtain and maintain onsite manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
- B. In-Place Materials:
 - 1. Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible:
 - a. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Existing Conditions:
 - 1. The existence and location of underground and other utilities and construction indicated as existing are not warranted. Before beginning site Work, investigate and verify existence and location of underground utilities, mechanical and electrical systems, and construction affecting the Work:
 - a. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water service piping, underground electrical services, and other utilities.
 - b. Furnish location data for work related to the Work that must be performed by public utilities serving the site.
- B. Examination and Acceptance of Conditions:
 - 1. Before proceeding with each component of the Work, examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations:
 - a. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - b. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - c. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report:
 - 1. Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - a. Description of the Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
- D. Proceed with installation after correcting unsatisfactory conditions. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field

measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 31 00: Project Management and Coordination.

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. Engage a land surveyor or professional Engineer to lay out the Work using accepted surveying practices:
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as necessary to locate each element of Project.
 - 2. Establish limits on use of site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level, and plumb of every major element as the Work progresses.
 - 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two (2) or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points:
 - 1. Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations:
 - a. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or

- control points to Architect before proceeding.
 - b. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks:
- 1. Establish and maintain a minimum of two (2) permanent benchmarks on site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark:
 - a. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - b. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - c. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- E. Final Property Survey:
- 1. Engage a land surveyor or professional Engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional Engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey:
 - a. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 - b. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated:
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 96 inches (2,440 mm) in occupied spaces and 90 inches (2,300 mm) in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions ensuring the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items onsite and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check shop drawings of other Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment:
 - 1. Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions:
 - a. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - b. Allow for building movement, including thermal expansion and contraction.
 - c. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous. Materials containing asbestos and BCPs are prohibited.

3.6 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to site for Owner's construction personnel.
- B. Coordination:
 - 1. Coordinate construction and operations of the Work with Work performed by Owner's construction personnel:
 - a. Construction schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 - b. Pre-installation conferences: Include Owner's construction personnel at pre-installation conferences covering portions of the Work that are to receive Owner's Work. Attend pre-installation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

- A. Clean site and Work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully:
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven (7) days during normal weather or three (3) days if the temperature is expected to rise above 80 degrees F (27 degrees C).
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - 4. Use containers intended for holding waste materials of type to be stored.
 - 5. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

- B. Site: Maintain site free of waste materials and debris.
- C. Work Areas:
 - 1. Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work:
 - a. Remove liquid spills promptly.
 - b. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire Work area, as appropriate.
- D. Installed Work: Keep installed Work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials onsite. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 50 00: Temporary Facilities and Controls.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with mechanical, plumbing, and electrical requirements.
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00: Quality Requirements.

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

SECTION 01 73 29 CUTTING AND PATCHING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes procedural requirements for cutting and patching.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

- A. Cutting and Patching Plan:
 - 1. Submit plan describing procedures at least ten (10) days prior to the time cutting and patching will be performed. Include the following information:
 - a. Extent: Describe reason for and extent of each occurrence of cutting and patching.
 - b. Changes to in-place construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
 - c. Products: List products used for patching and firms or entities that will perform patching work.
 - d. Dates: Indicate when cutting and patching will be performed.
 - e. Utilities and mechanical and electrical systems:
 - 1) List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted:
 - a) Include description of provisions for temporary services and systems during interruption of permanent services and systems.

1.5 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
- B. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
- C. Operational Elements:
 - 1. Do not cut and patch operating elements and related components that results in

reducing the capacity to perform as intended or that results in increased maintenance or decreased operational life or safety:

- a. Primary operational systems and equipment.
- b. Fire separation assemblies.
- c. Air or smoke barriers.
- d. Fire suppression systems.
- e. Mechanical systems' piping and ducts.
- f. Control systems.
- g. Communication systems.
- h. Fire detection and alarm systems.
- i. Conveying systems.
- j. Electrical wiring systems.
- k. Operating systems of special construction.

D. Miscellaneous Elements:

1. Do not cut and patch the following elements or related components that change the load bearing capacity, resulting in a reduction of capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain wall construction.
 - d. Equipment supports.
 - e. Piping, ductwork, vessels, and equipment.
 - f. Noise and vibration control elements and systems.
 - g. Sprayed fire resistive material.

E. Visual Requirements:

1. Do not cut and patch construction resulting in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner:
 - a. If possible, retain original installer or fabricator to cut and patch exposed Work. If possible, engage original installer or fabricator. If original installer is not available, engage recognized, experienced, and specialized firm for the Work:
 - 1) Processed concrete finishes.
 - 2) Ornamental metal.
 - 3) Matched veneer woodwork.
 - 4) Preformed metal panels.
 - 5) Roofing.
 - 6) Firestopping.
 - 7) Window system.
 - 8) Fluid applied flooring.
 - 9) Wall covering.
 - 10) HVAC enclosures, cabinets, or covers.

- F. Cutting and Patching Conference: Before proceeding, meet at site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

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

PART 2 PRODUCTS

2.1 MATERIALS

- A. Comply with specified requirements.
- B. Existing Materials:
 - 1. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible:
 - a. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed:
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Services: Where removal, relocation, or abandonment is necessary, bypass existing services before cutting to avoid interruption of services to occupied areas.

3.3 CUTTING AND PATCHING

- A. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at earliest feasible time, and complete without delay:
 - 1. Cut existing construction to provide for installation of components or performance of construction, and subsequently patch as necessary to restore surfaces to an original condition.
 - 2. Cut in place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Temporary Support: Provide temporary support of Work to be cut.
- C. Protection: Protect in place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of

free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00: Summary and what is shown on Drawings.

E. Cutting:

1. Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original installer; comply with original installer's written recommendations:
 - a. 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. Temporarily cover openings when not in use.
 - b. Finished surfaces: Cut or drill from exposed or finished side into concealed surfaces.
 - c. Concrete and masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - d. Excavating and backfilling: Comply with requirements in applicable earthwork specifications by cutting and patching operations.
 - e. 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. Proceed with patching after construction operations requiring cutting are complete.

F. Patching:

1. Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications:
 - a. Inspection:
 - 1) Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - b. Exposed finishes:
 - 1) Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction to eliminate evidence of patching and refinishing:
 - a) Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b) Restore damaged pipe covering to its original condition.
2. Floors and walls: Where walls or partitions are removed, extend one finished area into another, patch and repair surfaces in new space. Provide even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
3. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior building enclosure: Patch components and restore enclosure to a weathertight condition.

END OF SECTION 01 73 29

SECTION 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 1. Salvaging nonhazardous demolition and construction waste.
 2. Recycling nonhazardous demolition and construction waste.
 3. Disposing of nonhazardous demolition and construction waste.

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 SUBMITTALS

- A. Waste Management Plan: Submit plan within ten (10) days of date established for commencement of the Work.
- B. Waste Reduction Progress Reports:
 1. Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste. Include the following information:
 - a. Material category.
 - b. Generation point of waste.
 - c. Total quantity of waste in tons (tonnes).
 - d. Quantity of waste salvaged, both estimated and actual in tons (tonnes).
 - e. Quantity of waste recycled, both estimated and actual in tons (tonnes).
 - f. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).
 - g. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total

waste.

- C. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end of Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.5 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Firm having minimum ten (10) years of documented experience in specializing in waste management coordination.
- B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Waste Management Conference:
 - 1. Conduct conference at site. Review methods and procedures related to waste management including, but not limited to, the following:
 - a. Review and discuss waste management plan including responsibilities of waste management coordinator.
 - b. Review requirements for documenting quantities of each type of waste and its disposition.
 - c. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - d. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - e. Review waste management requirements for each trade.

1.6 PERFORMANCE REQUIREMENTS

- A. Conform to County regulations regarding Solid Waste Control.
- B. Achieve end of Project rates for salvage/recycling of 75 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in

the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials:

1. Demolition waste:
 - a. Asphalt paving.
 - b. Concrete.
 - c. Concrete reinforcing steel.
 - d. Brick.
 - e. Concrete masonry units.
 - f. Wood studs.
 - g. Wood joists.
 - h. Plywood and oriented strand board.
 - i. Wood paneling.
 - j. Wood trim.
 - k. Structural and miscellaneous steel.
 - l. Rough hardware.
 - m. Roofing.
 - n. Insulation.
 - o. Doors and frames.
 - p. Door hardware.
 - q. Windows.
 - r. Glazing.
 - s. Metal studs.
 - t. Gypsum board.
 - u. Acoustical tile and panels.
 - v. Carpet.
 - w. Carpet pad.
 - x. Demountable partitions.
 - y. Equipment.
 - z. Cabinets.
 - aa. Plumbing fixtures.
 - bb. Piping.
 - cc. Supports and hangers.
 - dd. Valves.
 - ee. Sprinklers.
 - ff. Mechanical equipment.
 - gg. Refrigerants.
 - hh. Electrical conduit.
 - ii. Copper wiring.
 - jj. Lighting fixtures.
 - kk. Lamps.
 - ll. Ballasts.
 - mm. Electrical devices.
 - nn. Switchgear and panelboards.
 - oo. Transformers.
2. Construction waste:
 - a. Masonry and CMU.
 - b. Lumber.
 - c. Wood sheet materials.
 - d. Wood trim.
 - e. Metals.
 - f. Roofing.
 - g. Insulation.
 - h. Carpet and pad.
 - i. Gypsum board.
 - j. Piping.

- k. Electrical conduit.
- l. Packaging - Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - 1) Paper.
 - 2) Cardboard.
 - 3) Boxes.
 - 4) Plastic sheet and film.
 - 5) Polystyrene packaging.
 - 6) Wood crates.
 - 7) Plastic pails.

1.7 WASTE MANAGEMENT PLAN

- A. Develop a waste management plan and requirements. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition site clearing and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan:
 - 1. List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures:
 - a. Salvaged materials for reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - b. Salvaged materials for sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - c. Salvaged materials for donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - d. Recycled materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - e. Disposed materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - f. Handling and transportation procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.
- D. Cost/Revenue Analysis:
 - 1. Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste and Form CWM-6 for demolition waste. Include the following:
 - a. Total quantity of waste.
 - b. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
 - c. Total cost of disposal (with no waste management).
 - d. Revenue from salvaged materials.

- e. Revenue from recycled materials.
- f. Savings in hauling and tipping fees by donating materials.
- g. Savings in hauling and tipping fees that are avoided.
- h. Handling and transportation costs. Include cost of collection containers for each type of waste.
- i. Net additional cost or net savings from waste management plan.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 PLAN IMPLEMENTATION

- A. Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract:
 - 1. Comply with operation, termination, and removal requirements in Section 01 50 00: Temporary Facilities and Controls.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. Training:
 - 1. Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work:
 - a. Distribute waste management plan to everyone concerned within three (3) days of submittal return.
 - b. Distribute waste management plan to entities when they first begin work onsite. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls:
 - 1. Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities:
 - a. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - b. Comply with Section 01 50 00: Temporary Facilities and Controls for the control of dust and dirt, environmental protection, and noise control.
- E. Waste Management in Historic Zones or Areas: Hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by 12 inches (300 mm) or more.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
 - 1. Salvage items for reuse and handle:
 - a. Clean salvaged items.
 - b. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 - c. Store items in a secure area until installation.
 - d. Protect items from damage during transport and storage.
 - e. Install salvaged items to comply with installation requirements for new materials

and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

- B. Salvaged Items for Sale and Donation: Not permitted on Project site.
- C. Salvaged Items for Owner's Use:
 - 1. Salvage items for Owner's use and handle as follows:
 - a. Clean salvaged items.
 - b. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 - c. Store items in a secure area until delivery to Owner.
 - d. Transport items to Owner's storage area designated by Owner.
 - e. Protect items from damage during transport and storage.
- D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors, unless otherwise designated by Owner.
- E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- F. Plumbing Fixtures: Separate by type and size.
- G. Lighting Fixtures: Separate lamps by type and protect from breakage.
- H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING WASTE

- A. Recycle paper and beverage containers used by onsite workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures:
 - 1. Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan:
 - a. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin:
 - 1) Inspect containers and bins for contamination and remove contaminated materials if found.
 - b. Stockpile processed materials onsite without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - c. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - d. Store components off the ground and protect from the weather.
 - e. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 DISPOSAL OF WASTE

- A. Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction:
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate onsite.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

- B. Burning:
 - 1. Do not burn waste materials:
 - a. Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

- C. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.

3.5 ATTACHMENTS

- A. Form CWM-1 for construction waste identification.
- B. Form CWM-2 for demolition waste identification.
- C. Form CWM-3 for construction waste reduction work plan.
- D. Form CWM-4 for demolition waste reduction work plan.
- E. Form CWM-5 cost/revenue analysis of construction waste reduction work plan.
- F. Form CWM-6 cost/revenue analysis of demolition waste reduction work plan.
- G. Form CWM-7 for construction waste
- H. Form CWM-8 for demolition waste.

CWM FORMS ON FOLLOWING PAGES

| FORM CWM-1: CONSTRUCTION WASTE IDENTIFICATION | | | | | | | |
|--|-------------------------|---|---------------------------|--|----------------------------|----------------------------------|--------------------------------|
| MATERIAL CATEGORY | GENERATION POINT | EST. QUANTITY OF MATERIALS RECEIVED* (A) | EST. WASTE - % (B) | TOTAL EST. QUANTITY OF WASTE* (C = A x B) | EST. VOLUME CY (CM) | EST. WEIGHT TONS (TONNES) | REMARKS AND ASSUMPTIONS |
| Packaging: Cardboard | | | | | | | |
| Packaging: Boxes | | | | | | | |
| Packaging: Plastic Sheet or Film | | | | | | | |
| Packaging: Polystyrene | | | | | | | |
| Packaging: Pallets or Skids | | | | | | | |
| Packaging: Crates | | | | | | | |
| Packaging: Paint Cans | | | | | | | |
| Packaging: Plastic Pails | | | | | | | |
| Site-Clearing Waste | | | | | | | |
| Masonry or CMU | | | | | | | |
| Lumber: Cut-Offs | | | | | | | |
| Lumber: Warped Pieces | | | | | | | |
| Plywood or OSB (scraps) | | | | | | | |
| Wood Forms | | | | | | | |
| Wood Waste Chutes | | | | | | | |
| Wood Trim (cut-offs) | | | | | | | |
| Metals | | | | | | | |
| Insulation | | | | | | | |
| Roofing | | | | | | | |
| Joint Sealant Tubes | | | | | | | |
| Gypsum Board (scraps) | | | | | | | |
| Carpet and Pad (scraps) | | | | | | | |
| Piping | | | | | | | |
| Electrical Conduit | | | | | | | |
| Other: | | | | | | | |

| FORM CWM-2: DEMOLITION WASTE IDENTIFICATION | | | | |
|--|----------------------|----------------------------|----------------------------------|--------------------------------|
| MATERIAL DESCRIPTION | EST. QUANTITY | EST. VOLUME CY (CM) | EST. WEIGHT TONS (TONNES) | REMARKS AND ASSUMPTIONS |
| Asphaltic Concrete Paving | | | | |
| Concrete | | | | |
| Brick | | | | |
| CMU | | | | |
| Lumber | | | | |
| Plywood and OSB | | | | |
| Wood Paneling | | | | |
| Wood Trim | | | | |
| Miscellaneous Metals | | | | |
| Structural Steel | | | | |
| Rough Hardware | | | | |
| Insulation | | | | |
| Roofing | | | | |
| Doors and Frames | | | | |
| Door Hardware | | | | |
| Windows | | | | |
| Glazing | | | | |
| Acoustical Tile | | | | |
| Carpet | | | | |
| Carpet Pad | | | | |
| Demountable Partitions | | | | |
| Equipment | | | | |
| Cabinets | | | | |
| Plumbing Fixtures | | | | |
| Piping | | | | |
| Piping Supports and Hangers | | | | |
| Valves | | | | |
| Sprinklers | | | | |
| Mechanical Equipment | | | | |
| Electrical Conduit | | | | |
| Copper Wiring | | | | |
| Light Fixtures | | | | |
| Lamps | | | | |
| Lighting Ballasts | | | | |
| Electrical Devices | | | | |
| Switchgear and Panelboards | | | | |
| Transformers | | | | |
| Other: | | | | |

| FORM CWM-3: CONSTRUCTION WASTE REDUCTION WORK PLAN | | | | | | |
|---|-------------------------|---|---|---|---|---|
| MATERIAL CATEGORY | GENERATION POINT | TOTAL EST. QUANTITY OF WASTE TONS (TONNES) | DISPOSAL METHOD AND QUANTITY | | | HANDLING AND TRANSPORTION PROCEDURES |
| | | | EST. AMOUNT SALVAGED TONS (TONNES) | EST. AMOUNT RECYCLED TONS (TONNES) | EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES) | |
| Packaging: Cardboard | | | | | | |
| Packaging: Boxes | | | | | | |
| Packaging: Plastic Sheet or Film | | | | | | |
| Packaging: Polystyrene | | | | | | |
| Packaging: Pallets or Skids | | | | | | |
| Packaging: Crates | | | | | | |
| Packaging: Paint Cans | | | | | | |
| Packaging: Plastic Pails | | | | | | |
| Site-Clearing Waste | | | | | | |
| Masonry or CMU | | | | | | |
| Lumber: Cut-Offs | | | | | | |
| Lumber: Warped Pieces | | | | | | |
| Plywood or OSB (scraps) | | | | | | |
| Wood Forms | | | | | | |
| Wood Waste Chutes | | | | | | |
| Wood Trim (cut-offs) | | | | | | |
| Metals | | | | | | |
| Insulation | | | | | | |
| Roofing | | | | | | |
| Joint Sealant Tubes | | | | | | |
| Gypsum Board (scraps) | | | | | | |
| Carpet and Pad (scraps) | | | | | | |
| Piping | | | | | | |
| Electrical Conduit | | | | | | |
| Other: | | | | | | |

| FORM CWM-4: DEMOLITION WASTE REDUCTION WORK PLAN | | | | | | |
|---|-------------------------|---|---|---|---|---|
| MATERIAL CATEGORY | GENERATION POINT | TOTAL EST. QUANTITY OF WASTE TONS (TONNES) | DISPOSAL METHOD AND QUANTITY | | | HANDLING AND TRANSPORTION PROCEDURES |
| | | | EST. AMOUNT SALVAGED TONS (TONNES) | EST. AMOUNT RECYCLED TONS (TONNES) | EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES) | |
| Asphaltic Concrete Paving | | | | | | |
| Concrete | | | | | | |
| Brick | | | | | | |
| CMU | | | | | | |
| Lumber | | | | | | |
| Plywood and OSB | | | | | | |
| Wood Paneling | | | | | | |
| Wood Trim | | | | | | |
| Miscellaneous Metals | | | | | | |
| Structural Steel | | | | | | |
| Rough Hardware | | | | | | |
| Insulation | | | | | | |
| Roofing | | | | | | |
| Doors and Frames | | | | | | |
| Door Hardware | | | | | | |
| Windows | | | | | | |
| Glazing | | | | | | |
| Acoustical Tile | | | | | | |
| Carpet | | | | | | |
| Carpet Pad | | | | | | |
| Demountable Partitions | | | | | | |
| Equipment | | | | | | |
| Cabinets | | | | | | |
| Plumbing Fixtures | | | | | | |
| Piping | | | | | | |
| Supports and Hangers | | | | | | |
| Valves | | | | | | |
| Sprinklers | | | | | | |
| Mechanical Equipment | | | | | | |
| Electrical Conduit | | | | | | |
| Copper Wiring | | | | | | |
| Light Fixtures | | | | | | |
| Lamps | | | | | | |
| Lighting Ballasts | | | | | | |
| Electrical Devices | | | | | | |
| Switchgear and Panelboards | | | | | | |
| Transformers | | | | | | |
| Other: | | | | | | |

| FORM CWM-5: COST/REVENUE ANALYSIS OF CONSTRUCTION WASTE REDUCTION WORK PLAN | | | | | | | | |
|---|--|---------------------------|---|-------------------------------------|-------------------------------------|-----------------------------------|---|---|
| MATERIALS | TOTAL QUANTITY OF MATERIALS (VOL. OR WEIGHT) (A) | EST. COST OF DISPOSAL (B) | TOTAL EST. COST OF DISPOSAL (C = A x B) | REVENUE FROM SALVAGED MATERIALS (D) | REVENUE FROM RECYCLED MATERIALS (E) | LANDFILL TIPPING FEES AVOIDED (F) | HANDLING AND TRANSPORTATION COSTS AVOIDED (G) | NET COST SAVINGS OF WORK PLAN (H = D+E+F+G) |
| Packaging: Cardboard | | | | | | | | |
| Packaging: Boxes | | | | | | | | |
| Packaging: Plastic Sheet or Film | | | | | | | | |
| Packaging: Polystyrene | | | | | | | | |
| Packaging: Pallets or Skids | | | | | | | | |
| Packaging: Crates | | | | | | | | |
| Packaging: Paint Cans | | | | | | | | |
| Packaging: Plastic Pails | | | | | | | | |
| Site-Clearing Waste | | | | | | | | |
| Masonry or CMU | | | | | | | | |
| Lumber: Cut-Offs | | | | | | | | |
| Lumber: Warped Pieces | | | | | | | | |
| Plywood or OSB (scraps) | | | | | | | | |
| Wood Forms | | | | | | | | |
| Wood Waste Chutes | | | | | | | | |
| Wood Trim (cut-offs) | | | | | | | | |
| Metals | | | | | | | | |
| Insulation | | | | | | | | |
| Roofing | | | | | | | | |
| Joint Sealant Tubes | | | | | | | | |
| Gypsum Board (scraps) | | | | | | | | |
| Carpet and Pad (scraps) | | | | | | | | |
| Piping | | | | | | | | |
| Electrical Conduit | | | | | | | | |
| Other: | | | | | | | | |

| FORM CWM-6: COST/REVENUE ANALYSIS OF DEMOLITION WASTE REDUCTION WORK PLAN | | | | | | | | |
|---|--|---------------------------|---|-------------------------------------|-------------------------------------|-----------------------------------|---|---|
| MATERIALS | TOTAL QUANTITY OF MATERIALS (VOL. OR WEIGHT) (A) | EST. COST OF DISPOSAL (B) | TOTAL EST. COST OF DISPOSAL (C = A x B) | REVENUE FROM SALVAGED MATERIALS (D) | REVENUE FROM RECYCLED MATERIALS (E) | LANDFILL TIPPING FEES AVOIDED (F) | HANDLING AND TRANSPORTATION COSTS AVOIDED (G) | NET COST SAVINGS OF WORK PLAN (H = D+E+F+G) |
| Asphaltic Concrete Paving | | | | | | | | |
| Concrete | | | | | | | | |
| Brick | | | | | | | | |
| CMU | | | | | | | | |
| Lumber | | | | | | | | |
| Plywood and OSB | | | | | | | | |
| Wood Paneling | | | | | | | | |
| Wood Trim | | | | | | | | |
| Miscellaneous Metals | | | | | | | | |
| Structural Steel | | | | | | | | |
| Rough Hardware | | | | | | | | |
| Insulation | | | | | | | | |
| Roofing | | | | | | | | |
| Doors and Frames | | | | | | | | |
| Door Hardware | | | | | | | | |
| Windows | | | | | | | | |
| Glazing | | | | | | | | |
| Acoustical Tile | | | | | | | | |
| Carpet | | | | | | | | |
| Carpet Pad | | | | | | | | |
| Demountable Partitions | | | | | | | | |
| Equipment | | | | | | | | |
| Cabinets | | | | | | | | |
| Plumbing Fixtures | | | | | | | | |
| Piping | | | | | | | | |
| Supports and Hangers | | | | | | | | |
| Valves | | | | | | | | |
| Sprinklers | | | | | | | | |
| Mech. Equipment | | | | | | | | |
| Electrical Conduit | | | | | | | | |
| Copper Wiring | | | | | | | | |
| Light Fixtures | | | | | | | | |
| Lamps | | | | | | | | |
| Lighting Ballasts | | | | | | | | |
| Electrical Devices | | | | | | | | |
| Switchgear and Panelboards | | | | | | | | |
| Transformers | | | | | | | | |
| Other: | | | | | | | | |

| FORM CWM-7: CONSTRUCTION WASTE REDUCTION PROGRESS REPORT | | | | | | | | |
|---|-------------------------|--|-----------------------------------|---------------------------------|-----------------------------------|---------------------------------|--|--|
| MATERIAL CATEGORY | GENERATION POINT | TOTAL QUANTITY OF WASTE TONS (TONNES) (A) | QUANTITY OF WASTE SALVAGED | | QUANTITY OF WASTE RECYCLED | | TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C) | TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100) |
| | | | ESTIMATED TONS (TONNES) | ACTUAL TONS (TONNES) (B) | ESTIMATED TONS (TONNES) | ACTUAL TONS (TONNES) (C) | | |
| Packaging: Cardboard | | | | | | | | |
| Packaging: Boxes | | | | | | | | |
| Packaging: Plastic Sheet or Film | | | | | | | | |
| Packaging: Polystyrene | | | | | | | | |
| Packaging: Pallets or Skids | | | | | | | | |
| Packaging: Crates | | | | | | | | |
| Packaging: Paint Cans | | | | | | | | |
| Packaging: Plastic Pails | | | | | | | | |
| Site-Clearing Waste | | | | | | | | |
| Masonry or CMU | | | | | | | | |
| Lumber: Cut-Offs | | | | | | | | |
| Lumber: Warped Pieces | | | | | | | | |
| Plywood or OSB (scraps) | | | | | | | | |
| Wood Forms | | | | | | | | |
| Wood Waste Chutes | | | | | | | | |
| Wood Trim (cut-offs) | | | | | | | | |
| Metals | | | | | | | | |
| Insulation | | | | | | | | |
| Roofing | | | | | | | | |
| Joint Sealant Tubes | | | | | | | | |
| Gypsum Board (scraps) | | | | | | | | |
| Carpet and Pad (scraps) | | | | | | | | |
| Piping | | | | | | | | |
| Electrical Conduit | | | | | | | | |
| Other: | | | | | | | | |

| FORM CWM-8: DEMOLITION WASTE REDUCTION PROGRESS REPORT | | | | | | | | |
|--|------------------|---|----------------------------|--------------------------|----------------------------|--------------------------|---|---|
| MATERIAL CATEGORY | GENERATION POINT | TOTAL QUANTITY OF WASTE TONS (TONNES) (A) | QUANTITY OF WASTE SALVAGED | | QUANTITY OF WASTE RECYCLED | | TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C) | TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100) |
| | | | ESTIMATED TONS (TONNES) | ACTUAL TONS (TONNES) (B) | ESTIMATED TONS (TONNES) | ACTUAL TONS (TONNES) (C) | | |
| Asphaltic Concrete Paving | | | | | | | | |
| Concrete | | | | | | | | |
| Brick | | | | | | | | |
| CMU | | | | | | | | |
| Lumber | | | | | | | | |
| Plywood and OSB | | | | | | | | |
| Wood Paneling | | | | | | | | |
| Wood Trim | | | | | | | | |
| Miscellaneous Metals | | | | | | | | |
| Structural Steel | | | | | | | | |
| Rough Hardware | | | | | | | | |
| Insulation | | | | | | | | |
| Roofing | | | | | | | | |
| Doors and Frames | | | | | | | | |
| Door Hardware | | | | | | | | |
| Windows | | | | | | | | |
| Glazing | | | | | | | | |
| Acoustical Tile | | | | | | | | |
| Carpet | | | | | | | | |
| Carpet Pad | | | | | | | | |
| Demountable Partitions | | | | | | | | |
| Equipment | | | | | | | | |
| Cabinets | | | | | | | | |
| Plumbing Fixtures | | | | | | | | |
| Piping | | | | | | | | |
| Supports and Hangers | | | | | | | | |
| Valves | | | | | | | | |
| Sprinklers | | | | | | | | |
| Mechanical Equipment | | | | | | | | |
| Electrical Conduit | | | | | | | | |
| Copper Wiring | | | | | | | | |
| Light Fixtures | | | | | | | | |
| Lamps | | | | | | | | |
| Lighting Ballasts | | | | | | | | |
| Electrical Devices | | | | | | | | |
| Switchgear and Panelboards | | | | | | | | |
| Transformers | | | | | | | | |
| Other: | | | | | | | | |

END OF SECTION 01 74 19

SECTION 01 77 00 CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PRE-CLOSEOUT MEETING

- A. Pre-Closeout Meeting: Schedule and convene a pre-closeout meeting with Owner and Architect in accordance with Section 01 31 00: Project Management and Coordination.

1.3 SUBSTANTIAL COMPLETION

- A. The items identified in the Contract Documents, including the Supplementary Conditions and the following items shall be completed before Substantial Completion will be granted (also see Section 01 77 22: Substantial Completion Procedures):
 1. Contractor's completion list (punch list): Submit a thorough list of items to be completed or corrected, along with a written request for Substantial Completion and for review of the Work or portion of the Work. Architect's or Engineer's Project representative, at their discretion, may attend and assist in the preparation of Contractor's punch list.
 2. Architect's supplemental punch list: Architect/Engineer, along with Owner at Owner's discretion, will inspect the Work utilizing Contractor's prepared punch list, noting completed items and incomplete items, and will prepare a supplemental list of items that have been omitted or incomplete items that were not previously noted.
 3. Operations and maintenance manuals: Submit as described.
 4. Final cleaning: Provide final cleaning and adequate protection of installed construction as described.
 5. Starting of systems: Start up equipment and systems as described.
 6. Testing and balancing: Testing and balancing of systems must be performed and completed by Owner's forces, and the report submitted and accepted by Architect/Engineer and Owner, as described in the Contract Documents. Make adjustments to equipment as required to achieve acceptance.
 7. Demonstrations: If required by individual Specification Sections or by Owner, provide demonstrations and instructions for use of equipment as described.
- B. Date of Substantial Completion: Complete or correct items identified on punch list and confirm that all items have been corrected prior to Architect's re-inspection. Architect/Engineer, along with Owner, will re-inspect the corrected work to establish the Date of Substantial Completion. Incomplete items remaining will be appended to the Certificate of Substantial Completion (AIA G704). The Date of Substantial Completion represents day one of the closeout period and represents the date of commencement of Contractor's correctional period and all warranty periods as described and required by the Contract Documents, except as amended in the Certificate of Substantial Completion and elsewhere in the Contract Documents.
- C. Certificate of Substantial Completion: When the Work or designated portion thereof is substantially complete, Architect will prepare the Certificate of Substantial Completion to be executed by Owner and Contractor. Items on the appended punch list shall be completed or corrected within the time limits established in the Certificate.

1.4 PUNCH LIST

- A. A comprehensive list prepared by Contractor prior to Substantial Completion, and attached thereto, to establish all items to be corrected, or limited items of work to be completed, if any. This list is intended to represent a limited number of items needing attention.
- B. Punch lists shall be furnished to Architect in Microsoft Excel and PDF formats. The punch list shall be in matrix form and shall include the following information for each punch list item:
 - 1. Room number or other suitable location identifier.
 - 2. Description of the Work.
 - 3. Subcontractor/trade sign-off that the work has been verified to be 100 percent complete and in accordance with the Contract Documents.
 - 4. Subcontractor/trade sign-off date.
 - 5. General Contractor sign-off that the work has been verified to be 100 percent complete and in accordance with the Contract Documents.
 - 6. General Contractor/trade sign-off date.
 - 7. A/E consultant sign-off.
 - 8. A/E consultant sign-off date.
 - 9. If requested by Owner, provide two (2) additional similar columns for their sign-off.
 - 10. In the case of excessive repetition of the same item at various locations, the punch list may contain "general notes/items" that shall be applied to the entire Project. It shall be the responsibility of the Contractor/Subcontractor to thoroughly examine the entire Project and make corrective measures at all applicable locations.
- C. Should Architect determine that Contractor's punch list lacks sufficient detail or requires extensive supplementation, the punch list will be returned to Contractor for re-inspection and revision. The date of Substantial Completion will be delayed until the punch list submitted is a reasonable representation of the Work to be done.
- D. A significantly large number of items to be completed or corrected will preclude Architect from issuing a Certificate of Substantial Completion. Owner and Architect will be the sole judges of what constitutes a significantly large number of items. It is anticipated that the detailed list of items of Work to be completed or corrected at the Date of Substantial Completion will be no longer than five (5) typed pages.
- E. Contractor's superintendent shall participate in the preparation of Contractor's punch list that is submitted to Architect and Owner for supplementation. Upon receipt, Architect and consultants shall perform a spot review to determine the adequacy and completeness of Contractor's punch list.
- F. Upon receipt of an acceptable Contractor's punch list, Contractor's superintendent shall accompany Architect, his consultants and Owner (at his discretion) during their observation and the preparation of their supplements to Contractor's punch list:
 - 1. The superintendent shall record or otherwise take note of all supplementary items.
 - 2. Architect will endeavor to furnish to Contractor typed, hand written, or recorded supplements to the punch list in a prompt manner; however, any delay in Contractor receiving said supplements from Architect will not be cause for a claim for additional cost or extension of time as Contractor's superintendent shall have been in attendance during the inspections of Architect and his consultants and will have been expected to take his own notes.

1.5 OPERATIONS AND MAINTENANCE MANUAL

- A. As a requirement for Substantial Completion, the final operation and maintenance manual shall be submitted to, and reviewed and accepted by Architect prior to issuance of the

Certificate.

- B. Prepare a 3-ring D-slant binder cover and spline with printed title "OPERATIONS AND MAINTENANCE MANUAL," title of Project, and subject matter of binder when multiple binders are required.
- C. Submit one (1) copy of preliminary operations and maintenance manuals to respective consultants (civil, MEP, structural, etc.) for review of conformance with Contract requirements prior to submitting final to Architect. Allow time for proper review.
- D. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- E. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- F. Contents:
 - 1. Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
 - a. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, subcontractors, and major equipment suppliers.
 - b. Part 2: Operation and Maintenance, arranged by system and subdivided by Specification Section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:
 - 1) Significant design criteria.
 - 2) List of equipment.
 - 3) Parts list for each component.
 - 4) Equipment start-up instructions
 - 5) Operating instructions.
 - 6) Maintenance instructions for equipment and systems.
 - 7) Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - c. Part 3: Project documents and certificates, including the following:
 - 1) Product data.
 - 2) Air and water balance reports.
 - 3) Photocopies of warranties, certificates and bonds. Submit originals with Closeout Documents as specified below.
- G. Submit one (1) final original and two (2) copies to Architect.
- H. Contractor shall provide a DVD, in PDF Format, the following documents after approval by Architect, consultants, and Owner: Closeout Manual, MSDS binder, O&M Manuals, Specifications and approved submittals. Documents shall be hyperlinked to the Table of Contents.

1.6 PROJECT CLOSEOUT

- A. Final Payment will not be authorized by Architect until Architect finds the Work acceptable under the Contract Documents, subject to the completion and acceptance of the following requirements and other applicable Contract requirements:
 - 1. Close-out Documents: Provide bound closeout documents as described. Refer to the Supplementary Conditions for additional information.
 - 2. Record Documents: Submit as described.
 - 3. Extra materials: Provide extra stock, materials, and products as described when

- required by individual Specification Sections.
4. Locks: Make final changeover of permanent locks and transmit keys to Owner. Advise Owner's personnel of changeover in security provisions.
 5. Temporary Facilities: Discontinue and remove temporary facilities from the site, along with mockups, construction aids, and similar elements.
 6. Warranties, Certificates and Bonds: Execute and assemble transferable warranty documents, certificates, and bonds from subcontractors, suppliers, and manufacturers as described.
 7. Final Inspection and Acceptance by Architect is achieved as described.

1.7 CLOSEOUT DOCUMENTS

- A. Coordinate the following items with the requirements of Document CB, Supplementary Conditions of the Contract.
- B. Prepare 3-ring D-slant binder cover and spline with printed title "CLOSEOUT DOCUMENTS", title of Project, and subject matter of binder when multiple binders are required. Submit one (1) original and two (2) copies.
- C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. The closeout documents shall be neatly organized and easily useable as determined by Architect and Owner. Separate closeout document binders from operations and maintenance manuals. Documents identified as "affidavit" shall be notarized.
- E. Prepare a table of contents for each volume, with each item description identified, typed on white paper, in five (5) parts as follows:
 1. Part 1: Directory listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, subcontractors, and major equipment suppliers. All General Contractor's vendors/suppliers and subcontractors that provided materials or performed any work related to this Project must be listed on this form. Submit final list of subcontractors on Document AD.
 2. Part 2: Closeout documents and affidavits, including the following:
 - a. AIA G707 - Consent of Surety to Final Payment.
 - b. AIA G706 - Contractor's Affidavit of Payment of Debts and Claims.
 - c. AIA G706A - Contractor's Affidavit of Release of Liens.
 3. Part 3: Project documents and certificates, including the following:
 - a. Copy of Certificate of Substantial Completion (AIA G704).
 - b. Copy of All Permits.
 - c. Copy of Final Utility Bill or letter of transfer.
 - d. Copy of Certificate of Occupancy.
 - e. Copy of Certification of Project Compliance: Submit on attached **Closeout Form "B"**. Owner and Architect will initiate form and forward to Contractor for signature once Substantial Completion is established (Owner to be provided original separately).
 4. Part 4: Warranties and Release of Liens; compile sequentially based on Specification Sections:
 - a. General Contractor's warranty: Submit on company letterhead as described below. This Warranty shall state all sections of Work performed by General Contractor's own forces, and warranty period for each section of Work.
 - b. Subcontractor's release of lien: Include Contractor's, Subcontractor's, and direct material and equipment supplier's separate final releases. Submit on attached **Closeout Form "A"** – Subcontractor's Affidavit of Release of Lien.
 - c. Hazardous material certificate: Submit on attached **Closeout Form "C"**. Affidavits from Contractor, subcontractors and General Contractor's vendors or suppliers

- stating that no hazardous materials/products have been used or installed in this Project.
- d. Subcontractor's warranty: Notarized and submitted on attached **Closeout Form "D"**. This warranty shall state all sections of Work performed by the Subcontractor and warranty period.
 - e. Special/extended warranties: List and provide notarized warranties requested by Owner, or required by or incorporated in the Contract Documents.
 - f. Spreadsheet depicting all items and materials that carry a warranty longer than one (1) year. Include information consisting of material/supplier/installer/Specification Section/length of warranty and contact information.
5. Part 5: Receipts:
- a. Extra stock: Provide original receipts for delivery of "extra stock" items as described below. Receipts must be signed by an authorized Owner's representative.
 - b. Keys: Provide original receipts for delivery of "keys." Receipts must be signed by an authorized Owner's representative.
 - c. Sign-in sheets: Provide signatures of attendees from all demonstrations.
- F. In addition to the three (3) required closeout binders listed above, provide Architect with one (1) separate binder for their records containing the following:
- 1. Directory listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, subcontractors, and major equipment suppliers.
 - 2. All MSDS sheets for the Project.
 - 3. All warranties from Contractor, subcontractors, direct suppliers, and manufacturers.
- G. Failure to complete and closeout Project after substantial completion may result in liquidated damages being assessed to Contractor. Refer to Conditions of the Contract for additional requirements and liquidated damages.

1.8 FINAL CLEANING

- A. Execute final cleaning prior to final Project inspection and acceptance.
- B. Clean interior and exterior glass, and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces, mop hard floor surfaces.
- C. Remove smudges, marks, stains, fingerprints, soil, dirt, spots, dust, lint, and other foreign materials from finished and exposed surfaces
- D. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.
- E. Clean and replace filters of operating equipment as required by Contract Documents
- F. Clean debris from roofs, gutters, downspouts, and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste and surplus materials, rubbish, and temporary construction facilities from site.

1.9 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual

Specification Sections until Work is accepted by Architect and Owner.

- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic from landscaped areas.

1.10 STARTING OF SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect/Engineer and Owner 48 hours prior to start-up of each item.
- C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of Contractors' personnel, and installer in accordance with manufacturers' instructions.
- G. When specified in individual Specification Sections or required by manufacturer, 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. When specified in individual Specification Sections or required by Owner or Architect/Engineer, submit a written report in accordance with Section 01 33 00, Submittal Procedures, that equipment or system has been properly installed and is functioning correctly.

1.11 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of products to Owner's personnel a minimum of 48 hours prior to date of Final Completion in accordance with Owner's requirements.
- B. Demonstrate Project equipment instructed by qualified manufacturer's representative who is knowledgeable about the Project and equipment.
- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six (6) months.
- D. Utilize maintenance manual as basis for instruction. Review contents of manual with

Owner's personnel to explain all aspects of operation and maintenance.

- E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment.
- F. Prepare and insert additional data in maintenance manuals when needed for when additional data becomes apparent during instruction.
- G. Review and verify proper start-up and operation of equipment prior to scheduling demonstrations with Owner.
- H. All demonstrations are to be documented by video and submitted to Owner in DVD format along with the closeout documents. General Contractor is responsible for all video and compilation onto DVD with linked menus.

1.12 PROJECT RECORD DOCUMENTS

- A. Project Record Documents, as described in Section 01 78 39: Project Record Documents, shall be submitted at Project closeout. Final payment will not be authorized by Architect until final review and acceptance by Architect and Engineers is achieved in accordance with Owner's requirements.
- B. At Contractor's request, and with associated fee, Architect may provide electronic versions of the construction Drawing and Specification files for Contractor's use, subject to the terms and conditions of Architect's standard electronic document transfer agreement.
- C. Submit reproducible to respective consultants (civil, structural, MEP, etc.) for review. Consultant will mark-up corrections and return to Contractor for final revisions. Make final revisions prior to submitting to Architect:
 - 1. Format: One (1) set of film positive reproducible and two (2) sets of blueprints of approved reproducible.
 - 2. Provide Owner with one (1) set of Record Drawings on a non-rewritable CD in AutoCAD® latest release.
 - 3. Provide Owner with one (1) set of Record Drawings on a non-rewritable CD in PDF format.
 - 4. Label electronic CAD files and PDF files in the same manner as the sheets (example, A2.02 First Floor Area 'A', etc.)

1.13 EXTRA STOCK, MATERIALS, AND MAINTENANCE PRODUCTS

- A. Furnish extra stock, maintenance, and extra products in quantities specified in individual Specification Sections.
- B. Deliver to Project site or to District Maintenance Department as directed by Owner; obtain signed receipt from Owner's authorized representative prior to final application for payment. Delivery of materials to, or obtaining receipt from anyone other than Owner's authorized representative may constitute breach of this requirement and may require delivery of additional materials at no cost to Owner if original materials are misplaced.
- C. Include signed receipts for delivery of extra stock and materials, including keys, with closeout documents.

1.14 WARRANTIES, CERTIFICATES, AND BONDS

- A. Definitions:

1. Standard product warranties: Preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to Owner.
 2. Special warranties: Written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide coverage of specific defects, or both.
- B. In accordance with the general warranty obligations under the General Conditions as amended by the Supplementary Conditions, General Contractor's warranty shall be for a period of one (1) year following the date of Substantial Completion, hereinafter called the one-year warranty period. Contractor's one (1) year general warranty shall include all labor, material, and delivery costs required to correct defective material and installation. This warranty shall not limit Owner's rights with respect to latent defects, gross mistakes, or fraud.
- C. Contractor's one (1) year warranty shall run concurrently with the one (1) year period for correction of Work required in the General Conditions.
- D. No service charges or call out charges are allowed to investigate warranty claims.
- E. In addition to Contractor's one (1) year warranty, special warranties, as described in individual Specifications Sections, shall extend the warranty period for the period specified without limitation in respect to other obligations for which Contractor has under the Contract Documents.
- F. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of the warranty on the Work that incorporates the products, nor does it relieve the suppliers, manufacturers, and subcontractors required to countersign special warranties with Contractor.
- G. Warranty Requirements:
1. When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
 2. When Work covered by a warranty has failed and been corrected by replacement or reconstruction, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
 3. Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. Contractor is responsible for the cost of replacing defective Work regardless of whether Owner has benefited from use of the Work through a portion of its anticipated useful service life.
 4. Written warranties made to Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights, and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which Owner can enforce such other duties, obligations, rights, or remedies.
 5. Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or designated portion of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.
- H. Compile copies of each required warranty properly executed by Contractor and the Subcontractor, supplier, or manufacturer. Verify documents are in proper form, contain full information, and are notarized. Co-execute warranties, certificates, and bonds when required and include signed warrantees with Closeout Documents submitted to Architect.

1.15 FINAL COMPLETION AND FINAL PAYMENT

- A. Final Notice and Inspection:
 - 1. When all items on the punch list have been corrected, final cleaning has been completed, and installed work has been protected, submit written notice to Architect that the Work is ready for final inspection and acceptance.
 - 2. Upon receipt of written notice that the Work is ready for final inspection and acceptance, Architect and Engineer will make final inspection.
- B. Final Change Order: When the Project closeout items described above are successfully completed and the Work is found acceptable to Architect/Engineer and Owner, a Final Change Order will be executed. This Change Order will include any Allowance adjustments as required by the Contract Documents.
- C. Final Application for Payment: When all of the above items are successfully complete, submit to Architect a final Application for Payment and request for release of retainage.
- D. Release of Retainage: Release of retainage will not be authorized by Architect until Contractor completes all requirements for closeout to the satisfaction of Owner and Architect as described herein.

1.16 TERMINAL INSPECTION

- A. Immediately prior to expiration of the one (1) year period for correction of the Work, Contractor shall make an inspection of the Work in the company of Architect and Owner. Architect and Owner shall be given not less than ten (10) days' notice prior to the anticipated date of terminal inspection.
- B. Where any portion of the work has proven to be defective and requires replacement, repair, or adjustment, Contractor shall immediately provide materials and labor necessary to remedy such defective work and shall execute such work without delay until completed to the satisfaction of Architect and Owner, even if the date of completion of the corrective work may extend beyond the expiration date of the correction period.
- C. Contractor shall not be responsible for correction of Work that has been damaged because of neglect or abuse by Owner, nor the replacement of parts necessitated by normal wear in use.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 77 00

SECTION 01 77 22 SUBSTANTIAL COMPLETION PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, Substantial Completion procedures.
- B. Related Sections:
 - 1. Section 01 77 00: Closeout Procedures.

1.3 SUBMITTALS

- A. Contractor's List of Incomplete Items (Punch List): Initial submittal at Substantial Completion.

1.4 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion:
 - 1. Minimum of ten (10) days prior to requesting an inspection for determining date of Substantial Completion. List items that are incomplete at time of request:
 - a. Certificates of release: Obtain and submit releases from all (i.e. city, county, authorities) authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - b. Submit closeout submittals, including Project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - c. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - d. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable:
 - 1) List of extra materials: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 - e. Submit test/adjust/balance records from Owner vendor.
 - f. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

- C. Procedures Prior to Substantial Completion:
1. A minimum of ten (10) days prior to requesting inspection for determining date of Substantial Completion, submit list items that are incomplete at time of request:
 - a. Advise Owner of pending insurance changeover requirements.
 - b. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - c. Complete startup and testing of systems and equipment.
 - d. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - e. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings as applicable.
 - f. Advise Owner of changeover in heat and utilities.
 - g. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 - h. Terminate and remove temporary facilities from site, including mockups, construction tools, and similar elements, and restore or configure area to required or original condition.
 - i. Complete final cleaning requirements, including touchup painting.
 - j. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
 - k. Conditional lien regulations.
- D. Inspection:
1. Submit written request for inspection to determine Substantial Completion a minimum of ten (10) days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued:
 - a. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - b. Results of completed inspection will form the basis of requirements for final completion.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 FINAL CLEANING

- A. Perform Final Cleaning:
1. Conduct cleaning and waste-removal operations to comply with local laws and ordinances, and Federal and local environmental and antipollution regulations.
 2. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions:
 - a. Complete cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project. Cleaning activities include but are not limited to:
 - 1) Clean site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - 2) Sweep paved areas broom clean. Remove petrochemical spills, stains, and

- foreign deposits.
- 3) Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - 4) Remove tools, construction equipment, machinery, and surplus material from Project site.
 - 5) Remove snow and ice to provide safe access to building.
 - 6) Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - 7) Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - 8) Sweep concrete floors broom clean in unoccupied spaces.
 - 9) Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - 10) Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - 11) Remove labels that are not permanent.
 - 12) Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - 13) Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - 14) Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - 15) Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection:
 - a) Clean HVAC system in compliance with NADCA Standard ACR 2013. Provide written report on completion of cleaning.
 - 16) Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - 17) Leave Project clean and ready for occupancy.
- B. Construction Waste Disposal:
1. Comply with waste disposal requirements.

END OF SECTION 01 77 22

SECTION 01 78 23 OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 1. Operation and maintenance documentation directory manuals.
 2. Emergency manuals.
 3. Systems and equipment operation manuals.
 4. Systems and equipment maintenance manuals.
 5. Product maintenance manuals.

1.3 DEFINITIONS

- A. Subsystem: A portion of a system with characteristics similar to a system.
- B. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

1.4 SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section:
 1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format:
 1. Submit operation and maintenance manuals in the following format:
 - a. Submit on digital media acceptable to Architect or by uploading to web-based project software site or by email to Architect. Enable reviewer comments on draft submittals.
 - b. Submit three (3) paper copies. Architect will return two (2) copies.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal:
 1. Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments:
 - a. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of

receipt of Architect's comments and prior to commencing demonstration and training.

- E. Comply with **Section 01 77 00: Closeout Procedures** for schedule for submitting operation and maintenance documentation. **Where applicable use 01 91 13: General Commissioning Requirements.**

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files:
 - 1. Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required:
 - a. Electronic files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - b. File names and bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy:
 - 1. Submit manuals in the form of hard-copy, bound and labeled volumes:
 - a. Binders:
 - 1) Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2 by 11-inch (215 mm X 280 mm) paper, with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets:
 - a) If two (2) or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b) Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
 - b. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project manual.
 - c. Protective plastic sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
 - d. Supplementary text: Prepared on 8-1/2 by 11-inch (215 mm X 280 mm) white bond paper.
 - e. Drawings:
 - 1) Attach reinforced, punched binder tabs on Drawings and bind with text:
 - a) If oversize Drawings are necessary, fold Drawings to same size as text pages and use as foldouts.
 - b) If Drawings are too large to be used as foldouts, fold and place Drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating Drawing titles, descriptions of contents, and Drawing locations.

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals:
 - 1. Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - a. Title page.
 - b. Table of contents.
 - c. Manual contents.
- B. Title Page:
 - 1. Include the following information:
 - a. Subject matter included in manual.
 - b. Name and address of Project.
 - c. Name and address of Owner.
 - d. Date of submittal.
 - e. Name and contact information for Contractor.
 - f. Name and contact information for Construction Manager.
 - g. Name and contact information for Architect.
 - h. Name and contact information for commissioning authority.
 - i. Names and contact information for major consultants to Architect that designed the systems contained in the manuals.
 - j. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents:
 - 1. List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual:
 - a. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory:
 - 1. Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
 - a. List of systems and subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 - b. List of equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 - c. Tables of contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.8 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content:
 - 1. Organize manual into a separate section for each of the following:
 - a. Type of emergency.
 - b. Emergency instructions.
 - c. Emergency procedures.
- C. Type of Emergency:
 - 1. Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - a. Fire.
 - b. Flood.
 - c. Gas leak.
 - d. Water leak.
 - e. Power failure.
 - f. Water outage.
 - g. System, subsystem, or equipment failure.
 - h. Chemical release or spill.
- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures:
 - 1. Include the following, as applicable:
 - a. Instructions on stopping.
 - b. Shutdown instructions for each type of emergency.
 - c. Operating instructions for conditions outside normal operating limits.
 - d. Required sequences for electric or electronic systems.
 - e. Special operating instructions and procedures.

1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual:
 - 1. Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures:
 - a. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - b. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content:
 - 1. In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 - a. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 - b. Performance and design criteria if Contractor has delegated design responsibility.
 - c. Operating standards.

- d. Operating procedures.
 - e. Operating logs.
 - f. Wiring diagrams.
 - g. Control diagrams.
 - h. Piped system diagrams.
 - i. Precautions against improper use.
 - j. License requirements including inspection and renewal dates.
- C. Descriptions:
- 1. Include the following:
 - a. Product name and model number. Use designations for products indicated on Contract Documents.
 - b. Manufacturer's name.
 - c. Equipment identification with serial number of each component.
 - d. Equipment function.
 - e. Operating characteristics.
 - f. Limiting conditions.
 - g. Performance curves.
 - h. Engineering data and tests.
 - i. Complete nomenclature and number of replacement parts.
- D. Operating Procedures:
- 1. Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Instructions on stopping.
 - f. Normal shutdown instructions.
 - g. Seasonal and weekend operating instructions.
 - h. Required sequences for electric or electronic systems.
 - i. Special operating instructions and procedures.
- E. Systems and Equipment Controls: Describe the sequence of operation and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed and identify color coding where required for identification.

1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals:
- 1. Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information:
 - a. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - b. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

- C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project manual and Drawing or schedule designation or identifier where applicable.
- D. Manufacturers' Maintenance Documentation:
 - 1. Include the following information for each component part or piece of equipment:
 - a. Standard maintenance instructions and bulletins:
 - 1) Include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one (1) item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable:
 - a) Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 - b. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - c. Identification and nomenclature of parts and components.
 - d. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures:
 - 1. Include the following information and items that detail essential maintenance procedures:
 - a. Test and inspection instructions.
 - b. Troubleshooting guide.
 - c. Precautions against improper maintenance.
 - d. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - e. Aligning, adjusting, and checking instructions.
 - f. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules:
 - 1. Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment:
 - a. Scheduled maintenance and service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - b. Maintenance and service record: Include manufacturers' forms for recording maintenance.
- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. Warranties and Bonds:
 - 1. Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds:
 - a. Include procedures to follow and required notifications for warranty claims.
- J. Drawings:
 - 1. Prepare Drawings supplementing manufacturers' printed data to illustrate the

relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these Drawings with information contained in record Drawings to ensure correct illustration of completed installation:

- a. Do not use original Project record documents as part of maintenance manuals.

1.11 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project manual and Drawing or schedule designation or identifier where applicable.
- D. Product Information:
 1. Include the following, as applicable:
 - a. Product name and model number.
 - b. Manufacturer's name.
 - c. Color, pattern, and texture.
 - d. Material and chemical composition.
 - e. Reordering information for specially manufactured products.
- E. Maintenance Procedures:
 1. Include manufacturer's written recommendations and the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Schedule for routine cleaning and maintenance.
 - e. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds:
 1. Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds:
 - a. Include procedures to follow and required notifications for warranty claims.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 78 23

SECTION 01 78 39 PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for Project record documents, including but not limited to:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product data.
 - 4. Miscellaneous record submittals.

1.3 SUBMITTALS

- A. Record Drawings:
 - 1. Number of copies - Submit one (1) set of marked up record prints.
 - 2. Number of Copies - Submit copies of record Drawings:
 - a. Initial submittal:
 - 1) Submit PDF electronic files of scanned record prints and one (1) of file prints.
 - 2) Submit record digital data files and one (1) set of plots.
 - 3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final submittal:
 - 1) Submit PDF electronic files of scanned record prints and three (3) sets of prints.
 - 2) Submit record digital data files and three (3) sets of record digital data file plots.
 - 3) Plot each Drawing file, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one (1) paper copy and one (1) annotated PDF electronic files of the Project Specifications, including addenda and Contract modifications.
- C. Record Product Data:
 - 1. Submit one (1) paper copy and one (1) annotated PDF electronic file and directories of each submittal:
 - a. Where record product data are required as part of operation and maintenance manuals, submit duplicate marked up product data as a component of manual.
- D. Miscellaneous Record Submittals: Refer to the individual Specification Sections for miscellaneous record keeping requirements and submittals in connection with various construction activities. Submit one (1) paper copy and annotated PDF electronic files and directories of each submittal.
- E. Reports: Submit written report monthly indicating items incorporated into Project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.4 PROJECT RECORD DOCUMENT PROCEDURES

- A. Do not use Project record documents for construction purposes. Protect Project record documents from deterioration and loss. Provide access to Project record documents for Architect's reference:
 - 1. **Do not use** as-built Drawings and Specifications for record Drawings and Specifications.
- B. Recording Procedures: Update Drawings and Specifications on daily bases to record actual conditions. Record information concurrently with construction progress. Do not conceal work until required information is accurately recorded.
- C. Store record documents and samples apart from as-built documents used for construction:
 - 1. Label and file record documents and samples in accordance with Section number listings in table of contents. Label each document **PROJECT RECORD** in neat, large, printed letters.
 - 2. Maintain record documents in clean, dry, and legible condition.
 - 3. Make record documents and samples available for inspection upon request of Architect.

PART 2 PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints:
 - 1. Maintain one (1) set of marked up paper copies of the Contract Drawings and shop drawings:
 - a. Preparation:
 - 1) Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is installer, Subcontractor, or similar entity, to provide information for preparation of corresponding marked up record prints. Show actual installation conditions where installation varies from that shown originally:
 - a) Give attention to information on concealed elements difficult to identify or measure and record later.
 - b) Accurately record information in an acceptable drawing technique.
 - c) Record data as soon as possible after obtaining it.
 - d) Record and check the markup before enclosing concealed installations.
 - e) Cross reference record prints to corresponding shop drawings or archive photographic documentation.
 - 2. Content:
 - a. Types of items requiring marking include, but are not limited to, the following:
 - 1) Dimensional changes to Drawings.
 - 2) Revisions to details shown on Drawings.
 - 3) Depths of foundations below first floor.
 - 4) Locations and depths of underground utilities.
 - 5) Revisions to routing of piping and conduits.
 - 6) Revisions to electrical circuitry.
 - 7) Actual equipment locations.
 - 8) Duct size and routing.
 - 9) Locations of concealed internal utilities.
 - 10) Changes made by Change Order or Construction Change Directive.
 - 11) Changes made following Architect's written orders.
 - 12) Details not on the original Contract Drawings.

- 13) Field records for variable and concealed conditions.
 - 14) Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings and shop drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked up record prints.
 4. Mark record sets with erasable, red colored pencil. Use colors to distinguish between changes for different categories of the work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files:
1. Immediately before inspection for Certificate of Substantial Completion, review marked up record prints with Architect. When authorized, prepare full set of corrected digital data files of the Contract Drawings:
 - a. Format: Same digital data software program, version, and operating system as the original Contract Drawings and annotated PDF electronic file with comment function enabled.
 - b. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 - c. Refer instances of uncertainty to Architect for resolution.
 - d. Architect will furnish Contractor one (1) set of digital data files of the Contract Drawings for use in recording information:
 - 1) Refer to Section 01 33 00: Submittal Procedures for requirements related to use of Architect's digital data files.
 - 2) Architect will provide data file layer information. Record markups in separate layers.
- C. Newly Prepared Record Drawings:
1. Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor shop drawings are suitable to show actual installation:
 - a. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or modification. Including ALL documents used for Construction Change Directive to DSA.
 - b. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- D. Format:
1. Identify and date each record Drawing; include the designation *PROJECT RECORD DRAWING* in a prominent location:
 - a. Record prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - b. Format: Annotated PDF electronic file with comment function enabled.
 - c. Record digital data files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 - d. Identification:
 - 1) As follows:
 - a) Project name.
 - b) Date.
 - c) Designation PROJECT RECORD DRAWINGS.

- d) Name of Architect.
- e) Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation:
 - 1. Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and Contract modifications:
 - a. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - b. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - c. Record the name of manufacturer, supplier, installer, and other information necessary to provide a record of selections made.
 - d. For each principal product, indicate whether record product data has been submitted in operation and maintenance manuals instead of submitted as record product data.
 - e. Note related Change Orders, record product data, and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file and marked up paper copy of Specifications. ALL documents to match PBK format.

2.3 RECORD PRODUCT DATA

- A. Preparation:
 - 1. Mark product data to indicate the actual product installation where installation varies substantially from that indicated in product data submittal:
 - a. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - b. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - c. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record product data as annotated PDF electronic file. Include record product data directory organized by Specification Section number and title, electronically linked to each item of record product data.

2.4 RECORD SAMPLES

- A. Record Samples: Determine with Architect and Owner which submitted samples are to be maintained as record samples. Maintain and mark one (1) set to indicate date of review and approval by Architect; note any deviations or variations between reviewed sample and installed product or material.

2.5 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by the individual Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference. Include the following:
 - 1. Reviewed shop drawings, product data, and samples.
 - 2. Field test reports.
 - 3. Inspection certificates and manufacturer's certificates.

4. Inspections by authorities having jurisdiction (AHJ [DSA]).
 5. Documentation of foundation depths.
 6. Special measurements or adjustments.
 7. Tests and inspections.
 8. Surveys.
 9. Design mixes.
 10. DSA submitted CCDs.
- B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked up miscellaneous record submittals. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one (1) copy of each submittal during the construction period for Project record document purposes. Post changes and revisions to Project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and samples in the field office apart from the Contract Documents used for construction. Do not use Project record documents for construction. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project record documents for Architect's reference during normal working hours.

END OF SECTION 01 78 39

SECTION 01 79 00 DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 1. Demonstration of operation of systems, subsystems, and equipment.
 2. Training in operation and maintenance of systems, subsystems, and equipment.
 3. Demonstration and training video recordings.
 4. Operation and maintenance manuals should be uploaded into Owner's designated software (Prolog).

1.3 SUBMITTALS

- A. Instruction Program:
 1. Submit outline of instructional program for demonstration and training including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module:
 - a. Indicate proposed training modules utilizing manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Demonstration and Training Video Recordings:
 1. Submit two (2) copies within seven (7) days of end of each training module:
 - a. Identification:
 - 1) On each copy, provide an applied label with the following information:
 - a) Name of Project.
 - b) Name and address of videographer.
 - c) Name of Architect.
 - d) Name of Contractor.
 - e) Date of video recording.
 - b. At completion of training, submit complete training manual(s) for Owner's use.

1.4 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00: Quality Requirements, experienced in operation and maintenance procedures and training.

PART 2 PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

- B. Training Modules:
 - 1. Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - a. Basis of system design, operational requirements, and criteria - include the following:
 - 1) System, subsystem, and equipment descriptions.
 - 2) Performance and design criteria if Contractor is delegated design responsibility.
 - 3) Operating standards.
 - 4) Regulatory requirements.
 - 5) Equipment function.
 - 6) Operating characteristics.
 - 7) Limiting conditions.
 - 8) Performance curves.
 - 2. Documentation:
 - a. Review the following items in detail:
 - 1) Emergency manuals.
 - 2) Operations manuals.
 - 3) Maintenance manuals.
 - 4) Project record documents.
 - 5) Identification systems.
 - 6) Warranties and bonds.
 - 7) Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies:
 - a. Include the following, as applicable:
 - 1) Instructions on meaning of warnings, trouble indications, and error messages.
 - 2) Instructions on stopping.
 - 3) Shutdown instructions for each type of emergency.
 - 4) Operating instructions for conditions outside of normal operating limits.
 - 5) Sequences for electric or electronic systems.
 - 6) Special operating instructions and procedures.
 - 4. Operations:
 - a. Include the following, as applicable:
 - 1) Startup procedures.
 - 2) Equipment or system break-in procedures.
 - 3) Routine and normal operating instructions.
 - 4) Regulation and control procedures.
 - 5) Control sequences.
 - 6) Safety procedures.
 - 7) Instructions on stopping.
 - 8) Normal shutdown instructions.
 - 9) Operating procedures for emergencies.
 - 10) Operating procedures for system, subsystem, or equipment failure.
 - 11) Seasonal and weekend operating instructions.
 - 12) Required sequences for electric or electronic systems.
 - 13) Special operating instructions and procedures.
 - 5. Adjustments:

- a. Include the following:
 - 1) Alignments.
 - 2) Checking adjustments.
 - 3) Noise and vibration adjustments.
 - 4) Economy and efficiency adjustments.
6. Troubleshooting:
 - a. Include the following:
 - 1) Diagnostic instructions.
 - 2) Test and inspection procedures.
7. Maintenance:
 - a. Include the following:
 - 1) Inspection procedures.
 - 2) Types of cleaning agents to be used and methods of cleaning.
 - 3) List of cleaning agents and methods of cleaning detrimental to product.
 - 4) Procedures for routine cleaning
 - 5) Procedures for preventive maintenance.
 - 6) Procedures for routine maintenance.
 - 7) Instruction on use of special tools.
8. Repairs:
 - a. Include the following:
 - 1) Diagnosis instructions.
 - 2) Repair instructions.
 - 3) Disassembly: Component removal, repair, and replacement, and reassembly instructions.
 - 4) Instructions for identifying parts and components.
 - 5) Review of spare parts needed for operation and maintenance.

PART 3 EXECUTION

3.1 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

3.2 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23: Operation and Maintenance Data.
- B. Set up instructional equipment at instruction location.

3.3 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system:
 1. Owner will furnish an instructor to describe Owner's operational philosophy.
 2. Owner will furnish Contractor with names and positions of participants.

- B. Scheduling:
 - 1. Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season:
 - a. Schedule training with Owner through program manager with at least ten (10) days advance notice.
- C. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.4 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
- B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Architect.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

END OF SECTION 01 79 00

SECTION 01 91 13 GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section establishes general and administrative requirements pertaining to commissioning (Cx) of equipment, devices, and building systems on the Project. Technical requirements for Cx of particular systems and components are established in the respective technical sections of this Project manual.
- B. It is of primary concern that all operable systems installed in the Project perform in accordance with the Contract Documents, Owner's Project requirements and the basis of design. During Cx, Contractor systematically demonstrates to Owner or Owner's representative that the operable systems have been installed and perform in strict accordance with the Contract Documents.
- C. Commissioning requires cooperation and involvement of all parties throughout the construction process. Contractor shall deliver a successful Cx process. Successful Cx requires that installation of all building systems complies with Contract Document requirements and that full operational check-out and necessary adjustments are performed prior to Substantial Completion with the exception of deferred tests approved in advance by Owner.
- D. Commissioning will encompass and coordinate traditionally separate functions of:
 - 1. System documentation.
 - 2. Installation checkout.
 - 3. System verification checklists and start-up.
 - 4. Control system calibration and point-to-point checkout.
 - 5. Testing, adjusting, and balancing (TAB).
 - 6. Functional performance tests.
 - 7. Integrated system tests.
 - 8. Contractor demonstration to Owner and training of Owner's personnel:
 - a. This requires assembling all related documentation into one (1) cohesive collection. Commissioning is intended to achieve the following specific objectives of the Contract Documents:
 - 1) Verify and document proper installation and intended performance of equipment, systems, and integrated systems.
 - 2) Ensure that operating and maintenance and Cx documentation requirements are complete.
- E. Provide Owner with functional buildings and systems that meet the Contract Document requirements and Owner's Project requirements at Substantial Completion.

1.3 DEFINITIONS

- A. Basis of Design: A document that records the concepts, calculations, decisions, and product selections used to meet Owner's Project requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions

and lists of individual items that support the design process.

- B. Commissioning (Cx): A systematic process confirming that building systems have been installed, properly started, and consistently operated in strict accordance with the Project documents, that all systems are complete and functioning in accordance with the Contract Documents at Substantial Completion, and that Contractor has provided Owner adequate system documentation and training.
- C. Commissioning Authority (CxA): Party having a contractual agreement with Owner to provide third party Cx services as defined herein under CxA's Role and Responsibilities. Commissioning Authority may represent Owner and is authorized to act on behalf of Owner. The CxA does not have authority to alter design or installation procedures without the written approval of Owner or the design team.
- D. Contract Documents: The General Conditions, Drawings, Specifications, addenda, and other documents developed by the Architect/Engineer (A/E) Team and approved by Owner that constitute the contractual obligations of the Project scope.
- E. Control Point and Sensor Calibration Verification: Process of verifying the point integrity and/or sensor calibration from the physical point of monitoring (sensor, contact, actuator, etc.) to the digital point location at the Operator's interface within the respective control system (building automation, lighting controls, power status and monitoring, etc.).
- F. Deferred Testing: Functional performance or integrated system tests performed after Substantial Completion due to partial occupancy, partial equipment acceptance, seasonal requirements, design, or other site conditions that prohibit the test from being performed prior to Substantial Completion.
- G. Deficiency: Condition of a component, piece of equipment, or system that is not in compliance with the Project documents.
- H. Functional Performance Test: Test of dynamic function and operation of equipment and systems executed by Contractor and witnessed by the CxA. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, life safety conditions, power failure, etc. Systems are operated through all specified sequences of operation. Components are verified to be responding in accordance with requirements in the Project documents.
- I. Functional Performance Testing Procedures: Commissioning protocols, detailed test procedures and instructions in tabular and script-type format that fully describe system configuration and steps required to determine if the system is performing and functioning properly.
- J. Integrated Systems Test: Test of dynamic function and operation of multiple systems. Integrated systems tests are tested under various modes, such as fire alarm and emergency situations, life safety conditions, power failure, etc. Systems are integrally operated through all specified sequences of operation. Systems and interconnections are verified to be responding in accordance with the requirements in the Project documents.
- K. Integrated Systems Testing Procedures: Commissioning protocols and detailed test procedures and instructions in tabular and script-type format that fully describe system configurations and steps required to determine if the interacting systems are performing and functioning properly.
- L. Operational Testing: Activities and testing occurring after initial energizing and/or start-up of

equipment that determine whether equipment is operating within the manufacturer's recommendations and the design requirements. These activities are intended to ensure that equipment and systems meet all warranty requirements and are ready for functional performance testing. Common examples are TAB of HVAC systems and initial load testing of electrical equipment.

- M. Owner's Project Requirements: A written document that details the functional requirements of a Project and the expectations of how the facility will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
- N. Project Documents: Consists of the Contract Documents, approved submittals, Requests for Information (RFI), vendor documentation, operations and maintenance information, and other documentation that determines the requirements for acceptable installation and operation of the specific equipment and systems on the Project.
- O. Start-up: The activities where equipment is initially energized, tested, and operated. Start-up is completed prior to operational testing and functional performance testing, and is an integral item documented in the system verification checklist.
- P. System Verification Checklist: A list of static inspections and material or component tests that verify proper installation of equipment (e.g., belt tension, oil levels, labels affixed, gages in place, sensors calibrated, etc.), start-up activities and documentation, as well as operational testing results. The checklists are meant to document all activities for an individual piece of equipment from procurement on the Project through operational testing are performed in accordance with the requirements in the Project documents.
- Q. Training Plan: A detailed plan prepared by Contractor and reviewed by Owner and CxA that outlines the training activities, instructors, time durations, and system requirements in accordance with the Contract Documents and Cx plan.
- R. Trending: Data collection of monitored points using the building automation system, lighting controls system, power status and monitoring system, or independent data acquisition instrumentation.

1.4 COMMISSIONING TEAM

- A. Owner shall appoint the following Members:
 - 1. Owner's project manager and any other designated representatives of Owner's staff.
 - 2. CxA.
 - 3. A/E.
 - 4. TAB Firm – may be subcontracted to the CxA.
- B. Contractor shall appoint the following Members:
 - 1. Individuals, each having authority to act on behalf of the entity they represent, explicitly organized to implement the Cx process through coordinated actions. At a minimum, Contractor shall designate a Cx coordinator and each major subcontractor (MEP, building automation, etc.) shall have a dedicated representative.
 - 2. Vendor representatives (as needed) required for start-up, operational testing, functional performance testing, integrated systems testing, and Owner training activities.
 - 3. Representatives of independent testing agencies (TAB, Electrical Testing Agency, etc.).

1.5 ROLES AND RESPONSIBILITIES

- A. Roles and responsibilities of Cx team members related to the Cx process are provided in this Section. The respective entities defined below shall fulfill the listed roles and responsibilities as contained herein. Specific technical roles and responsibilities are defined in other Sections of the Project Specifications.

- B. Owner's Roles and Responsibilities:
 - 1. Provide guidance in development of Owner's Project requirements.
 - 2. Review technical Specifications containing Cx requirements.
 - 3. Approve the Cx scope of Work and schedule of Cx activities.
 - 4. Assign Owner's representatives and schedule them to participate in Cx activities, including the following:
 - a. Commissioning team meetings.
 - b. Review and approval of the Cx plan, training plan, system verification checklist templates, functional performance test procedures, integrated systems test procedures, deferred testing plans, final Cx process report, systems manual, measurement and verification plan, and other Cx documents.
 - c. Attend Owner training sessions in operation and maintenance of systems and equipment.
 - d. Observation of Contractor's demonstration of systems and equipment operation.

- C. Commissioning Authority's Roles and Responsibilities:
 - 1. Prepare the Cx plan with Owner's and Contractor's review and input.
 - 2. Periodically attend and/or review the proceedings of the regular construction meetings hosted by Contractor to understand the progress of construction activities on the Project.
 - 3. Conduct and document Cx team meetings including the Cx kickoff meeting.
 - 4. Perform site visits as necessary to observe component and system installations prior to energizing or start-up of equipment and systems.
 - 5. Review and comment on product data and shop drawing submittals and coordination drawings applicable to systems being commissioned.
 - 6. Following submittal review and approvals by the A/E team, review the sequences of operation and coordinate with Contractor and A/E team in order to prepare the functional performance test procedures and integrated systems test procedures. Submit to Owner and Contractor for review and comment prior to facilitating functional performance tests and integrated systems tests on the Project.
 - 7. Upon written notice that equipment or systems are ready for initial energizing or start-up, review the progress of the systems verification checklists for the respective systems and components and ensure that all requirements have been completed by Contractor to permit energizing or start-up in accordance with the Project documents; CxA shall issue written notice to Owner and Contractor that equipment is ready to energize or start-up. Commissioning Authority will witness and ensure proper documentation is provided by Contractor for major equipment energizing and start-ups as executed by Contractor with appropriate notice as indicated herein.
 - 8. Witness, verify, and document results of functional performance tests and integrated systems tests.
 - 9. Coordinate resolution of deficiencies identified during site observations, equipment energizing or start-up, functional performance testing, integrated systems testing, deferred testing, and during the warranty period.
 - 10. Review the operations and maintenance documents to ensure that as-built information and correct data is included prior to Owner training sessions; review final operations and maintenance submittal to ensure compliance with the requirements in the Project documents and provide written comments to Owner.
 - 11. Review Contractor's training plan and individual training agendas for compliance with the requirements in the Project documents. Recommend acceptance to Owner prior to Contractor scheduling training sessions with Owner. Review the attendance and content of the training sessions to ensure the requirements of the Project documents

are completed. Conduct a survey of Owner's personnel to evaluate the effectiveness of Owner training.

12. Compile the final Cx process report and submit to Owner for review and approval.

D. A/E's Roles and Responsibilities:

1. Specify control sequences of operation within the Contract Documents that comply with Owner's Project requirements and basis of design.
2. Incorporate Cx requirements into the Contract Documents if requested by Owner.
3. Attend Cx team meetings.
4. Review the Cx plan, system verification checklists templates, functional performance test procedures, integrated systems test procedures, deferred testing plans, and other Cx documents as required by Owner or the Contract Documents.
5. Review Contractor's training plan and provide comments to Owner.
6. Approve technical requirements for correction of deficiencies identified during Cx, deferred tests, and during the warranty period.
7. Review operation and maintenance manuals and provide comments to Owner.

E. Contractor's Roles and Responsibilities:

1. Contractor shall review and provide comments on documents produced by the CxA, and shall accept the Cx plan, system verification checklists, functional performance test procedures, and integrated system test procedures as approved by Owner.
2. Provide an individual, subject to Owner's approval, experienced in construction and Cx of building systems to organize, schedule, conduct, and document Contractor's responsibilities in the Cx process. Contractor shall assign this individual to act as Contractor's Cx coordinator. Contractor's Cx coordinator may have additional duties such as MEP coordinator, but not as project manager or superintendent. Submit qualifications demonstrating the Cx coordinator's technical expertise and experience to Owner for approval. If Contractor chooses to subcontract its Cx obligations, then Contractor must submit the subcontractor's qualifications and personnel to Owner for Owner's approval.
3. Furnish and install systems that meet all requirements of the Contract Documents.
4. Ensure that Cx process activities are incorporated into the master Project schedule. Contractor shall coordinate with the CxA and Owner to determine the required activities, durations, and predecessors.
5. Submit inspection requests, start-up requests, and all supporting documentation in accordance with the Contract Documents, General Conditions, and Cx plan.
6. Cooperate with Owner's representative(s), provide access to work, and provide adequate labor, resources, and time for Cx.
7. Furnish copies of all shop drawings and submittals, manufacturers' literature, maintenance information, and any other information required for the Cx process. Contractor must submit to Owner installation and checkout materials shipped inside equipment and actual field checkout sheet forms used by the factory or field technicians. This requirement does not supersede any additional requirements contained in the Contract Documents.
8. Schedule and conduct pre-installation meetings and pre-commissioning meetings with subcontractors and equipment suppliers related to Cx. Contractor must invite A/E, Owner, and CxA to attend the pre-installation meetings and pre-commissioning meetings.
9. Provide qualified personnel, including subcontractors as required, to fully perform the testing and operational demonstrations required by the Contract Documents and the Cx plan, including any deferred testing or re-testing related to warranty work.
10. Correct deficiencies identified during any stage of the Cx process.
11. Coordinate with the CxA to develop the training plan and submit to Owner for approval. Provide training to Owner's personnel in accordance with the Contract Documents and the approved training plan. Coordinate with Owner to schedule training sessions and coordinate subcontractor/vendor participation in all training sessions.

12. Perform deferred testing and make necessary amendments to operating and maintenance manuals and as-built drawings for applicable issues identified during the deferred testing.
13. Perform system maintenance during construction as specified and recommended by Owner and send the maintenance records to Owner for record.
14. Document the equipment as it arrives onsite to ensure that the submitted and received equipment is correct as it arrives onsite, including the completion of the system verification sections pertaining to the procurement process.

1.6 SYSTEMS TO BE COMMISSIONED

- A. The following systems shall be commissioned according to the process defined in this Section:
 1. Major HVAC Systems (including but not limited to the list below):
 - a. Air handling units.
 - b. Fan coil units.
 - c. Exhaust fans.
 - d. Supply fans.
 - e. Pumps.
 - f. Chillers.
 - g. Boilers.
 2. Terminal units (ten percent [10%] sampling).
 3. Building automation system.
 4. Lighting controls - occupancy sensors (25 percent greater than 25 sensors installed, 100 percent less than 25 sensors installed).
 5. Lighting - daylight controls.
 6. Lighting - time switch controls.
 7. Normal and emergency power systems.

PART 2 PRODUCTS

2.1 COMMISSIONING PLAN

- A. Document developed by the CxA that provides the structure, schedule, and coordination plan for the Cx process from the pre-construction phase through the occupancy phase. The Cx plan shall describe the Project and systems to be commissioned, Cx process activities and deliverables, procedures to follow throughout the process, specific roles and responsibilities for each participant, and general description of testing and verification methods.
- B. The Cx plan shall comply with Owner Project requirements.
- C. The Cx team shall review the Cx plan prior to the pre-commissioning meeting and submit written comments or questions to the CxA to be addressed in the meeting.
- D. Following the pre-commissioning meeting, the CxA shall incorporate all changes discussed and agreed upon in the pre-commissioning meeting and submit the final Cx plan to the Cx team for approval and acceptance.
- E. If changes to the Cx plan are needed during the Cx process, the CxA shall edit the plan and distribute to the Cx team for approval and acceptance.
- F. Contractor's acceptance shall constitute acceptance of all parties subcontracted to Contractor. Contractor shall ensure that all subcontractors and vendors agree and accept the Cx plan.

2.2 SYSTEM VERIFICATION CHECKLISTS

- A. System verification checklists are important to ensure that the equipment and systems are connected and operational and that functional performance testing proceeds without unnecessary delays. These checklists document the inspections and procedures necessary to take a piece of equipment from a static state into an operating state. These checklists augment the manufacturer's start-up checklists to provide a complete document from procurement to the start of functional performance testing when combined.
- B. The CxA shall develop the system verification checklist templates for review by the Cx team. Contractor, appropriate subcontractors, and vendors shall support the CxA in development of system verification checklists for each system and components by providing any necessary supporting documentation as requested by the CxA and reviewing and commenting on the checklist templates in accordance with the Project Specifications and the Cx plan.
- C. Once the checklist templates are reviewed and accepted, the CxA will produce checklists for all equipment and components to be commissioned on the Project utilizing an electronic Cx database that is accessible via web portal or local field tool (i.e., iPad, tablet, laptop, etc.).
- D. The CxA shall provide login access and training to Contractor and other members of the Cx team in the use of the electronic Cx database.
- E. Contractor shall be responsible for completing the required sections of the system verification checklists utilizing the electronic Cx database and providing all supporting documentation via electronic transmittal to the CxA. Additional requirements for completion of the checklists are included in this Section and other technical Sections of the Specifications.
- F. Once equipment arrives on the Project site, Contractor or subcontractors shall begin completing the individual checklists and continue throughout the installation process. The checklists are meant to be progressive and a tool for tracking progress.
- G. Once the system verification checklists are electronically completed, the CxA will review and approve the checklists and supporting documentation and compile the information to include in the final Cx process report.

2.3 FUNCTIONAL PERFORMANCE TESTING PROCEDURES

- A. The purpose of the functional performance testing procedures is to verify and document that the equipment and systems on the project individually perform in accordance with the requirements in the Contract Documents and meet Owner's Project requirements.
- B. The CxA shall develop specific script-type test procedures to verify and document proper operation of each piece of equipment and system. Contractor shall provide any supporting information to the CxA that may be needed including, but not limited to, product submittals, operations and maintenance information, and sequences of operation. Once developed, the CxA will issue to the Cx team for review and comment.
- C. The Cx team shall review the functional performance testing procedures and submit written comments or questions to the CxA. Contractor shall ensure that the subcontractors and any vendors that would be involved with functional performance testing review the procedures and provide comments.
- D. The CxA will coordinate with the Cx team to address any comments and produce the final

functional performance testing procedures for acceptance by the Cx team. Contractor's acceptance shall constitute acceptance of all parties subcontracted to Contractor.

- E. Contractor shall utilize the functional performance testing procedures for any pre-testing activities prior to functional performance testing.

2.4 INTEGRATED SYSTEMS TESTING PROCEDURES

- A. The purpose of the integrated systems testing procedures is to verify and document that all the integrated equipment and systems on the Project perform together in accordance with the requirements in the Contract Documents and meet Owner's Project requirements.
- B. The CxA shall develop specific script-type test procedures to verify and document proper operation of the integrated systems throughout the facility. Contractor shall provide any supporting information to the CxA that may be needed including but not limited to product submittals, operation and maintenance information, and sequences of operation. Once developed, the CxA will issue to the Cx team for review and comment.
- C. The Cx team shall review the integrated systems testing procedures and submit written comments or questions to the CxA. Contractor shall ensure that the subcontractors and any vendors that would be involved with integrated systems testing review the procedures and provide comments.
- D. The CxA shall coordinate with the Cx team to address any comments and produce the final integrated systems testing procedures for acceptance by the Cx team. Contractor's acceptance shall constitute acceptance of all parties subcontracted to Contractor.
- E. The CxA shall also develop the integrated system test personnel matrix that will be utilized to track the individual testing teams involved with the integrated system test. The CxA will distribute the matrix to the Cx team so that Contractor and Owner can assign the appropriate personnel to the appropriate teams.
- F. The CxA shall also host a coordination meeting prior to the integrated system test to review the integrated system test procedures, complete any final coordination, review safety procedures, and answer any questions.
- G. The CxA estimates there will be two integrated system tests on the Project. The first will test the data center systems separately and the second will test the entire facility. Requirements of the testing are included in the respective technical Sections of the Project Specifications.
- H. The integrated systems testing procedures shall be utilized by Contractor for any pre-testing activities prior to official integrated systems testing.

2.5 TRAINING PLAN

- A. Contractor, in coordination with Owner and CxA, shall develop the training plan with Project specific requirements for Owner training, after reviewing the different systems to be installed and commissioned. The purpose of the training plan is to specifically communicate the required content and training durations required by Owner based upon the type of equipment and Owner's experience.
- B. Contractor shall review all of the individual technical sections of this Specification for specific training requirements.
- C. Contractor shall coordinate with Owner to ensure that the proposed training requirements

meet Owner's needs and expectations.

- D. Contractor shall coordinate with the subcontractors and vendors to ensure Owner training requirements can be achieved and gather any additional information or recommendations.
- E. Any changes to the training requirements in this specification must follow contractual protocols.
- F. The training plan shall include a list of systems and equipment for which training will be provided according to the three-tiered training approach outlined in the Project Specifications.
- G. All training sessions shall have a syllabus indicating the following as a minimum in addition to any other specification requirements:
 - 1. Session objectives.
 - 2. Proposed instructor(s).
 - 3. Instructor qualifications.
 - 4. Training materials that will be provided.
 - 5. Location and durations of the various parts of the training session (i.e., classroom, onsite, etc.).
 - 6. Applicable Specification Sections and operation and maintenance manual sections.
 - 7. Detailed outline of training session content.
- H. Contractor shall coordinate with the CxA to organize the systemic training sessions comparable to the organization of the systems manual.
- I. Owner training must be completed prior to Contractor obtaining Substantial Completion by Owner.

2.6 FINAL COMMISSIONING PROCESS REPORT

- A. The CxA shall prepare the final Cx process report that will include the following:
 - 1. Executive summary.
 - 2. Participants and roles.
 - 3. Brief building description.
 - 4. Overview of Cx and testing scope.
 - 5. General description of testing and verification methods.
 - 6. Appendices with supporting information, issues log, and communications.
- B. Contractor shall coordinate with the CxA to provide any additional information that may be needed to complete the final Cx process report.
- C. Contractor shall resolve any outstanding Cx items prior to the CxA preparing the final Cx report.
- D. The CxA shall issue the final Cx process report to the Cx team for review. Owner shall approve the final Cx process report after any comments or discrepancies are resolved by the CxA.

PART 3 EXECUTION

3.1 PROJECT SCHEDULE

- A. Contractor shall integrate all Cx activities into the detailed Project schedule. All parties will address scheduling problems and make necessary notifications in a timely manner to

expedite the Cx process.

3.2 COMMISSIONING TEAM MEETINGS

- A. Upon obtaining Owner's approval of the Cx plan, the CxA shall coordinate with the Cx team to schedule, plan, and conduct a pre-commissioning meeting with all parties involved in the Cx process. This meeting should include the major subcontractors, specialty manufacturers/suppliers, A/E, TAB Firm, Electrical Testing Agency, and Owner's representatives as participants.
- B. Contractor shall prepare for the pre-commissioning meeting by supplying the following documents created by the CxA to all applicable subcontractors and vendors: Cx plan, example system verification checklists, example functional performance test procedures, and example integrated systems test procedures.
- C. The CxA shall conduct the pre-commissioning meeting and review all aspects of the Cx plan and applicable Specifications.
- D. The Cx plan shall be reviewed with all attendees and the scope of work discussed. Contractor should be prepared to distribute copies of the pertinent sections to the various subcontractors involved in the Cx process.
- E. The outcome of the meeting shall be an understanding of the Cx process, roles and responsibilities, and consensus acceptance of the Cx plan by the Cx team.
- F. Contractor may request additional meetings with the CxA and individual subcontractors to clarify roles, responsibilities, and procedures as needed.

3.3 TEST EQUIPMENT

- A. Contractor shall provide all specialized tools, test equipment, and instruments required to execute start-up, checkout, and testing of equipment.
- B. All specialized tools, test equipment and instruments required to execute start-up, checkout, and testing of equipment shall be of sufficient quality and accuracy to test and/or measure system performance within specified tolerances. A testing laboratory must have calibrated test equipment within the previous 12 months. Calibration shall be NIST traceable. Contractor must calibrate test equipment and instruments according to manufacturer's recommended intervals and whenever the test equipment is dropped or damaged. Calibration tags must be affixed to the test equipment or certificates readily available.

3.4 REPORTING

- A. Beginning at the procurement stage for the equipment included in the Cx scope, Contractor shall communicate at least monthly with all members of the Cx team, keeping them apprised of construction progress and scheduling changes.
- B. Contractor shall submit deficiency reports to Owner within five (5) days of the deficiency occurrence. This includes responses to items noted by the CxA.

3.5 DEFICIENCY RESOLUTION

- A. The CxA shall document any issues noted during observation or testing activities in the CxIL. The CxIL shall be distributed electronically to the Cx team at regular intervals.

- B. Contractor shall respond in writing to the CxA within ten [10] days to all new CxIL items regardless of the disposition. This response does not constitute a request for re-verification, only an acknowledgement of the outstanding item. Contractor should utilize CxIL responses to update the Cx team on the progress of deficiency resolution.
- C. Contractor shall respond to the CxA and Owner indicating CxIL items that are completed and ready for the CxA to verify completion.
- D. If any item indicated complete by Contractor is found to be incomplete by the CxA upon re-verification, Contractor is responsible for all costs and additional compensation resulting from incomplete CxIL items.

3.6 REQUEST FOR ENERGIZING / START-UP OF EQUIPMENT

- A. Owner and/or Owner's representative may install lockout devices on equipment in addition to Contractor's lockout/tagout devices once permanent power is connected to the facility. This lock would be removed once the proper start-up notification is received by Owner and/or the CxA, and the CxA has reviewed the appropriate system verification checklists and supporting documentation to verify the equipment is ready for energizing and/or start-up.
- B. These requirements do not supersede any additional requirements noted elsewhere in the Contract Documents or as required by applicable code authorities.
- C. Contractor shall notify Owner and the CxA in writing to request initial energizing and/or start-up of equipment and systems at least 72 hours (not including weekends or holidays) prior to the scheduled start-up.
- D. Contractor shall complete the applicable sections of the system verification checklists evidencing Contractor's thorough inspection of the system and readiness for start-up activities as required by the Project documents and the Cx plan. Contractor shall submit required supporting documentation to Owner and/or the CxA including, but not limited to, factory testing reports, alignment reports, electrical testing reports and any other documentation required by the Project documents prior to energizing and/or start-up.
- E. The CxA shall review the system verification checklists and supporting documentation within the 72-hour notice period and confirm in writing that the systems and equipment are approved to proceed with energizing and start-up.
- F. The CxA and/or owner may witness equipment energizing and/or start-up at the scheduled time, but witness is not required, unless noted elsewhere in the Specifications, as long as written approval is received as noted herein.
- G. Contractor shall perform start-up under supervision of the responsible manufacturer's representative in accordance with manufacturer's instructions and Project document requirements.
- H. Contractor shall complete all required factory start-up documentation and applicable items in the system verification checklist, prior to startup, to ensure compliance with the requirements in the Project documents.

3.7 OPERATIONAL TESTING

- A. Once the appropriate start-up activities are completed, Contractor shall complete all necessary operational testing requirements included in the Project documents prior to

functional performance testing. Specific requirements for systems and equipment are included in other technical Sections of the Specifications.

- B. Contractor shall complete all operational testing items in the system verification checklist and submit all supporting documentation to Owner and/or CxA for review.
- C. Contractor and manufacturer's representatives shall supervise and coordinate adjustments and balancing of all devices and systems for proper operation prior to requesting a functional performance test.
- D. Contractor shall clearly list outstanding items or system verification checklist items not completed successfully. Contractor shall obtain from subcontractor or vendor completed forms documenting any outstanding deficiencies within five (5) days of completion of energizing and/or start-up activities.
- E. Contractor shall review completed deficiencies to determine if outstanding items prevent execution of the functional performance tests and shall issue any necessary responses to Owner and/or the CxA.
- F. Contractor shall notify Owner and CxA in writing to request functional performance testing of equipment and systems at least 72 hours (not including weekends or holidays) prior to the scheduled activities. Owner may require Contractor to reschedule functional performance testing to ensure availability of Owner's representative(s) as needed.
- G. The CxA shall review the system verification checklists and supporting documentation within the 72-hour notice period and confirm in writing that the systems and equipment are approved to proceed with functional performance testing.
- H. If any item indicated complete by Contractor is found to be incomplete by the CxA upon re-verification Contractor is responsible for all costs and additional compensation resulting from incomplete system verification checklist items.

3.8 CONTROL POINT AND SENSOR CALIBRATION VERIFICATION

- A. Automation systems installed on the Project must be fully verified for point integrity and sensor calibration prior to functional performance testing. Additional requirements for this verification are listed in other technical Sections of the Specifications.
- B. Contractor shall verify these points according to the requirements in the Project documents as part of start-up and operational testing of systems.
- C. The TAB contractor shall independently verify each sensor and point and document the results to be included in the final TAB report.
- D. The CxA will witness, at their discretion, this verification and/or independently verify and document the results to be included in the final Cx process report.
- E. These activities must be completed prior to Contractor requesting functional performance testing as indicated herein.

3.9 FUNCTIONAL PERFORMANCE TESTING

- A. The objective of functional performance testing is to demonstrate that each system operates according to the requirements in the Project documents and meets Owner's Project requirements and basis of design.

- B. Contractor shall operate, or cause to be operated, each system, device, or equipment item, both intermittently and continuously, for a duration period as indicated in the Specification Section(s) for each item and/or in accordance with the Project documents, the Cx plan and applicable functional performance testing procedures.
- C. Contractor shall operate each component device and each building system to the full extent of its capability, from minimum to maximum, and under automatic control and manual control.
- D. The CxA and members of the Cx team, including Owner's personnel, may observe functional performance testing of equipment components and systems. The CxA shall facilitate the functional performance testing activities according to the accepted functional performance testing procedures and record the results of all testing activities.
- E. The CxA shall record any deficiencies noted during the testing in the CxIL. If significant deficiencies exist, Owner and/or CxA may request that the testing activities be terminated and re-scheduled after proper verification by Contractor. Contractor is responsible for all costs and additional compensation resulting from deficiencies and incomplete systems noted during scheduled functional performance testing.
- F. All functional performance testing of integrated systems must be completed in accordance with the Project documents and the Cx plan prior to Contractor scheduling the integrated systems testing activities.

3.10 INTEGRATED SYSTEMS TESTING

- A. The objective of integrated systems testing is to demonstrate that each integrated system operates jointly and/or independently of other systems according to the requirements in the Contract Documents.
- B. Contractor shall operate each system, jointly and independently of other systems, through selected modes of operation (fire alarm integration with HVAC, emergency power modes, equipment failures among related systems, etc.) according to the accepted integrated systems testing procedures developed by the CxA. The CxA shall facilitate and document the testing, organizing the appropriate testing teams and providing sufficient instruction to all participants to conduct efficient and effective testing activities.
- C. Integrated systems testing typically involves multiple teams with representation from the CxA, Owner, and Contractor. Contractor shall provide any needed communication equipment (i.e., radios) or make available any centralized intercom or paging system for communication with all testing groups.
- D. Contractor shall provide no less than seven (7) days (not including weekends or holidays) notice when requesting to conduct the integrated systems testing. All personnel must be assigned to the personnel matrix by the CxA and a coordination meeting held within the seven (7) day period as prescribed elsewhere in this Section.
- E. Contractor conducts integrated systems testing after all applicable functional performance testing is satisfactorily completed and approved by Owner and/or CxA.
- F. The CxA shall record any deficiencies noted during the testing in the CxIL. If significant deficiencies exist, Owner and/or CxA may request that the testing activities be terminated and re-scheduled after proper verification by Contractor. Contractor is responsible for all costs and additional compensation resulting from deficiencies and incomplete systems noted during scheduled integrated systems testing.

3.11 DEMONSTRATION AND OWNER TRAINING

- A. Contractor, in coordination with Owner and CxA, shall develop the training plan with Project-specific requirements for Owner training as required throughout various Sections of the Project Specifications.
- B. The specific requirements for scheduling and conducting Owner training are included in other sections of this Specification.
- C. Owner training activities shall not occur until the training plan is approved by Owner and Contractor has submitted all operation and maintenance information for review and use during the training sessions.
- D. Contractor shall notify the CxA of all training sessions. Contractor shall record attendance of the training sessions and Owner shall ensure the appropriate personnel are in attendance.
- E. The CxA shall ensure the content of Owner training sessions meets the requirements in the Project documents.
- F. The CxA may conduct surveys of Owner's personnel to gauge the effectiveness of Owner training sessions. If unfavorable surveys are received by Owner's personnel indicating unsatisfactory training, Owner reserves the right to require Contractor to re-train in those specific areas of nonconformance until the requirements in the Project documents are satisfactorily completed.
- G. Owner training must be completed prior to Contractor obtaining substantial completion by Owner.

3.12 DEFERRED / SEASONAL TESTING

- A. All construction phase requirements of the Cx process must be completed prior to Substantial Completion or as indicated elsewhere in this Specification.
- B. If any testing or other requirements cannot be completed prior to Substantial Completion due to the building structure, required occupancy condition, or other condition, performance of such test may be delayed to later in the warranty period, upon approval of Owner. Contractor shall reschedule testing according to the protocols described in this Section and any other operational protocols prescribed by Owner.
- C. Contractor shall complete all outstanding Cx requirements as part of this Contract during the warranty period. Contractor shall schedule all activities with Owner and/or CxA.
- D. The CxA shall document any deferred testing activities and ensure the appropriate Cx documents are updated. Contractor shall provide any additional documentation needed by the CxA to complete these requirements.

END OF SECTION 01 91 13

SECTION 02 41 00 SITE DEMOLITION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Furnishing all labor, materials, and equipment necessary for demolition, dismantling, cutting, and alterations as indicated, specified, and required for completion of the Contract, as applicable. Includes items such as the following:
 - a. Protecting existing work to remain.
 - b. Hazardous material identification and removal.
 - c. Utility service and termination.
 - d. Removing debris and equipment.
 - e. Removal of items indicated on Drawings.
 - f. Landscape and sprinkler demolition and reinstall.
 - g. Disposal of material.
- B. Related Sections:
 - 1. Section 01 50 00: Temporary Facilities and Controls.
 - 2. Section 31 00 00: Earthwork.
- C. Regulatory Requirements:
 - 1. Conform to applicable jurisdictional authority regulations and codes for disposal of debris.
 - 2. Coordinate clearing work with utility companies.
 - 3. Maintain emergency access ways at all times.
 - 4. Contractor shall comply with all applicable laws and ordinances regarding hazardous materials, including contaminated soils, hazardous material transformers, and similar materials or components.

1.3 SUBMITTALS

- A. Schedule: Submit a detailed sequence of demolition and removal work, including dates for shutoff, capping, and continuance of utility services.
- B. Procedures: Submit written procedures documenting the proposed methods to be used to control dust and noise.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

- A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during Work, notify Architect promptly for instructions. Failure to notify will

make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

- B. Conduct demolition to minimize interference with adjacent structures or items to remain. Maintain protected egress and access at all times.

3.2 PROTECTION

- A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.
- B. In accordance with generally accepted construction practices, Contractor shall be solely and completely responsible for working conditions at the jobsite, including safety of all persons and property during performance of the Work. This requirement shall apply continuously and shall not be limited to normal working hours.
- C. Safety precautions prevent damage to existing elements identified to remain or to be salvaged and prevent injury to the public and workmen engaged onsite. Demolish roofs, walls, and other building elements in such a manner that demolished materials fall within foundation lines of building. Do not allow demolition debris to accumulate onsite. Pull down hazardous work at end of each day; do not leave standing or hanging overnight, or over weekends:
 - 1. Protect existing items that are not indicated to be altered. Protect utilities designated to remain from damage.
 - 2. Protect trees, plant growth, and features designated to remain as final landscaping as shown on Drawings.
 - 3. Protect bench marks from damage or displacement.
- D. Trees: Carefully protect existing trees that are to remain. Provide temporary irrigation as necessary to maintain health of trees.
- E. Fire Safety: Contractor shall conform to Chapter 33 of the California Fire Code (CFC), "Fire Safety During Construction and Demolition," at all times during the construction process. A copy of this chapter can be provided.
- F. Any construction review of Contractor's performance conducted by the geotechnical Engineer is not intended to include review of the adequacy of Contractor's safety measures in, on, or near the construction site.
- G. Surface Drainage: Provide for surface drainage during period of construction in a manner to avoid creating nuisance to adjacent areas. Contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of Work, regardless of cause, source, or nature of water.
- H. Adjacent streets and sidewalks shall be kept free of mud, dirt, or similar nuisances resulting from earthwork operations.
- I. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

3.3 EXAMINATION

- A. Examine conditions of work in place before beginning Work; report defects.
- B. Report existence of hazardous materials or unsafe structural conditions.

3.4 PREPARATION

- A. Scheduling:
 - 1. General: Coordinate and schedule demolition work as required by Owner and as necessary to facilitate construction progress.
- B. Hazardous Materials:
 - 1. General: Identify chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations, and notify such jurisdictional agencies as may be required. Collect and legally dispose of such materials at official disposal locations away from the site.
 - 2. Asbestos: If asbestos or materials containing asbestos are encountered, stop work immediately and contact Owner. Do not proceed with demolition until directed by Owner.
- C. Utility and Service Termination:
 - 1. Locate and identify existing utility, service, and irrigation system components affected by Work of this Contract. Review existing record Drawings, conduct site investigations, contact Underground Service Alert and other qualified cable/pipe/line locator services, and implement all other means necessary to define the location of underground systems.
 - 2. Prior to beginning any demolition, properly disconnect all water, gas, and electrical power supply at appropriate disconnect locations. Obtain all necessary releases and approvals from serving utility companies.
 - 3. Prior to demolition or disconnect, obtain Owner's approval that such system does not impact facilities or systems beyond the extent of this Contract.
 - 4. Mark location of disconnected systems. Identify and indicate stub-out locations on Project record documents.
- D. Verify that existing plant life and features designated to remain are tagged or identified.
 - 1. Architect will mark the features, trees, and shrubs to remain within the construction area. Contractor shall not commence clearing and grubbing operations until authorized by Owner and all protective measures are in place.
- E. Coordinate the time and duration of all system disconnects with Owner.

3.5 DEMOLITION

- A. General Requirements:
 - 1. Clear areas required for access to site and execution of Work, including pavement, structures, foundations, vegetation, trash, and debris.
 - 2. Coordinate with Owner the time of day and route to remove demolished materials from premises.
 - 3. Remove demolished materials from site as work progresses. Upon completion of work, leave areas of work in clean condition.
 - 4. Remove all buried debris, rubble, trash, or other material not deemed suitable by the geotechnical Engineer.
 - 5. Fill all voids or excavations resulting from clearing, demolition, or removal of vegetation with specified fill material.
- B. Fixture and Equipment Removal:

1. Remove existing fixtures and equipment as identified and shown on Drawings and required by Architect.
2. Verify all service connections to fixtures and equipment designated for removal have been properly disconnected.
3. Remove all conductors from conduit at all abandoned circuits.

3.6 UTILITY AND BUILDING SERVICES REMOVAL AND RE-INSTALLATION

- A. Where crossing paths and potential points of interference with existing utility services are shown or can be reasonably inferred from surface conditions or evidence of subsurface systems, such as meter boxes, vaults, relief vents, cleanouts, and similar components:
 1. Review all Contract Documents showing crossing paths and potential points of interference.
 2. Pot-hole or determine by other means the accurate depth and location of such utilities.
 3. Incorporate all costs required to complete work under this Contract, including additional trenching, re-routing of existing and new utilities, and all means necessary to construct work under this Contract.
 4. No additional cost to Owner will be allowed for work necessary to accommodate utility conflicts where such crossing paths are shown on Contract Drawings or can be reasonably inferred from surface conditions or components.
- B. Remove all conductors from conduit at all abandoned electrical circuits.
- C. Seal off ends of all piping, drains, and other components as directed by Architect and serving utility.
- D. Where necessary to maintain service to existing utility and building systems, relocate or redirect all conduit and conductors, piping, drains, and associated system components:
 1. Re-circuit all electrical as required.
 2. Re-circuit all landscape irrigation valving and control systems as required.
 3. Temporarily terminate landscape system components in approved boxes or with approved caps, suitable for re-connection or extension.
 4. Extend or otherwise modify all site drainage systems, including catch basins, drain inlets, and piping. Fine grade to maintain proper drainage flow pattern to drains.
- E. Demolish structure in an orderly and careful manner:
 1. Use of explosives prohibited.

3.7 SITE PAVEMENT REMOVAL

- A. Remove sidewalk and curb where required for new construction as specified and as indicated on the Drawings:
 1. Remove all paving by saw-cutting.
 2. Remove concrete paving and curbing at locations shown on Drawings. Locate closest adjacent expansion or weakened plane joint to define start of removal or saw-cutting.
- B. Remove asphalt concrete paving areas where required for new construction as specified and as indicated on the Drawings:
 1. Remove all paving by saw-cutting.
 2. Remove paving assembly as required to expose subgrade.

3.8 LANDSCAPE AND IRRIGATION SYSTEMS DEMOLITION AND RENOVATION

- A. Clearing, Grubbing, and Planting Demolition:
 1. Remove grass and grass roots to a minimum depth of two inches (2") below existing

- grade.
2. Remove all shrubs, plants, and other vegetation within the area of the work unless designated to remain. Grub and remove all roots of all vegetation to a depth of 24 inches below existing grade.
 3. Remove only those trees that are specifically designated for removal, or as shown on the Drawings, within the construction area. Remove all stumps. Remove root ball and root systems larger than one inch (1") in diameter to a depth of two feet (2') below existing or finished grades, whichever is lower, and a minimum of five feet (5') beyond the edge of paving, structure, wall, or walkway.
 4. Hand cut existing tree roots over one inch (1") in diameter as necessary for trenching or other new construction. Apply multiple coats of emulsified asphalt sealant especially made for horticultural use on cut or damaged plant tissues to cut faces and adjacent surfaces. Cover exposed roots with wet burlap to prevent roots from dying out until backfilling is complete.
 5. Disking and mixing of vegetation, trash, debris, and other deleterious materials with surface soils prior to grading is not permitted.
 6. Remove all buried debris, organic material, rubble, trash, or other material not deemed suitable by the geotechnical Engineer.
 7. Fill all voids or excavations resulting from clearing, demolition, or removal of vegetation with fill material in compliance with **Section 31 00 00: Earthwork**.
 8. Selected equipment of such sizes and capacities that the existing environment is disturbed as little as possible, and to afford ease of mobility within limited and relatively confined work areas. Make every effort to preserve the topography in its natural state.
 9. Keep drains, catch basins, surface drainage courses, and related drainage system components clear of debris and construction materials.
 10. Remove irrigation piping and appurtenances as necessary within area of work, unless noted otherwise to remain. Replace irrigation piping and appurtenances to irrigate new and/or existing landscaping. Contractor shall be responsible for temporary landscape irrigation until such time that irrigation system is restored and operational.

3.9 DISPOSAL

- A. Demolished materials become property of the Contractor and shall be removed from premises, except those items specifically listed to be retained by Owner.
- B. Dispose of all demolished material, trash, debris, and other materials not used in the work in accordance with the regulations of jurisdictional authority.
- C. It is required that all materials that are of a recyclable nature, be transported to a suitable legal recycling facility instead of a dump or refuse facility (unless they are one-in-the same).
- D. Burning and Burying of Materials: **Not allowed**.
- E. Haul Routes:
 1. Obtain permits as required by jurisdictional agencies. Establish haul routes in advance; post flagmen for the safety of the public and workmen.
 2. Keep streets free of mud, rubbish, etc. Assume responsibility for damage resulting from hauling operations; hold Owner free of liability in connection therewith.
- F. Remove demolished materials and debris from site on a daily basis.

3.10 CLEANING

- A. Upon completion of work of this Section, promptly remove from the working area all scraps and debris.

- B. Clean excess material from the surface of all remaining paved surfaces and utility structures.
- C. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION 02 41 00

SECTION 02 41 19 SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 1. Demolition and removal of selected portions of building or structure.
 2. Accessories necessary for demolition and deconstruction.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose off-site unless indicated as salvaged or reinstallation.
- B. Existing to Remain: Leave existing items that are not scheduled for salvage or reuse, as is; do not remove.
- C. Deconstruct: To remove by disassembling or detaching an item from a surface, using methods and equipment to successfully prevent damage to the item and surfaces, and dispose of items unless indicated as salvaged or for reinstallation.

1.4 SUBMITTALS

- A. Qualification Data: Submit copies of qualifications for refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Proposed Protection Measures: Submit report, including Drawings, indicating proposed measures for protecting individuals and property, for environmental protection, dust control, and noise control. Indicate proposed locations, types, and construction of barriers.
- D. Schedule of Selective Demolition Activities:
 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's onsite operations are uninterrupted.
 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 3. Coordination for shutoff, capping, and continuation of utility services.
 4. Use of elevator and stairs.
 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- E. Inventory: Submit a list of items for removal and salvage and deliver to Owner prior to start of demolition.
- F. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Demolition standards: Comply with ASSE A10.6 and NFPA 241.
 - 2. Comply with EPA regulations prior to commencement of the work. Comply with hauling and disposal regulations of authorities having jurisdiction.
 - 3. Comply with applicable federal, state, and local codes for demolition work, dust and noise control, safety of structure, and debris removal.
 - 4. Obtain required permits from authorities having jurisdiction.
- B. Refrigerant Recovery Technician Qualifications: Certified by an EPA approved certification program.
- C. Pre-Demolition Conference:
 - 1. Conduct conference at the site:
 - a. Inspect and discuss condition of construction to be selectively demolished.
 - b. Review structural load limitations of existing structure.
 - c. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - d. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - e. Review areas where existing construction is to remain and requires protection.
- D. Arrange selective demolition schedule to avoid interference with Owner's and the school's operations.

1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor prior to proceeding. Existing warranties to be provided by Owner prior to the start of construction.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying existing system has been inspected and warranty remains in effect. Submit supporting documentation at closeout.

1.7 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 MATERIALS

- A. Repair Materials:
 - 1. Use repair materials identical to existing materials:
 - a. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - b. Use materials whose installed performance equals or surpasses that of existing

materials.

- B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 EXECUTION

3.1 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. Provide minimum of 72 hours' notice to Owner of demolition activities that will affect Owner's operations including but not limited to:
 - 1. Interruption of power.
 - 2. Interruption of utility services.
 - 3. Excessive noise.
- B. Condition of Structure:
 - 1. Conditions existing at time of inspection will be maintained by Owner as far as practical. Owner assumes no responsibility for actual condition of items or structures to be demolished:
 - a. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
 - b. Before commencing selective demolition, Owner will remove the following items:
- C. Hazardous Materials:
 - 1. It is not anticipated that hazardous materials will be encountered in the Work:
 - a. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract but before start of the Work.
- D. Storage or sale of removed items or materials onsite is not permitted.
- E. Traffic:
 - 1. Conduct operations and debris removal to ensure minimum interference with roads, streets, drives, fire lanes, walks, accessible paths, and adjacent occupied or used facilities:
 - a. Do not close, block, or obstruct streets, drives, walks, or occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around obstructed traffic ways.
- F. Explosives: Explosives are **not permitted** at the site.
- G. Flame Cutting: Do not use cutting torches for removal until flammable materials are removed. At concealed spaces, verify conditions prior to flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.
- H. Environmental Controls: Use water sprinkling, temporary enclosures, or other acceptable methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions.
- I. Utility Services:
 - 1. Maintain existing utilities and protect against damage during demolition operations:
 - a. Do not interrupt utilities serving occupied or used facilities, except when authorized

in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, acceptable to Owner and governing authorities.

- J. Protections:
1. Provide temporary barriers to protect Owner's personnel and public from injury from work:
 - a. Take protective measures to provide free and safe passage to occupied portions of building.
 - b. Provide protection to ensure safe passage of Owner's personnel and the public around demolition areas and to and from occupied portions of adjacent areas, buildings, and structures.
 - c. Provide shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
 - d. Protect existing work that becomes exposed during demolition operations:
 - 1) Protect existing improvements, appurtenances, and conditions to remain.
 - 2) Protect adjacent floors with coverings.
 - 3) Protect walls, openings, roofs, and adjacent exterior construction to remain and exposed to building demolition operations.
 - e. Construct temporary, insulated, dustproof partitions to separate areas from noisy or extensive dirt or dust when operations are performed. Equip partitions with dustproof doors and security locks.
 - f. Provide temporary weather protection when exposing exterior conditions to prevent water leakage or damage to structure or interior areas of existing building.
- K. Damages: Promptly repair damages caused to adjacent facilities by demolition work.

3.2 EXAMINATION

- A. Verify that affected utilities have been disconnected and capped before commencing selective demolition operations.
- B. Review Project record documents of existing construction or existing condition and hazardous material information provided by Owner. Owner does not warrant existing conditions are same as those indicated in Project record documents.
- C. Perform an engineering survey of condition of building to determine whether removing an element might result in structural deficiency or unplanned collapse of a portion of structure or adjacent structures during selective building demolition operations:
 1. Perform surveys as the work progresses to detect hazards resulting from selective demolition activities.
- D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- F. Survey of Existing Conditions:
 1. Record existing conditions with measured drawings or preconstruction photographs or video and templates:
 - a. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
 - b. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final work, make permanent record of measurements,

- materials, and construction details required to make exact reproduction.
- c. For any electrical or low-voltage work to be performed in the Project (including fire alarm, PA, intercom, or data), test entire system for operation prior to initiation of Work. Notify Owner of any non-working components. Test entire system at the end of construction to ensure all systems operate properly.

3.3 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.
- B. Pest Control: Employ certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations.
- C. 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. Comply with requirements for access and protection.
- D. Temporary Facilities:
 1. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain:
 - a. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - b. Provide temporary weather protection during interval between selective demolition of existing construction on exterior surfaces and new construction to prevent water leakage and damage to structure and interior areas.
 - c. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - d. Cover and protect furniture, furnishings, and equipment that have not been removed.
 - e. Comply with requirements for temporary enclosures, dust control, heating, and cooling.
- E. Furnishings and Equipment: Cover and protect furniture, equipment, and fixtures from spoilage or damage as necessary.

3.4 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned:
 1. Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished:
 - a. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - b. Arrange to shut off utilities with utility companies.
 - c. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - d. Disconnect, demolish, and remove fire suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed:
 - 1) Piping to be removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2) Piping to be abandoned in place: Drain piping and cap or plug piping with

- same or compatible piping material and leave in place.
- 3) Equipment to be removed: Disconnect and cap services and remove equipment.
 - 4) Equipment to be removed and reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5) Equipment to be removed and salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - 6) Ducts to be removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - 7) Ducts to be abandoned in place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.5 POLLUTION CONTROLS

- A. Dust Control:
1. Use water mist, temporary enclosures, and suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations including, but not limited to SCAQMD (Fugitive Dust) rules and regulations:
 - a. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
 - b. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.

3.6 PROTECTION

- A. Temporary Shoring:
1. Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished:
 - a. Strengthen or add new supports when required during progress of selective demolition.
- B. Remove temporary barricades and protections where hazards no longer exist.

3.7 SELECTIVE DEMOLITION

- A. Demolish and remove existing construction to the extent necessary for new work. Use methods required to complete the work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.
 5. Maintain fire watch during and for at least 24 hours after flame cutting operations.
 6. Maintain adequate ventilation when using cutting torches.

7. Remove decayed, vermin infested, and dangerous or unsuitable materials and promptly dispose of off-site.
 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 9. Locate selective demolition equipment and remove debris and materials to avoid imposing excessive loads on supporting walls, floors, or framing.
 10. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
1. Remove items indicated for salvage. Clean and pack or crate items after cleaning. Identify contents of containers. Store items in secure area until delivery to Owner:
 - a. Transport items to Owner's storage area designated by Owner. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse:
 - a. Pack or crate items after cleaning and repairing. Identify contents of containers.
 - b. Protect items from damage during transport and storage.
 - c. 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.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Owner, items may be removed to a suitable, protected storage location during selective demolition, cleaned, and reinstalled in original locations after selective demolition operations are complete.
- F. Patching and Repair: Repair damage to adjacent construction caused by selective demolition operations promptly.

3.8 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. 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. 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.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- D. Concrete Slabs on Grade: Saw cut perimeter of area to be demolished, and then break up and remove.
- E. Interior Slab on Grade: Use best practice removal methods to prevent cracking or structurally disturbing adjacent slabs or partitions. Use power saw where possible.
- F. Resilient Floor Coverings: Remove floor coverings and adhesive according to

recommendations in RFCI *Recommended Work Practices for the Removal of Resilient Floor Coverings*. Do not use methods requiring solvent-based adhesive strippers.

- G. Below Grade Voids: Completely fill below grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over six inches (150 mm) in diameter, roots, or other organic matter.
- H. Partitions: Completely remove indicated interior partitions and interior finishes indicated. Leave adjacent work scheduled to remain sound and ready for patching or for new finishes.
- I. Doors and Frames:
 - 1. Remove doors, frames, and hardware where indicated. Remove from site:
 - a. Clean, store, and protect for reinstallation or return hardware to Owner as directed.
- J. Cut existing masonry walls for new doors, windows, or openings indicated. Leave openings ready to receive new work or patching.
- K. Windows: Remove existing windows where indicated. Remove associated anchors, shims, blocking, operating devices, sealant, and trim. Cut back interior finishes required for plumb surface for patching. Leave openings ready for installation of new materials and finishes.
- L. Mechanical, Electrical, and Structural Elements:
 - 1. If unanticipated mechanical, electrical, or structural elements conflicting with intended function or design are encountered, investigate and measure both nature and extent of the conflict:
 - a. Submit written report to Architect in accurate detail. Pending receipt of directive, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.
 - b. HVAC Equipment: Remove air conditioning equipment without releasing refrigerants.

3.9 REMOVAL OF STRUCTURAL ELEMENTS

- A. Foundation: Demolish foundation walls to a minimum depth of 12 inches (300mm) below existing ground surface. Demolish and remove below grade wood or metal construction. Break up below grade concrete slabs.
- B. Pneumatic Operated Hammers:
 - 1. When possible, reduce use of pneumatic operated hammers. When necessary to use pneumatic tools, locate compressors as remote from occupied areas as possible:
 - a. To break large pieces of concrete, isolate concrete from floor slabs and building structure to prevent structure borne vibration.
- C. Saw Cutting:
 - 1. Locate compressors as remote as possible from occupied areas of facility:
 - a. Use diamond tipped saw blades and related equipment.
 - b. Saw cut portions of walls and slabs. Angle saw blade at floors and corners to cut as closely as possible to desired location.
 - c. Control runoff water used with saw to prevent damage to existing materials.

3.10 ROOF REMOVAL

- A. Roof Assembly:
 - 1. Remove existing roofing to the extent that can be covered in one (1) day by new roofing. Maintain building interior in watertight and weathertight condition:

- a. Remove existing roof membrane, flashings, copings, and roof accessories.
 - b. Remove existing roofing system down to substrate.
- B. At new column extensions, cut through roofing as required for welding of new extension. Provide temporary watertight enclosure over stubs and temporarily flash to existing roof to make completely watertight.
- C. At existing parapets, remove portions of roofing, flashing, stone, and masonry necessary to weld new steel and set form work. Provide temporary watertight enclosures over areas of open roof and temporarily flash to make watertight.
- D. As column forms are placed, temporarily flash columns to existing roofing and cover with watertight tarpaulins before and after pouring. After column forms have been removed, temporarily flash new concrete structure into existing roofing immediately to maintain watertight roof.
- E. When removing roofing to place supports for shoring of form work to transfer loads to existing columns or approved structure or to support scaffolding, work platforms, or similar loads, temporarily flash supports to make roof watertight.
- F. Remove excess residue. Thoroughly clean and remove asphalt, dust, and loose materials and leave ready for new work.

3.11 PATCHING AND REPAIRS

- A. Promptly repair damage to adjacent construction caused by selective demolition operations.
- B. Patching: Comply with Section 01 73 29: Cutting and Patching.
- C. Repairs:
 1. When necessary to repair to existing surfaces, patch to produce surfaces suitable for new materials:
 - a. Fill holes and depressions in existing masonry walls to remain with masonry patching material applied according to manufacturer's written recommendations.
- D. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
- E. Floors and Walls:
 1. Where walls or partitions are demolished, extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance:
 - a. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
 - b. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
 - c. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
- F. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.12 DISPOSAL OF DEMOLISHED MATERIALS

- A. Legally remove demolition waste materials from site and dispose in an EPA approved construction and demolition waste landfill acceptable to authorities having jurisdiction; recycle or reuse components:
 - 1. Do not allow demolished materials to accumulate onsite.
 - 2. Remove and transport debris to prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or devices that convey debris to grade level in a controlled descent.

- B. Burning: Do not burn demolished materials.

3.13 CLEANING

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

END OF SECTION 02 41 19

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Form-facing material for cast-in-place concrete.
2. Shoring, bracing, and anchoring.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each of the following:

1. Form-release agent.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Minutes of preinstallation conference.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:
 - a. Plywood, metal, or other approved panel materials.
 - b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 1) APA HDO (high-density overlay).

- 2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
 - 3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
 - 4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.
- B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
1. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 RELATED MATERIALS

- A. Reglets: Fabricate reglets of not less than **0.022-inch- (0.55-mm-)** thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- B.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, **3/4 by 3/4 inch (19 by 19 mm)**, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- 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.
 2. Form release agent for form liners shall be acceptable to form liner manufacturer.
- 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.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

- A. Comply with **ACI 301 (ACI 301M)**.
- 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)** and to comply

with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes.

- C. Limit concrete surface irregularities as follows:
 - 1. Surface Finish-2.0: ACI 117 Class B, **1/4 inch (6 mm)**.
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips.
 - 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.
- I. **Chamfer** exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than **12 inches (305 mm)**.
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
 - 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- L. Construction and Movement Joints:
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.

2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 3. Place joints perpendicular to main reinforcement.
 4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
 - a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 6. Space vertical joints in walls **as indicated on Drawings**.
 - a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 4. Clean embedded items immediately prior to concrete placement.

3.3 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.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a **qualified testing and inspecting agency** to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of the Architect.

1.4 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement:
- 2.

B. Field quality-control reports.

C. Minutes of preinstallation conference.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, **Grade 60 (Grade 420)**, deformed.
- B. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- C.
- D. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
- B. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than **0.0508 inch (1.2908 mm)** in diameter.
 - 1. Finish: **Plain**

2.3 FABRICATING REINFORCEMENT

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

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:

1. Do not cut or puncture vapor retarder.
 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than **1 inch (25 mm)**, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with **ACI 318 (ACI 318M)**.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or **24 inches (610 mm)**, whichever is greater.
 2. Stagger splices in accordance with **ACI 318 (ACI 318M)**.
- G. Install welded-wire reinforcement in longest practicable lengths.
1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
 - a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed **12 inches (305 mm)**.
 2. Lap edges and ends of adjoining sheets at least one wire spacing plus **2 inches (50 mm)** for plain wire and **8 inches (200 mm)** for deformed wire.
 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
 4. Lace overlaps with wire.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
1. Place joints perpendicular to main reinforcement.
 2. Continue reinforcement across construction joints unless otherwise indicated.
 3. Do not continue reinforcement through sides of strip placements of floors and slabs.

3.4 INSTALLATION TOLERANCES

- A. Comply with **ACI 117 (ACI 117M)**.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a **qualified testing and inspecting agency** to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. Steel-reinforcement placement.

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners.
2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, and other pozzolans materials subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Aggregates.
6. Admixtures:

- a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

7. Vapor retarders.
8. Curing materials.
9. Joint fillers.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Slump limit.
6. Air content.
7. Nominal maximum aggregate size.
8. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
9. Intended placement method.
10. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Vapor retarders.
5. Joint-filler strips.

B. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Aggregates.
6. Admixtures:

- C. Research Reports: For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
- D. Preconstruction Test Reports: For each mix design.
- E. Field quality-control reports.
- F. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

- A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
 - 1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
 - 1. Include the following information in each test report:
 - a. Admixture dosage rates.
 - b. Slump.
 - c. Air content.
 - d. Seven-day compressive strength.
 - e. 28-day compressive strength.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94/C94M and **ACI 301 (ACI 301M)**.

1.9 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with **ACI 301 (ACI 301M)** and ACI 306.1.
- B. Hot-Weather Placement: Comply with **ACI 301 (ACI 301M)** and **ACI 305.1 (ACI 305.1M)**.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

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

2.2 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, **Type V, gray**.
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

- B. Normal-Weight Aggregates: ASTM C33/C33M, **Class 3M** coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:

- a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
- b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
- c. Alkali Content in Concrete: Not more than **4 lb./cu. yd. (2.37 kg/cu. m)** for moderately reactive aggregate or **3 lb./cu. yd. (1.78 kg/cu. m)** for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with **ACI 301 (ACI 301M)**.

2. Maximum Coarse-Aggregate Size: **1 inch (25 mm)** nominal.

3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C260/C260M.

- D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures 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 C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

- E. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.3 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than **10 mils (0.25 mm)** thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.4 CURING MATERIALS

- A. 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.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
 - 1. Color:
 - a. Ambient Temperature Below **50 deg F (10 deg C)**: Black.
 - b. Ambient Temperature between **50 deg F (10 deg C)** and **85 deg F (29 deg C)**: Any color.
 - c. Ambient Temperature Above **85 deg F (29 deg C)**: White.
- C. Curing Paper: **Eight-feet- (2438-mm-)** wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.
- D. Water: Potable or complying with ASTM C1602/C1602M.
- E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.
- F. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B, **certified by curing compound manufacturer to not interfere with bonding of floor covering.**
- G. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.5 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: **ASTM D1751, asphalt-saturated cellulosic fiber.**
- B. Floor Slab Protective Covering: **Eight-feet- (2438-mm-)** wide cellulose fabric.

2.6 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with **ACI 301 (ACI 301M)**.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures. Mix designs shall be under the direct supervision of a California registered Civil Engineer.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash or Other Pozzolans: 25 percent by mass.
 2. Slag Cement: 50 percent by mass.
 3. Total of Fly Ash or Other Pozzolans, Slag Cement: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass.
 4. Total of Fly Ash or Other Pozzolans: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass.
- C. Admixtures: Use admixtures in accordance with 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**,].

2.7 CONCRETE MIXTURES

- A. Class A: Normal-weight concrete used for footings, and grade beams.
1. Exposure Class: **ACI 318 (ACI 318M) F1S2W0 C1**.
 2. Minimum Compressive Strength: [**As indicated** at 28 days.
 3. Maximum w/cm: As indicated.
 4. Slump Limit: As indicated.
 5. Air Content:
 - a. Exposure Class F1: **5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size, 4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch (25-mm) nominal maximum aggregate size**
 6. Limit water-soluble, chloride-ion content in hardened concrete to **0.15** percent by weight of cement.
- B. Class C: Normal-weight concrete used for interior slabs-on-ground.
1. Exposure Class: **ACI 318 (ACI 318M) F0 S0 W0C1**.
 2. Minimum Compressive Strength: **As indicated** at 28 days.
 3. Maximum w/cm: As Indicated.
 4. Slump Limit: As indicated. Air Content:
 - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

5. Limit water-soluble, chloride-ion content in hardened concrete to **0.15** percent by weight of cement.
- 6.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 1. For mixer capacity of **1 cu. yd. (0.76 cu. m)** or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
 2. For mixer capacity larger than **1 cu. yd. (0.76 cu. m)**, increase mixing time by 15 seconds for each additional **1 cu. yd. (0.76 cu. m)**.
 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.2 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
 1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
 2. Face laps away from exposed direction of concrete pour.
 3. Lap vapor retarder over footings and grade beams not less than **6 inches (150 mm)**, sealing vapor retarder to concrete.
 4. Lap joints **6 inches (150 mm)** and seal with manufacturer's recommended tape.

5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.
 - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by **6 inches (150 mm)** on all sides, and sealing to vapor retarder.

3.3 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
 2. Place joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints unless otherwise indicated.
 - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
 3. Form keyed joints as indicated. Embed keys at least **1-1/2 inches (38 mm)** into concrete.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least **one-fourth** of concrete thickness as follows:
 1. Grooved Joints: Form control 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 control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut **1/8-inch- (3.2-mm-)** wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
 2. 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, specified in Section 079200 "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.4 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of **ACI 301 (ACI 301M)**, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- E. 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.
1. If a section cannot be placed continuously, provide construction joints as indicated.
 2. Deposit concrete to avoid segregation.
 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with **ACI 301 (ACI 301M)**.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least **6 inches (150 mm)** into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.

- d. 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.
- F. 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. Do not place concrete floors and slabs in a checkerboard sequence.
 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 3. Maintain reinforcement in position on chairs during concrete placement.
 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 5. Level concrete, cut high areas, and fill low areas.
 6. Slope surfaces uniformly to drains where required.
 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 8. Do not further disturb slab surfaces before starting finishing operations.

3.5 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. **ACI 301 (ACI 301M)** Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
 - a. Patch voids larger than **1-1/2 inches (38 mm)** wide or **1/2 inch (13 mm)** deep.
 - b. Remove projections larger than **1 inch (25 mm)**.
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: **ACI 117 (ACI 117M)** Class D.
 - e. Apply to concrete surfaces **not exposed to public view**.
2. **ACI 301 (ACI 301M)** Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
 - a. Patch voids larger than **3/4 inch (19 mm)** wide or **1/2 inch (13 mm)** deep.
 - b. Remove projections larger than **1/4 inch (6 mm)**.
 - c. Patch tie holes.
 - d. Surface Tolerance: **ACI 117 (ACI 117M)** Class B.
 - e. Locations: 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**.

B. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.6 FINISHING FLOORS AND SLABS

- A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish:
1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
 2. Use stiff brushes, brooms, or rakes to produce a profile depth of **1/4 inch (6 mm)** in one direction.
 3. Apply scratch finish to surfaces **to receive concrete floor toppings to receive mortar setting beds for bonded cementitious floor finishes.**
- C. Float Finish:
1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
 2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with **ACI 117 (ACI A117M)** tolerances for conventional concrete.
 3. Apply float finish to surfaces **to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.**
- D. Trowel Finish:
1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
 2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
 3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 4. Do not add water to concrete surface.
 5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
 6. Apply a trowel finish to surfaces **exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.**
 7. 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 **1/4 inch (6 mm)**].
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces **where ceramic or quarry tile is to be installed by either thickset or thinset method.** While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.
1. Coordinate required final finish with Architect before application.
 2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
 - 2. Coordinate required final finish with Architect before application.

3.7 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

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

- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

- 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
- 2. Construct concrete bases **4 inches (100 mm)** high unless otherwise indicated on Drawings, and extend base not less than **6 inches (150 mm)** in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
- 3. Minimum Compressive Strength: **3000 psi (20.7 MPa)** at 28 days.
- 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch (450-mm)** centers around the full perimeter of concrete base.
- 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
- 6. Prior to pouring concrete, place and secure anchorage devices.
 - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.8 CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
 - 1. Comply with **ACI 301 (ACI 301M)** and ACI 306.1 for cold weather protection during curing.
 - 2. Comply with **ACI 301 (ACI 301M)** and **ACI 305.1 (ACI 305.1M)** for hot-weather protection during curing.

3. Maintain moisture loss no more than **0.2 lb/sq. ft. x h** (**1 kg/sq. m x h**), calculated in accordance with **ACI 305.1**.) before and during finishing operations.
- B. Curing Formed Surfaces: Comply with **ACI 308.1** (**ACI 308.1M**) as follows:
1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
 2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
 3. If forms remain during curing period, moist cure after loosening forms.
 4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
 - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
 - 2) Maintain continuity of coating and repair damage during curing period.
- C. Curing Unformed Surfaces: Comply with **ACI 308.1** (**ACI 308.1M**) as follows:
1. Begin curing immediately after finishing concrete.
 2. Interior Concrete Floors:
 - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than **12-inches** (**300-mm**).
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 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.

- a)
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
 - 4) 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.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 5) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- b. Floors to Receive Polished Finish: Contractor has option of the following:
- 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than **12 inches (300 mm)**.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- c. Floors to Receive Chemical Stain:
- 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
 - 2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.

- 3) Butt sides of curing paper tight; do not overlap sides of curing paper.
- 4) Leave curing paper in place for duration of curing period, but not less than 28 days.

d. Floors to Receive Urethane Flooring:

- 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
- 2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped **6 inches (150 mm)** and sealed in place.
- 3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
- 4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

e. Floors to Receive Curing Compound:

- 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
- 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
- 3) Maintain continuity of coating, and repair damage during curing period.
- 4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer **unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project**].

f. Floors to Receive Curing and Sealing Compound:

- 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
- 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
- 3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.9 TOLERANCES

- A. Conform to **ACI 117 (ACI 117M)**.

3.10 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: **Owner will engage** a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
 2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
 3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
 - a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.
 - 12) Field test results.
 - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- D. Inspections:
1. Headed bolts and studs.
 2. Verification of use of required design mixture.
 3. Concrete placement, including conveying and depositing.
 4. Curing procedures and maintenance of curing temperature.
 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
 6. Batch Plant Inspections: On a random basis, as determined by Architect.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with 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 C143/C143M:
 - a. 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.
 - b. Perform additional tests when concrete consistency appears to change.
3. Slump Flow: ASTM C1611/C1611M:
 - a. 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.
 - b. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C1064/C1064M:
 - a. 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.
6. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and laboratory cure two sets of **two 6-inch (150 mm) by 12-inch (300 mm) or 4-inch (100 mm) by 8-inch (200 mm)** cylinder specimens for each composite sample.
 - b. Cast, initial cure, and field cure **two** sets of **[two] [three] [four]** standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one set of **two** field-cured specimens at seven days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. 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)** if specified compressive strength is **5000 psi (34.5 MPa)**, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than **5000 psi (34.5 MPa)**.

10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests:
 - a. 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 Architect.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 - 1) Acceptance criteria for concrete strength shall be in accordance with **ACI 301 (ACI 301M)**, section 1.6.6.3.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

- F. Measure floor and slab flatness and levelness in accordance with **ASTM E1155 (ASTM E1155M)** within **24** hours of completion of floor finishing and promptly report test results to Architect.

3.11 PROTECTION

- A. Protect concrete surfaces as follows:
 1. Protect from petroleum stains.
 2. Diaper hydraulic equipment used over concrete surfaces.
 3. Prohibit vehicles from interior concrete slabs.
 4. Prohibit use of pipe-cutting machinery over concrete surfaces.
 5. Prohibit placement of steel items on concrete surfaces.
 6. Prohibit use of acids or acidic detergents over concrete surfaces.
 7. Protect concrete surfaces scheduled to receive polished concrete finish using Floor Slab Protective Covering.

END OF SECTION 033000

SECTION 04 22 00.13 CONCRETE UNIT VENEER MASONRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Concrete masonry units (CMUs).
 - 2. Mortar and grout.
 - 3. Masonry joint reinforcement.
 - 4. Ties and anchors.
 - 5. Embedded flashing.
 - 6. Control joint materials.
- B. Related Sections:
 - 1. Section 05 50 00: Metal Fabrication.
 - 2. Section 07 19 00: Water Repellents.
 - 3. Section 07 62 00: Sheet Metal Flashing and Trim.
 - 4. Section 07 92 00: Joint Sealants.
- C. Reference Standards:
 - 1. TMS 602 Specification for Masonry Structures.
 - 2. ASTM International (latest versions):
 - a. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - b. ASTM A951/A951M Standard Specification for Masonry Joint Reinforcement.
 - c. ASTM A1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 - d. ASTM A1064 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - e. ASTM C150/C150M Standard Specification for Portland Cement.
 - f. ASTM C270 Standard Specification for Mortar for Unit Masonry.
 - g. ASTM C595/C595M Standard Specification for Blended Hydraulic Cements.
 - h. ASTM C920 Standard Specification for Elastomeric Joint Sealants.

1.3 SUBMITTALS

- A. Obtain written acceptance of submittals prior to use of the following:
 - 1. Submit mix designs:
 - a. Preblended mortar: mix design indicating types and proportions of materials according to proportion specification of ASTM C270.
 - 2. Submit material certificates for each of the following certifying compliance:
 - a. Concrete masonry units.
 - b. Anchors, ties, fasteners, and metal accessories.
 - c. Elastomeric joint sealants.
- B. Samples for Verification:
 - 1. For each type and color of the following:

- a. Concrete masonry units.
- C. Mortar, for color selection or confirmation.

1.4 QUALITY ASSURANCE

- A. Sample Panels:
 - 1. Construct an approximate 6'-0": wide by 3'-4": high panel for representation of completed masonry, joint tooling, design details, and workmanship. Comply with requirements in Section 01 40 00: Quality Requirements for mockups:
 - a. Install the following in the sample panel:
 - 1) Include corner condition
- B. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00: Project Management and Coordination.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect all materials of this Section to maintain quality and physical requirements.
- B. Store all masonry units on the jobsite so that they are protected from rain, stored off-ground, and kept free of contamination.
- C. Store SPEC MIX preblended mortar mix in manufacturer's original, unopened, undamaged containers with identification labels intact, covered and protected from weather, or in a SPEC MIX dispensing silo.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Concrete Masonry Units:
 - 1. RCP Co., Inc.:
 - 2. Orco Block Co., Inc.:
- B. Preblended Mortar:
 - 1. SPEC MIX Preblended Mortar Mix, by E-Z Mix, Inc.:
 - a. Sun Valley, CA (818) 768-0568.
 - b. Rialto, CA (909) 874-7686.
- C. Grout Additive:
 - 1. PRE-MIX Products Grout Additive, by E-Z Mix, Inc.:
 - a. Sun Valley, CA (818) 768-0568.
 - b. Rialto, CA (909) 874-7686.

2.2 CONCRETE MASONRY UNITS

- A. Concrete Masonry Units - ASTM C90:
 - 1. Weight classification: Medium weight unless otherwise indicated.
 - 2. Color(s) and texture(s): Precision block to match existing adjacent cmu building

2.3 MORTAR MATERIALS

- A. SPEC MIX Masonry Mortar Type S preblended factory mix - ASTM C270 and ASTM
CONCRETE UNIT VENEER MASONRY

C1714/C1714M:

1. Natural gray color.
- B. Water: Potable.
- C. Admixtures:
1. Do not use admixtures except as specified herein, or as approved by the design professional and the building official.

2.4 REINFORCEMENT AND METAL ACCESSORIES

- A. Provide metal reinforcement and accessories conforming to TMS 602 Article 2.4.
- B. Masonry Joint Reinforcement - ASTM A951/A951M:
1. Masonry joint reinforcement used in exterior walls shall be hot-dipped galvanized, conforming to ASTM A153, Class B, minimum coating of 1.5 ounce for square foot.
 2. For seismic design categories E or F, provide continuous single wire joint reinforcement of wire size W1.7 (MW11).
- C. Sheet Metal Anchors and Ties - ASTM A1008/A1008M:
1. Sheet metal anchors and ties used in exterior walls shall be hot-dipped galvanized, conforming to ASTM A153, Class B.
- D. Wire Ties and Anchors - ASTM A1064:
1. Wire ties and anchors used in exterior walls shall be hot-dipped galvanized, conforming to ASTM A153, Class B, minimum coating of 1.5 ounce per square foot.
 2. For seismic design categories E or F, anchor shall provide a hook, clip, notch, or other means to mechanically engage the joint reinforcement.
- E. A continuous water-resistive barrier is required where the backing is constructed of studs.

2.5 WATER-RESISTIVE BARRIER

- A. Provide No. 15 asphalt felt, complying with ASTM D226 for Type 1.

2.6 FLASHING MATERIALS

- A. Provide metal flashing in accordance with Section 07 62 00: Sheet Metal Flashing and Trim.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

- A. Control joint materials:
1. Elastomeric joint sealer per ASTM C920.
 2. Use size and shape of joint filler per joint sealer manufacturer recommendations.

2.8 MASONRY CLEANER

- A. Use potable water and detergents to clean masonry unless otherwise approved.
- B. Do not use acid or caustic solutions unless otherwise approved.

2.9 MIXING

- A. Mortar:
1. Mix SPEC MIX Masonry Mortar preblended factory mix per manufacturer's

recommendations.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Prior to the start of masonry installation, verify all conditions pertinent to the performance of work in this Section are acceptable.
- B. Proceed with masonry work only after unsatisfactory conditions have been corrected.

3.2 FIELD CONDITIONS

- A. Cover top of unfinished masonry work to protect it from the weather.
- B. Cold-weather procedures when ambient temperature falls below 40°F (4°C) or the temperature of masonry units is below 40°F (4°C):
 - 1. Do not install wet or frozen units.
 - 2. Implement cold weather construction procedures in accordance with TMS 602 Article 1.8 C.
- C. Hot-weather procedures when ambient temperature exceeds 100°F (38°C), or exceeds 90°F(32°C) with a wind velocity greater than eight (8) mph:
- D. Implement hot weather construction procedures in accordance with TMS 602 Article 1.8 D.

3.3 INSTALLATION

- A. Select and arrange units for exposed masonry to produce a uniform blend of colors and textures:
 - 1. Mix units from several pallets or cubes as they are placed.
- B. Construct masonry veneer in compliance with TMS 402/TMS 602.
- C. Cut units as required to fit; use motor-driven masonry saw. Install cut units with cut surfaces edges concealed as much as possible.
- D. Lay dry units only, unless otherwise approved.
- E. Select and arrange units for exposed masonry to produce a uniform blend of colors and textures:
 - 1. Mix units from several pallets or cubes as they are placed.
- F. All masonry shall be laid true, level, plumb, and in accordance with the Drawings.
- G. Lay exposed masonry in running bond unless otherwise indicated in Project Drawings.

3.4 MORTAR BEDDING AND JOINTING

- A. Place mortar in accordance with TMS 602 Article 3.3 B.
- B. Initial bed joint shall not be less than 1/4 inch or more than 3/4 inch.
- C. All head and bed joints, except initial bed joints, shall be a nominal 3/8-inch thick, unless

otherwise required.

- D. Lay solid units with full head and bed joints. Do not fill head joints by slushing with mortar. Bed joints shall not be furrowed deep enough to produce voids.
- E. All mortar joints on exposed walls shall be concave, unless otherwise indicated, and struck to produce a dense, slightly concave surface well bonded to the surface of the masonry unit.
- F. Remove and re-lay in fresh mortar any unit that has been disturbed to the extent the initial bond is broken.

3.5 MASONRY JOINT REINFORCEMENT, TIES, AND ANCHORS

- A. Embed joint reinforcement, ties, and anchors in mortar and extend into the veneer a minimum 1-1/2 inches, with minimum 5/8-inch cover to outside face.
- B. Select from the table to fill in the values for B and C below:
 - 1. Anchor spacing:
 - a. Max Area:
 - 1) . 2-pc. Adjustable – 2.67 ft²; Others – 3.5².
 - 2) Seismic Design Category D – Reduce to 75 percent of above.
 - 3) High winds areas (>40 psf ≤ 55 psf) – Reduce to 70 percent of above.
 - b. Max Horizontal:
 - 1) 32 inches for running bond, not to exceed max area above.
 - 2) High winds areas (>40 psf ≤ 55 psf) – 18 inches.
 - c. Max Vertical:
 - 1) 25 inches, not to exceed max area above.
- C. Place ties and anchors:
- D. See structural drawings

3.6 CONTROL AND EXPANSION JOINTS

- A. Construct control joints as detailed in the drawings as masonry progresses.

3.7 FIELD QUALITY CONTROL

- A. Inspection tasks and frequency shall be performed in accordance with the Statement of Special Inspections.

3.8 POINTING AND CLEANING

- A. Point and tool holes in mortar joints to produce a uniform, tight joint.
- B. During construction, minimize any mortar or grout stains on the wall. Immediately remove any staining or soiling that occurs:
 - 1. For precision or textured units, except as noted below, clean masonry by dry brushing before tooling joints.
 - 2. For burnished, glazed, or pre-finished concrete masonry units, immediately remove any green mortar smears or soiling with a damp sponge.
- C. Final Cleaning:
 - 1. After mortar is thoroughly set and cured, clean exposed masonry surfaces of stains, efflorescence, mortar or grout droppings, and debris:

- a. Use appropriate masonry cleaner as tested on the sample panel and as approved by the design professional, strictly following manufacturer's recommendations.
 - b. Do not use acids.
- D. At completion of masonry work, remove all scaffolding and equipment used during construction, and remove all debris, refuse, and surplus masonry material from the site:
1. Comply with Construction Waste Management plan.

3.9 WATER REPELLENT APPLICATION

- A. Cleaning shall be complete and accepted by the design professional, and wall surfaces shall be thoroughly dry.
- B. Apply water repellent in strict accordance with **Section 07 19 00**: Water Repellants and the water repellent manufacturer's instructions.

END OF SECTION 04 22 00.13

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Shear stud connectors.
3. Shrinkage-resistant grout.

B. Related Requirements:

1. N.A.

1.2 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Anchor rods.
4. Threaded rods.
5. Shop primer.
6. Galvanized-steel primer.
7. Galvanized repair paint.
8. Shrinkage-resistant grout.

- B. Shop Drawings: Show fabrication of structural-steel components.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Mill test reports for structural-steel materials, including chemical and physical properties.
- C. Source quality-control reports.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
 - 1. ANSI/AISC 303.
 - 2. ANSI/AISC 360.
 - 3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- B. Connection Design Information:
 - 1. Connection designs have been completed and connections indicated on the Drawings.

- C. Construction: **Shear wall system**

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: **ASTM A992/A992M.**
- B. Channels, Angles: **ASTM A36/A36M.**
- C. Plate and Bar: **ASTM A36/A36M.**
- D. Cold-Formed Hollow Structural Sections: **ASTM A500/A500M, Grade B** structural tubing.
- E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.

- F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, **Grade A325 (Grade A325M)**, Type 1, heavy-hex steel structural bolts; **ASTM A563, Grade DH (ASTM A563M, Class 10S)**, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F959/F959M, **Type 325-1 (Type 8.8-1)**, compressible-washer type with plain finish.
- B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, **heavy-hexhead** assemblies, consisting of steel structural bolts with splined ends; **ASTM A563, Grade DH (ASTM A563M, Class 10S)**, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - 1. Finish: **Mechanically deposited zinc coating**.

2.4 RODS

- A. Unheaded Anchor Rods: **ASTM F1554, Grade 36**.
 - 1. Configuration: **Straight**.
 - 2. Finish: **Plain** or **Hot-dip zinc coating**, ASTM A153/A153M, **Class C** as indicated..
- B. Headed Anchor Rods: **ASTM F1554, Grade 36**, straight.
 - 1. Finish: **Plain** or **Hot-dip zinc coating**, ASTM A153/A153M, **Class C** as indicated .
- C. Threaded Rods: **ASTM A36/A36M**.
 - 1. Finish: **Plain** or **Hot-dip zinc coating**, ASTM A153/A153M, **Class C** as indicated .

2.5 PRIMER

- A. Steel Primer:
 - 1. Comply with **Section 099113 "Exterior Painting"** and **Section 099123 "Interior Painting."**
 - 2. SSPC-Paint 23, latex primer.
 - 3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanized-Steel Primer: **MPI#26**.
 - 1. Etching Cleaner: MPI#25, for galvanized steel.
 - 2. Galvanizing Repair Paint: **MPI#18, MPI#19, or SSPC-Paint 20** .

2.6 SHRINKAGE-RESISTANT GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

2.8 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: **Snug tightened.**
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.
 - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

2.10 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of **2 inches (50 mm)**.
 - 2. Surfaces to be field welded.
 - 3. Surfaces of high-strength bolted, slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Galvanized surfaces **unless indicated to be painted.**
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
 - 1. SSPC-SP 2.
 - 2. SSPC-SP 3.
 - 3. SSPC-SP 7 (WAB)/NACE WAB-4.

4. SSPC-SP 6 (WAB)/NACE WAB-3.
- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner.
- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of **1.5 mils (0.038 mm)**. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.11 SOURCE QUALITY CONTROL

- A. Testing Agency: **Owner will engage** a qualified testing agency to perform shop tests and inspections.
 1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
 2. Bolted Connections: Inspect **and test** shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E165/E165M.
 - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E164.
 - d. Radiographic Inspection: ASTM E94/E94M.
 4. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates **Bearing Plates and Leveling Plates**: Clean concrete-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. **Snug-tighten** anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. **Comply with manufacturer's written installation instructions for grouting.**

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

3.3 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: **Snug tightened.**

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: **Owner will engage** a qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspect **and test** bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."

2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

- 1) Liquid Penetrant Inspection: ASTM E165/E165M.
- 2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
- 3) Ultrasonic Inspection: ASTM E164.
- 4) Radiographic Inspection: ASTM E94/E94M.

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Roof deck.

B. Shop Drawings:

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

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

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

C. Research reports.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

2.2 ROOF DECK

- A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), **Grade 40 (275), G60 (Z180)** zinc coating.
 - 2. Deck Profile: **As indicated**
 - 3. Profile Depth: **As indicated**
 - 4. Design Uncoated-Steel Thickness: **As indicated**

2.3 ACCESSORIES

- A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of **33,000 psi (230 MPa)**, not less than **0.0359-inch (0.91-mm)** design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- E. Flat Sump Plates: Single-piece steel sheet, **0.0747 inch (1.90 mm)** thick, of same material and finish as deck. For drains, cut holes in the field.
- F. Galvanizing Repair Paint: or **SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.**

PART 3 - EXECUTIO

3.1 INSTALLATION

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- C. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- D. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- E. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- F. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and **mechanically fasten** flanges to top of deck. Space **mechanical fasteners** not more than **12 inches (305 mm)** apart with at least one **fastener** at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and **weld or mechanically fasten**.
- G. Miscellaneous Roof-Deck Accessories: Install ridge finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. **Weld** to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.2 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

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

END OF SECTION 053100

SECTION 05 50 00 METAL FABRICATIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Steel framing and supports.
 - 2. Miscellaneous steel trim including steel angle corner guards, and steel edgings.
 - 3. Metal downspouts.
 - 4. Metal finishes.
 - 5. Accessories necessary for a coordinated and complete installation.
- B. Related Sections:
 - 1. Section 03 30 00: Cast in Place Concrete.
 - 2. Section 09 21 16: Gypsum Board Assemblies.
 - 3. Section 09 24 00: Cement Plastering.
 - 4. Section 09 90 00: Painting and Coating.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design ladders and countertop supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance of Roof Anchor Points. Provide anchor points suitable for support of 5,000 pounds breaking point (see structural drawings).
- C. Structural Performance of Ladders: Provide ladders and landings capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- D. Structural Performance:
 - 1. Countertops and vanities:
 - a. Provide countertop and vanity framing capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections, or of exhibiting excessive deflections in any of the components making up the countertops and vanities:
 - 1) All deadloads.
 - 2) 250-pound live load placed on the countertop and vanity.
 - 3) Deflection at midspan: L/1000 times span or 1/8 inch, whichever is less.
- E. Thermal Movements:
 - 1. Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss:
 - a. Temperature change (range): 70 degrees F, ambient; 110 degrees F, material surfaces.

1.4 SUBMITTALS

- A. Product Data: Submit data for miscellaneous metal fabrications and paint, coatings, and grout accessories.
- B. Shop Drawings:
 - 1. Submit shop drawings detailing the fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items:
 - a. For installed products indicated to comply with design loads, include structural analysis data, for information only, signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Delegated Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Welding Certificates.
- E. Paint Compatibility Certificates: Submit manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Building Code: Comply with applicable provisions of the CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA), and chapter 35 of the CFC
 - 2. Welding:
 - a. Qualify procedures and personnel according to the following:
 - 1) AWS D1.1/D1.1M Structural Welding Code – Steel.
 - 2) AWS D1.2/D1.2M Structural Welding Code - Aluminum.
 - 3) AWS D1.3/D1.3M Structural Welding Code - Sheet Steel.
 - 4) AWS D1.6/D1.6M Structural Welding Code - Stainless Steel.
 - 5) Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- B. Fabricator/Installer Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project for a minimum of five (5) years, with a record of successful in-service performance, with sufficient production capacity to produce required units without causing delay in the work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store metal fabrications in a dry, well ventilated, weathertight place. Deliver and handle to prevent any type of damage to the fabricated work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Metal Surfaces: 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. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.
- D. Stainless Steel Bars and Shapes: ASTM A276, Type 304.
- E. Rolled Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.
- F. Rolled Stainless Steel Floor Plate: ASTM A793.
- G. Abrasive Surface Floor Plate:
 - 1. Steel plate with abrasive granules rolled into surface or with abrasive material metallurgically bonded to steel:
 - a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) IKG Industries, a division of Harsco Corporation.
 - 2) SlipNOT Metal Safety Flooring; W.S. Molnar Company.
- H. Steel Tubing: ASTM A500/A500M, cold formed steel tubing.
- I. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- J. Zinc Coated Steel Wire Rope - ASTM A741:
 - 1. Wire rope fittings: Hot dip galvanized steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- K. Slotted Channel Framing:
 - 1. Cold formed metal box channels (struts) complying with MFMA-4:
 - a. Size of channels: 1-5/8 inch by 1-5/8 inch (41 mm by 41 mm).
 - b. Material: Galvanized steel, ASTM A653/A653M, commercial steel, Type B, with G90 (Z275) coating; 0.108-inch (2.8 mm) nominal thickness.
 - c. Cold formed metal channels: Flange edges returned toward web and with 9/16-inch (14.3 mm) wide slotted holes in webs at two inches (51 mm) o.c.
 - d. Width of channels: 1-5/8 inch (41 mm).
 - e. Depth of channels: Indicated on Drawings.
 - f. Metal and thickness: Galvanized steel complying with ASTM A653/A653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating; 0.108-inch (2.8mm) nominal thickness.
 - g. Finish: Hot dip galvanized after fabrication.
- L. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.
- M. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
- N. Aluminum Alloy Rolled Tread Plate: ASTM B632/B 632M, Alloy 6061-T6.
- O. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.
- P. Fasteners:
 - 1. Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required:
 - a. Provide stainless steel fasteners for fastening stainless steel.
 - b. Provide bronze fasteners for fastening bronze.
 - c. Steel bolts and nuts: Regular hexagon head bolts, ASTM A307, Grade A with hex

- nuts, ASTM A563 and, where indicated, flat washers.
- d. Steel bolts and nuts: Regular hexagon head bolts, ASTM A325, Type 3 with hex nuts, ASTM A563, Grade C3 and, where indicated, flat washers.
 - e. Stainless steel bolts and nuts: Regular hexagon head annealed stainless steel bolts, ASTM F593 with hex nuts, ASTM F594 and, where indicated, flat washers; alloy.
 - f. Anchor bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 and, where indicated, flat washers.
 - g. Hot dip galvanize or provide mechanically deposited zinc coating where item being fastened is indicated to be galvanized.
 - h. Anchors: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
 - i. Post installed anchors - per Drawings:
 - 1) Material for interior locations: Carbon steel components zinc plated to comply with ASTM B633 or ASTM F1941 Class Fe/Zn 5, unless otherwise indicated.
 - 2) Material for exterior locations and where stainless steel is indicated: ASTM F593 and nuts, ASTM F594.
- Q. Miscellaneous Materials:
- 1. Shop primer for ferrous metal: Universal primer, organic zinc rich primer, complying with SSPC-Paint 20 and compatible with topcoat. Provide 10-99 (red) or 10-09 (gray) by Tnemec Company.
 - 2. Universal shop primer: Fast curing, lead and chromate free, universal modified alkyd primer and compatible with topcoat. Use primer containing pigments that make it easily distinguishable from zinc rich primer.
 - 3. Water based primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel and compatible with topcoat.
 - 4. Shop primer for galvanized steel: Primer formulated for exterior use over zinc coated metal and compatible with finish paint systems indicated.
 - 5. Galvanizing repair paint: High zinc dust content paint for regalvanizing welds in steel, complying with SSPC-Paint 20. Provide Tneme-Zinc 90-97 by Tnemec Company.
 - 6. Bituminous paint: Cold applied asphalt emulsion complying with SSPC-Paint 12, containing no asbestos fibers, or cold applied asphalt emulsion complying with ASTM D1187.
 - 7. Non-shrink, nonmetallic grout: Factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
 - 8. Concrete materials and properties: Composed of ASTM C150 Type I Portland cement, ASTM C33 sand and coarse aggregates and potable water to produce a low slump mix suitable for placement. Grade coarse aggregate from 1/8 inch with at least 95 percent passing a 3/8-inch sieve and not more than 10 percent passing a No. 8 sieve. Fill shall be proportioned to provide a minimum 28-day compressive strength of 3,000 psi (20 MPa).

2.2 FABRICATION

- A. Shop Assembly:
- 1. 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:
 - a. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove

- sharp or rough areas on exposed surfaces.
- b. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 - c. Form exposed work with accurate angles and surfaces and straight edges.
 - d. Weld corners and seams continuously to comply with the following:
 - 1) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2) Obtain fusion without undercut or overlap.
 - 3) Remove welding flux immediately.
 - 4) At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 - e. 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.
 - f. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
 - g. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
 - 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 inch by 1-1/2 inches (3.2 mm by 38 mm), with a minimum six-inch (150 mm) embedment and two-inch (50 mm) hook, not less than eight inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.
- B. Miscellaneous Framing and Supports:
1. Provide steel framing and supports necessary to complete the work and that are not a part of the structural framework, including, but not limited to, framing and supports for overhead lobby door frames, sliding doors, countertop and vanities, ceiling hung toilet compartments, tube framing for partial height walls, and mechanical and electrical equipment:
 - a. 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. Cut, drill, and tap units to receive hardware, hangers, and similar items:
 - 1) Fabricate units from slotted channel framing where indicated.
 - 2) Furnish inserts for units installed after concrete is placed.
- C. Shelf Angles:
1. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19 mm) bolts, spaced not more than six inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated:
 - a. Provide mitered and welded units at corners.
 - b. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately two inches (50 mm) larger than expansion or control joint.
 - c. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
 - d. Galvanize and prime shelf angles located in exterior walls.
 - e. Prime shelf angles located in exterior walls with zinc rich primer.
 - f. Furnish wedge type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.3 MISCELLANEOUS STEEL TRIM

- A. Miscellaneous Steel Trim:
 - 1. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible:
 - a. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work:
 - 1) Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction, spaced not more than six inches (150 mm) from each end, six inches (150 mm) from corners, and 24 inches (600 mm) o.c.
 - b. Cast in pit angles and edge angles: Provide edge angles, and pit angles, fabricated from angles of size as shown, or required, with welded on stud anchors spaced 24 inches (600 mm) on center. Provide pit and edge angles in as long lengths as possible. Miter and weld corners and provide splice plates for alignment between sections.
 - c. Galvanize miscellaneous steel trim.

2.4 METAL DOWNSPOUTS

- A. Downspouts:
 - 1. Provide downspouts made from schedule 40 steel pipe in heights indicated on drawings.
 - a. Outlet: Vertical, to discharge into splash block.
 - b. Galvanize and paint downspouts
 - c. Install splash pad or block under discharge port of downspouts. Install splash pan over a protection (walkway) pad for downspouts located at roof level.

2.5 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch (3mm) maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch (1.5mm).
- C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5mm).
- D. Maximum Bow: 1/8 inch (3mm) in 48 inches (1.2m).
- E. Maximum Deviation From Plane: 1/16 inch (1.5mm) in 48 inches (1.2m).

2.6 FINISHES

- 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.

2.7 STEEL AND IRON FINISHES

- A. Galvanizing:
 - 1. 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:
 - a. Do not quench or apply post galvanizing treatments that might interfere with paint

adhesion.

- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
- D. Preparation for Shop Priming:
 - 1. Prepare surfaces to comply with requirements indicated below:
 - a. Exterior items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Items indicated to receive zinc-rich primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - c. Other items: SSPC-SP 3, "Power Tool Cleaning."
- E. Shop Priming:
 - 1. Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting:
 - a. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

- A. Field Measurements:
 - 1. Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication:
 - a. Established dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - b. Provide allowance for trimming and fitting at site.

3.2 COORDINATION

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

3.3 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:
 - 1. Comply with the following requirements:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection:
 - 1. Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - a. Cast aluminum: Heavy coat of bituminous paint.
 - b. Extruded aluminum: Two (2) coats of clear lacquer.

3.4 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. Install framing and supports to comply with requirements of items being supported, including manufacturer's written instructions and requirements indicated on shop drawings.
- B. Anchor supports for overhead doors securely to, and rigidly brace from, building structure.

3.5 ERECTION TOLERANCES

- A. Maximum Variation from Plumb: 1/4 inch (6mm) per story, noncumulative.
- B. Maximum Offset from True Alignment: 1/4 inch (6mm).
- C. Maximum Out of Position: 1/4 inch (6mm).

3.6 ADJUSTING AND CLEANING

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop painted surfaces:
 - a. Apply by brush or spray to provide a minimum 2.0 mil (0.05 mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00: Painting and Coating.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Shear wall panels.
4. Wood blocking, **cants**, and nailers.
5. Wood sleepers.
6. Plywood backing panels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
- B. Sustainable Design Submittals:

1.3 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
 1. Wood-preservative-treated wood.
 2. Fire-retardant-treated wood.
 3. Shear panels.
 4. Power-driven fasteners.
 5. Post-installed anchors.
 6. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC

Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber indicated to receive a stained or natural finish, **mark grade stamp on end or back of each piece**
 3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: **15 percent for 2-inch nominal (38-mm actual) thickness or less; 19 percent for more than 2-inch nominal (38-mm actual) thickness** unless otherwise indicated.
- C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 **for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.**
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. **Do not use inorganic boron (SBX) for sill plates.**
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat **items indicated on Drawings, and the following:**
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. Wood sills, sleepers, blocking, and similar concealed members in contact with concrete.
 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 4. Wood framing members that are less than **18 inches (460 mm)** above the ground in crawlspaces or unexcavated areas.
 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than **10.5 feet (3.2 m)** beyond the centerline of the burners at any time during the test.
 - 1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
 - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat **items indicated on Drawings, and the following:**
 - 1. Concealed blocking.
 - 2. Framing for non-load-bearing partitions.
 - 3. Roof construction.
 - 4. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions: **Construction or No. 2** grade.
 - 1. Application: **Interior partitions not indicated as load bearing.**
 - 2. Species:
 - a. Western woods; WCLIB or WWPA.
- B. Framing Other Than Non-Load-Bearing Partitions: **No. 1** grade.
 - 1. Application: Framing other than **interior partitions.**
 - 2. Species:
 - a. Douglas fir-larch; WCLIB or WWPA.
- C. Exposed Framing: Hand-select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. Species and Grade: As indicated above for load-bearing construction of same type.

2.5 SHEAR WALL PANELS

- A. Wood-Framed Shear Wall Panels: Prefabricated assembly consisting of wood perimeter framing, tie downs, and Exposure I, Structural I plywood or OSB sheathing.
- B. Allowable design loads, as published by manufacturer, shall meet or exceed those **indicated** Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.6 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 1. Blocking.
 2. Nailers.
 3. Rooftop equipment bases and support curbs.Cants.
 4. .

Dimension Lumber Items: **Construction or No. 1** grade lumber of any species.

- B. Concealed Boards: **19** percent maximum moisture content and the following species and grades:
 1. Western woods; **Construction or No. 2 Common** grade; WCLIB or WWPA.

2.7 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, **Exterior, A-C fire-retardant treated**, in thickness indicated or, if not indicated, not less than **3/4-inch (19-mm)** nominal thickness.

2.8 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners **with hot-dip zinc coating complying with ASTM A153/A153M or of Type 304 stainless steel.**
- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, as appropriate for the substrate.

2.9 METAL FRAMING ANCHORS

- A. Allowable design loads, as published by manufacturer, shall meet or exceed those **of basis-of-design products**. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, **G60 (Z180)** coating designation.
 - 1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); **G185 (Z550)** coating designation; and not less than **0.036 inch (0.9 mm)** thick.
 - 1. Use for wood-preserved-treated lumber and where indicated.

2.10 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; **1-inch (25-mm)** nominal thickness, compressible to **1/32 inch (0.8 mm)**; selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Sill-Sealer Gaskets: Closed-cell neoprene foam, **1/4 inch (6.4 mm)** thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, **butyl rubber or rubberized-asphalt** compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than **0.025 inch (0.6 mm)**.
- D. Adhesives for Gluing to Concrete: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- D. Install shear wall panels to comply with manufacturer's written instructions.
- E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.

3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes **wet enough that moisture content exceeds that specified**, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preserved-treated plywood.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

- A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: **Treat items indicated on Drawings and plywood in contact with concrete or used with roofing, flashing, vapor barriers, and waterproofing.**
- D. Kiln-dry material after treatment to a maximum moisture content of 15 percent.
- E. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

- F. Application: Treat **plywood indicated on Drawings**.

2.3 WALL SHEATHING

- A. Plywood Sheathing: **Exterior, Structural I** sheathing.
- B. Oriented-Strand-Board Sheathing: DOC PS 2, **Exposure 1, Structural I** sheathing.
- C. Cellulose Fiber-Reinforced Gypsum Sheathing: ASTM C1278/C1278M, gypsum sheathing.
1. Product: Subject to compliance with requirements, provide "Fiberock Sheathing with Aqua-Tough" by United States Gypsum Co.
 2. Type and Thickness: **Type X, 5/8 inch (15.9 mm)** thick.
- D. Cementitious Backer Units: ASTM C1325, Type A.
1. Thickness: **As indicated**.
- E. Extruded-Polystyrene-Foam Sheathing: ASTM C578, Type IV, in manufacturer's standard lengths and widths with tongue-and-groove or shiplap long edges as standard with manufacturer.
1. Thickness: **As indicated**.
 2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. For **wall** sheathing, provide fasteners **with hot-dip zinc coating complying with ASTM A153/A153M] or of Type 304 stainless steel**.
 2. **wall** sheathing, provide fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.

2.5 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for **Glass-Mat** Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."
- B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
1. Sheathing Tape: Self-adhering glass-fiber tape, minimum **2 inches (50 mm)** wide, **10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m)**, of type recommended

by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. ICC-ES evaluation report for fastener.
- D. Coordinate **wall** sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Wall Sheathing:
 - a. **Nail** to wood framing
 - b. Space panels **1/8 inch (3 mm)** apart at edges and ends.

3.3 CEMENTITIOUS BACKER UNIT INSTALLATION

- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

END OF SECTION 061600

SECTION 07 13 26 SELF-ADHERING SHEET WATERPROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirement including but not limited to:
 - 1. Modified bituminous sheet waterproofing.
 - 2. Modified bituminous sheet waterproofing, fabric reinforced.
 - 3. Accessories necessary for a complete installation.

1.3 SUBMITTALS

- A. Product Data:
 - 1. For each type of product:
 - a. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - b. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings:
 - 1. Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions:
 - a. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.
- C. Samples:
 - 1. For each exposed product and for each color and texture specified, including the following products:
 - a. 8-by-8-inch (200-by-200-mm) square of waterproofing and flashing sheet.
- D. Qualification Data: For Installer.
- E. Field quality-control reports.
- F. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity having minimum 5 years documented experience and employs installers and supervisors who are trained and approved by waterproofing manufacturer.
- B. Source Limitations for Waterproofing System: Obtain waterproofing materials from single source from single manufacturer.
- C. Pre-installation Conference:
 - 1. Conduct conference at site.

2. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.5 WARRANTY

- A. Written warranty signed by manufacturer in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period:
 1. Warranty Period: Five years from date of Substantial Completion.
- B. Written warranty signed by Installer in which Installer agrees to warrant its work:
 1. Warranty Period: Two years from the date of Substantial Completion.
 2. Warranty includes removing and reinstalling protection board, drainage panels, insulation, and pedestals.

PART 2 PRODUCTS

2.1 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet:
 1. Minimum 60-mil (1.5-mm) nominal thickness, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated on one side to a 4-mil (0.10-mm) thick, polyethylene-film reinforcement, and with release liner on adhesive side.
 - a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) W. R. Meadows, Inc. MEL-ROL/PRECON – Basis of Design.
 - 2) Carlisle Coatings & Waterproofing Inc.
 - 3) Henry Company.
 - 4) Protecto Wrap Company.
 - 5) Approved equal.
 - b. Physical Properties:
 - 1) Tensile Strength, ASTM D412 Die C.
 - a) Plymeric Membrane: 460 psi (3.23 MPa) minimum.
 - b) Carrier Film: 5900 psi (1.7 MPa) minimum.
 - 2) Ultimate Elongation: 971.3 percent minimum; ASTM D412, Die C, modified.
 - 3) Low Temperature Flexibility: Pass at minus 20 degrees F (minus 29 degrees C); ASTM D1970.
 - 4) Crack Cycling: Unaffected after 100 cycles of 1/8 inch (3-mm) movement; ASTM C836.
 - 5) Puncture Resistance: 48.24 lbf (180 N) minimum; ASTM E154.
 - 6) Water Absorption: 0.1 percent, 72 hours maximum; ASTM D570.
 - 7) Water Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m) maximum; ASTM E96/E96M, Water Method.
 - c. Sheet Strips: Self adhering, rubberized asphalt strips of same material and thickness as sheet waterproofing.
- B. Modified Bituminous Sheet, Fabric Reinforced:
 1. Minimum 60 mil (1.5 mm) nominal thickness, self- adhering sheet consisting of rubberized asphalt membrane with embedded fabric reinforcement, and with release liner on adhesive side:
 - a. Manufacturers are subject to compliance with requirements. Provide products by the following:
 - 1) Protecto Wrap Company.

- 2) Approved equal.
- b. Physical Properties:
 - 1) Pliability: No cracks when bent 180 degrees over a 1-inch (25-mm) mandrel at minus 25 degrees F (minus 32 degrees C); ASTM D146.
 - 2) Puncture Resistance: 100 lbf (445 N) minimum; ASTM E154.
 - 3) Water Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m) maximum; ASTM E96/E96M, Water Method.
- c. Sheet Strips: Self adhering, reinforced, rubberized asphalt strips of same material and thickness as sheet waterproofing.

2.2 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
- B. Primer: Liquid primer recommended for substrate by sheet waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet waterproofing material manufacturer.
- D. Liquid Membrane: Elastomeric, two component liquid, cold fluid applied, of trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low viscosity, two component, modified asphalt coating.
- F. Metal Termination Bars: Aluminum bars, approximately 1 inch by 1/8 inch (25 mm by 3 mm) thick, predrilled at 9 inch (229 mm) centers.
- G. Protection Course:
 1. ASTM D6506, semirigid sheets of fiberglass or mineral reinforced asphaltic core, pressure laminated between two asphalt saturated fibrous liners and as follows:
 - a. Thickness: 1/8 inch (3 mm), nominal, for vertical applications; 1/4 inch (6 mm), nominal, elsewhere.
 - b. Adhesive: Rubber based solvent type recommended by waterproofing manufacturer for protection course type.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

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

3.2 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements and conditions affecting performance of the waterproofing:
 1. Verify concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.

2. Verify substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D4263.

- B. Proceed with installation after correcting unsatisfactory conditions.

3.3 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form release agents, paints, curing compounds, and other penetrating contaminants or film forming coatings from concrete.
- D. Remove fins, ridges, mortar, and projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D4258.
- F. Bridge and cover isolation joints, expansion joints with overlapping sheet strips of widths according to manufacturer's written instructions:
 1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- G. Corners: Prepare, prime, and treat inside and outside corners.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

3.4 MODIFIED BITUMINOUS SHEET WATERPROOFING APPLICATION

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2 inch (64 mm) minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
- D. Two Ply Application: Install sheets to form a membrane with lap widths not less than 50 percent of sheet widths, to provide a minimum of two thicknesses of sheet membrane over areas to receive waterproofing.
- E. Apply continuous sheets over already installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- F. Seal edges of sheet waterproofing terminations with mastic.

- G. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing.
- H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.
- I. Immediately install protection course with butted joints over waterproofing membrane:
 - 1. Molded sheet drainage panels may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

3.5 FIELD QUALITY CONTROL

- A. Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish daily reports to Architect.
- B. Engage an independent testing agency to observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.
- C. Prepare test and inspection reports.

3.6 PROTECTION, REPAIR, AND CLEANING

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

END OF SECTION 07 13 26

SECTION 07 19 00 WATER REPELLENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Penetrating water repellent treatment for masonry and concrete surfaces.
 - 2. Film forming water repellent treatments for masonry and concrete surfaces.
 - 3. Accessories necessary for a complete installation.

1.3 SUBMITTALS

- A. Product Data: Technical data including performance data, DFT per coat, spreading rate, number of coats for each type of substrate, application procedures, and available colors.

1.4 PERFORMANCE REQUIREMENTS

- A. Performance: Water repellents shall meet the following performance requirements as determined by testing on standard substrates representing those indicated.
- B. Water Absorption:
 - 1. Minimum 90 percent reduction of water absorption after 24 hours for treated compared to untreated specimens when tested according to the following:
 - a. Concrete masonry units: ASTM C140.
- C. Water-Vapor Transmission:
 - 1. Comply with one or both of the following:
 - a. Maximum ten percent (10%) reduction water-vapor transmission of treated compared to untreated specimens, according to ASTM E96/E96M.
 - b. Minimum 80 percent water-vapor transmission of treated compared to untreated specimens, according to ASTM D1653.
- D. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate of treated compared to untreated specimens, according to ASTM E514/E514M.
- E. Durability: Maximum five percent (5%) loss of water repellent performance after 2,500 hours of weathering according to ASTM G154 compared to water repellent-treated specimens before weathering.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.
- B. Pre-Installation Conference: Conduct conference at site.

1.6 WARRANTY

- A. Written warranty signed by manufacturer in which manufacturer and applicator agree to

repair or replace materials that fail to maintain water repellency within specified warranty period:

1. Warranty period: Two (2) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PENETRATING WATER REPELLENTS

- A. Silane, penetrating water repellent:
 1. Clear, containing 20 percent or more solids of alkyltrialkoxysilanes; with alcohol, mineral spirits, water, or other proprietary solvent carrier; and with 400 g/L or less of VOCs:
 - a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) W.R. Meadows; (800) 342-5976.
 - 2) BASF Corporation; Construction Systems; (800) 526-1072.
 - 3) PROSOCO, Inc.; (800) 255-4255.
 - 4) Tnemec, Inc.; (816) 483-3400.
 - 5) Vexcon Chemicals Inc.; (888) 839-2661.
 - 6) Approved equal.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Limitations:
 1. Proceed with application when existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:
 - a. Concrete surfaces and mortar have cured for not less than 28 days.
 - b. Building has been closed in for not less than 30 days before treating wall assemblies.
 - c. Ambient temperature is above 40 degrees F (4.4 degrees C) and below 100 degrees F (37.8 degrees C) and will remain so for 24 hours.
 - d. Substrate is not frozen and substrate surface temperature is above 40 degrees F (4.4 degrees C) and below 100 degrees F (37.8 degrees C).
 - e. Rain or snow is not predicted within 24 hours.
 - f. Not less than 24 hours have passed since surfaces were last wet.
 - g. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

3.2 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements and conditions affecting performance of the Work:
 - a. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in minimum of three (3) representative locations by method recommended by manufacturer.
 - b. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
 - c. Verify that required repairs are complete, cured, and dry before applying water repellent.
- B. Test pH level according to water-repellent manufacturer's written instructions to ensure

chemical bond to silica containing or siliceous minerals.

- C. Proceed with installation after correcting unsatisfactory conditions.

3.3 PREPARATION

- A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, according to repellent manufacturer's written instructions.
- B. Cleaning:
 - 1. Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water repellent manufacturer's written instructions:
 - a. Concrete unit masonry: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents according to ASTM E1857.
- C. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.
- D. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.
- E. Coordination with Sealant Joints:
 - 1. Do not apply water repellent until sealants for joints adjacent to surfaces receiving water repellent treatment have been installed and cured:
 - a. Water repellent work may precede sealant application if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.4 APPLICATION

- A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect the substrate before application of water repellent and to instruct applicator on the product and application method to be used.
- B. Apply coating of water repellent on surfaces to be treated using 15 psi (103 kPa) pressure spray with a fan type spray nozzle, roller, or brush to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated:
- C. Apply second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.5 FIELD QUALITY CONTROL

- A. Testing of Water Repellent Material:
 - 1. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:
 - a. Owner will engage the services of a qualified testing agency to sample water

repellent material being used. Samples of material delivered to site will be taken, identified, sealed, and certified in presence of Contractor.

- b. Testing agency will perform tests for compliance of water-repellent material with product requirements.
- c. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor shall remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect.

B. Coverage Test:

1. In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application:
 - a. Notify Architect seven (7) days in advance of the dates and times when surfaces will be tested.
 - b. Reapply water repellent until coverage test indicates complete coverage.

3.6 CLEANING

- A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.
- B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 07 19 00

SECTION 07 21 00 THERMAL INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 1. Polyisocyanurate foam plastic board.
 2. Glass fiber blanket.
 3. Acoustical Insulation.
 4. Accessories necessary for a complete installation.
- B. Related Sections:
 1. Section 06 10 00 Rough Carpentry.
 2. Section 09 21 16: Gypsum Board Assemblies.

1.3 SUBMITTALS

- A. Product Data: Technical data and installation instructions for each type of insulation product specified.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 1. Fire Performance Characteristics - Identify products with appropriate markings of applicable testing and inspecting organization:
 - a. Surface Burning Characteristic: ASTM E84.
 - b. Flame Spread Index: Maximum 25.
 - c. Smoke Developed Index: Maximum 450.
 - d. Fire Resistance Ratings: ASTM E119.
 - e. Combustion Characteristics: ASTM E136.
 2. Underwriter's Laboratories (UL) 723 Tests for Surface Burning Characteristics of Building Materials.
 3. SCAQMD – South Coast Air Quality Management District Regulations Rule 1168 Adhesive and Sealant Applications.
- B. Single Source Responsibility for Insulation Products: Obtain each type of building insulation from single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of work.
- C. Environmental Requirements:
 1. Manufacture extruded polystyrene with HCFC or other CFC free blowing agents. Mark insulation boards and packages with manufacturer's name and product designation. Unmarked boards and packages will be rejected:
 - a. Wherever possible, provide boards from manufacturers who recycle insulation materials.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam plastic board insulation:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 PRODUCTS

2.1 POLYISOCYANURATE FOAM PLASTIC BOARD

- A. Polyisocyanurate Board, Foil Faced - ASTM C1289, foil faced, Type I, Class 1 or 2:
 - 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Atlas Roofing Corporation.
 - b. Hunter Panels.
 - c. DuPont.
 - d. Firestone Building Products.
 - e. Rmax, Inc.
 - f. Approved equal.
 - 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 GLASS FIBER BLANKET

- A. Glass Fiber Blanket, Unfaced - ASTM C665, Type I; with maximum flame spread and smoke developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics:
 - 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Johns Manville (Basis of Design).
 - b. CertainTeed Corporation.
 - c. Guardian Building Products, Inc.
 - d. Owens Corning.
 - e. Approved equal.
- B. Glass Fiber Blanket, Polypropylene Scrim Kraft Faced - ASTM C665, Type II (non-reflective faced), Class A (faced surface with a flame spread index of 25 or less); Category 1 (membrane is a vapor barrier):
 - 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Johns Manville (Basis of Design).
 - b. CertainTeed Corporation.
 - c. Owens Corning.
 - d. Approved equal.

2.3 ACOUSTICAL INSULATION

- A. Glass Fiber Noise Reducer Blanket, Kraft-faced - ASTM C665, Type II; with maximum flame

spread and smoke developed indexes of 25 and 50, respectively, per ASTM E84; combustion characteristics. To be installed on interior wood stud framing:

1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. CertainTeed Corporation (Basis of Design).
 - b. Guardian Building Products, Inc.
 - c. Johns Manville; a Berkshire Hathaway company.
 - d. Owens Corning.
 - e. Approved equal.

2.4 INSULATION FASTENERS

- A. Adhesively Attached, Spindle Type Anchors:
 1. Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place:
 - a. Plate: Perforated, galvanized carbon steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
 - b. Spindle: Copper coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.
- B. Adhesively Attached, Angle Shaped, and Spindle Type Anchors:
 1. Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place:
 - a. Angle: Formed from 0.030 inch (0.762 mm) thick, perforated, galvanized carbon steel sheet with each leg 2 inches (50 mm) square.
 - b. Spindle: Copper coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.
- C. Insulation Retaining Washers:
 1. Self-locking washers formed from 0.016 inch (0.41 mm) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter:
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - 1) Crawl spaces.
 - 2) Ceiling plenums.
 - 3) Attic spaces.
- D. Insulation Standoff: Spacer fabricated from galvanized mild steel sheet for fitting over spindle of insulation anchor to maintain air space of 2 inches (50 mm) between face of insulation and substrate to which anchor is attached.
- E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.
- F. All other materials such as wire supports, fasteners and retainers not specifically described but required to complete the work shall be as recommended by approved manufacturer, provided and installed by the Contractor.

2.5 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 1. Glass Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame spread and smoke developed indexes of 5, per ASTM E84.
 2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum

flame spread and smoke developed indexes of 75 and 450, respectively, per ASTM E84, and shall conform to all SCAQMD and EPA air quality regulations.

- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
- C. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.
- B. Sequence work to ensure fireproofing and firestop materials are in place before beginning work.

3.2 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.
- B. Foam in Place Insulation:
 - 1. Verify that substrates are clean, dry, and free of substances that are harmful to insulation:
 - a. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Framed Construction - Blanket Insulation:
 - 1. Install in cavities formed by framing members according to the following requirements:
 - a. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - b. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - c. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - d. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - e. For metal framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - f. For wood framed construction, install blankets according to ASTM C1320 and as

follows:

- 1) With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
- g. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1) Glass Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
 - 2) Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.
- C. Reflective Insulation:
 1. Install sheet reflective insulation according to ASTM C727:
 - a. Install sheet radiant barriers according to ASTM C1744.
 - b. Install interior radiation control coating system according to ASTM C1321.
- D. Continuous Insulation for Exterior Walls (Polyisocyanurate Board):
 1. Install continuous insulation board according to manufacturer's written instructions:
 - a. Fastener components shall include a minimum 2 inch diameter plastic plate/washer and self-taping screws attached directly to stud framing.
 - b. All joints, penetrations, and flashings shall be taped and/or otherwise sealed with manufacture's recommended products.

3.4 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 22 00 ROOF AND DECK INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes roof insulation over the properly prepared deck substrate.
- B. Related Sections:
 - 1. Section 07 54 19 - PVC Thermoplastic Membrane Roofing
 - 2. Section 07 62 00: Roof Related Sheet Metal.
- C. Reference Standards:
 - 1. American Society for Testing and materials (ASTM):
 - a. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.
 - b. ASTM B29 Standard Specification for Refined Lead.
 - c. ASTM B32 Standard Specification for Solder Metal.
 - d. ASTM C165 Standard Test Method for Measuring Compressive Properties of Thermal Insulation.
 - e. ASTM C208 Standard Specification for Cellulosic Fiber Insulation Board.
 - f. ASTM C209 Standard Test Method for Cellulosic Fiber Insulating Board.
 - g. ASTM C272 Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
 - h. ASTM C1396 Standard Specification for Gypsum Wallboard.
 - i. ASTM C518 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - j. ASTM C578 Standard Specification for Perlite Thermal Insulation Board.
 - k. ASTM C728 Standard Test Methods for Fire Test of Roof Coverings.
 - l. ASTM C1289 Standard Specification for Faced Rigid Polyisocyanurate Thermal Insulation.
 - m. ASTM D5 Standard Test Method for Penetration of Bituminous Materials.
 - n. ASTM D36 Standard Test Method for Softening Point of Bitumen (Ring and Ball Apparatus).
 - o. ASTM D312 Standard Specification for Asphalt Used in Roofing.
 - p. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
 - q. ASTM D1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
 - r. ASTM D1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics.
 - s. ASTM D1863 Standard Specification for Mineral Aggregate Used on Built-Up Roofs.
 - t. ASTM D2126 Standard Test Method for Response of Rigid Cellular Plastics to Thermal Humid Aging.
 - u. ASTM D2178 Standard Specification for Asphalt Glass Felts used in Roofing and Waterproofing.
 - v. ASTM D4601 Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.

- w. ASTM D5147 Standard Sampling and Testing Modified Bituminous Sheet Material.
2. Cast Iron Soil Pipe Institute, Washington, D.C. (CISPI).
3. Factory Mutual Research (FM):
 - a. Roof Assembly Classifications.
4. National Roofing Contractors Association (NRCA):
 - a. Roofing and Waterproofing Manual.
5. Underwriters Laboratories, Inc. (UL):
 - a. Fire Hazard Classifications.
6. Warnock Hersey (WH):
 - a. Fire Hazard Classifications.
7. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
8. Steel Deck Institute, St. Louis, Missouri (SDI).
9. Southern Pine Inspection Bureau, Pensacola, Florida (SPIB).
10. Insulation Board, Polyisocyanurate (FS HH-I-1972).
11. Insulation Board, Thermal (Fiberboard) (FS LLL-1-535B).

1.3 SUBMITTALS

- A. Product Data: Provide manufacturer's specification data sheets for each product in accordance with Section 01 33 00: Submittal Procedures.
- B. Provide approval letters from insulation manufacturer for use of their insulation within this particular roofing system type.
- C. Provide a sample of each insulation type.
- D. Shop Drawings:
 1. Submit manufacturer's shop drawings indicating complete installation details of tapered insulation system, including identification of each insulation block, sequence of installation, layout, drain locations, roof slopes, thicknesses, crickets and saddles.
 2. Shop drawing shall include: Outline of roof, location of drains, a complete board layout of tapered insulation components, thickness and the average "R" value for the completed insulation system.
- E. Certification:
 1. Submit roof manufacturer's certification that insulation fasteners furnished are acceptable to roof manufacturer.
 2. Submit roof manufacturer's certification that insulation furnished is acceptable to roofing manufacturer as a component of roofing system and is eligible for roof manufacturer's system warranty.

1.4 QUALITY ASSURANCE

- A. Fire Classification, ASTM E108.
- B. Manufacturer's Certificate: Certify that roof system furnished is approved by Factory Mutual, Underwriters Laboratories, Warnock Hersey or approved third party testing facility in accordance with ASTM E108, Class A for external fire and meets local or nationally recognized building codes.
- C. Manufacturer's Certificate: Certify that the roof system is adhered properly to meet or exceed the requirements of FM 1-90.
- D. Pre-installation meeting: Refer to Division 07 roofing specifications for pre-installation meeting requirements.

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- E. Insulating materials shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450 per CBC section 720

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site with seals and labels intact, in manufacturer's original containers, dry and undamaged.
- B. Store all insulation materials in a manner to protect them from the wind, sun and moisture damage prior to and during installation. Any insulation that has been exposed to any moisture shall be removed from the project site.
- C. Keep materials enclosed in a watertight, ventilated enclosure (i.e. tarpaulins).
- D. Store materials off the ground. Any warped, broken or wet insulation boards shall be removed from the site.

PART 2 PRODUCTS

2.1 PRODUCTS, GENERAL

- A. Refer to Division 01 Section "Common Product Requirements."
- B. Basis of Design: Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.
- C. Substitutions:
 - 1. Products proposed as equal to the products specified in this Section shall be submitted in accordance with Bidding Requirements and Division 01 provisions:
 - a. Proposals shall be accompanied by a copy of the manufacturer's standard specification section. That specification section shall be signed and sealed by a professional engineer licensed in the state in which the installation is to take place. Substitution requests containing specifications without licensed engineer certification shall be rejected for non-conformance.
 - b. Include a list of three (3) projects of similar type and extent, located within a one-hundred-mile radius from the location of the project. In addition, the three projects must be at least five (5) years old and be available for inspection by the Architect, Owner or Owner's Representative.
 - c. Equivalency of performance criteria, warranty terms, submittal procedures, and contractual terms will constitute the basis of acceptance.
 - d. The Owner's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

2.2 INSULATION MATERIALS

- A. Thermal Insulation Properties and Approved Insulation Boards:
 - 1. Rigid Polyisocyanurate Roof Insulation; ASTM C1289:
 - a. Qualities: Rigid, closed cell polyisocyanurate foam core bonded to heavy duty glass fiber mat facers.
 - b. Thickness: Minimum: 5.2".
 - c. R-Value: Minimum: 30.
 - d. Compliances: UL, WH or FM listed under Roofing Systems.
 - e. Federal Specification HH-I-1972, Class 1.
 - f. Acceptable Products:
 - 1) ENRGY-3; Johns Manville.
 - 2) H-Shield; Hunter.

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- 3) EnergyGuard; GAF.
- 4) Approved Equivalent.
2. Tapered Polyisocyanurate Roof Insulation; ASTM C1289:
 - a. Qualities: Factory Tapered, closed cell polyisocyanurate foam core bonded to heavy duty glass fiber mat facers.
 - b. Thickness: Minimum: as needed for taper crickets for proper slope to drains, tapered design required as part of submittal process.
 - c. Average R-Value: Minimum varies
 - d. Tapered Slope: 1"
 - e. Compliances: UL, WH or FM listed under Roofing Systems Federal Specification HH-I-1972, Class 1
 - f. Acceptable Products:
 - 1) ENRGY 3; Johns Manville.
 - 2) EnergyGuard; GAF.
 - 3) H-Shield; Hunter.
 - 4) Approved Equivalent.
3. High Density Fiberboard Roof insulation; ASTM C208.
 - a. Qualities: Rigid, composed of interlocking fibers factory blended treated with asphalt on the top side.
 - b. Board Size: Four feet by eight feet (4' x 8').
 - c. Thickness: Minimum one-half inch (1/2").
 - d. Compliances: UL, WH, FM listed under Roofing Systems. Federal Specification LLL-I-535-B.
 - e. Acceptable Manufacturers:
 - 1) Blue Ridge; Celotex.
 - 2) Temple Inland.
 - 3) Georgia-Pacific.
 - 4) Approved Equivalent.
4. Dens-Deck Prime Roof Board:
 - a. Qualities: Nonstructural glass mat faced, noncombustible, water-resistant treated gypsum core panel.
 - b. Board Size: 4'x8'.
 - c. Thickness: 1/2".
 - d. R-Value: .56.
 - e. Compliances: UL, WH or FM listed under Roofing Systems.

2.3 RELATED MATERIALS

- A. Fiber Cant and Tapered Edge Strips:
 1. Performed rigid insulation units of sizes/shapes indicated, matching insulation board or of perlite or organic fiberboard, as per the approved manufacturer:
 - a. Acceptable Manufacturers:
 - 1) The Garland Company, Inc.
 - 2) Celotex.
 - 3) Johns Manville.
 - 4) GAF.
 - 5) Approved Equivalent.
- B. Protection Board: Pre-molded semi-rigid asphalt composition board one half (1/2) inch.
- C. Roof Board Joint Tape: Six (6) inches wide glass fiber mat with adhesive compatible with insulation board facers.
- D. Asphalt: ASTM D312, Type III Steep Asphalt.
- E. Roof Deck Insulation Adhesive:

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1. Insul-Lock E HR - Dual-component, high rise foam adhesive with 45% rapidly renewable material content as recommended by insulation manufacturer and approved by FM indicated ratings:
 - a. Tensile Strength (ASTM D412).....250 psi.
 - b. Density (ASTM D1875).....8.5 lbs./gal.
 - c. Viscosity (ASTM D2556).....22,000 to 60,000 cP.
 - d. 2` Peel Strength (ASTM D903).....17 lb/in.
 - e. 3` Flexibility (ASTM D816).....Pass @ -70°F.

- F. Fasteners:
 1. Corrosion resistant screw fastener as recommended by roof membrane manufacturer:
 - a. Factory Mutual Tested and Approved with three (3) inches coated disc for I-90 rating, length required to penetrate metal deck one inch.

PART 3 EXECUTION

3.1 EXECUTION, GENERAL

- A. Comply with requirements of Division 01 Section "Common Execution Requirements."

3.2 INSPECTOR OF SURFACES

- A. Roofing contractor shall be responsible for preparing an adequate substrate to receive insulation:
 1. Verify that work which penetrates roof deck has been completed.
 2. Verify that wood nailers are properly and securely installed.
 3. Examine surfaces for defects, rough spots, ridges, depressions, foreign material, moisture, and unevenness.
 4. Do not proceed until defects are corrected.
 5. Do not apply insulation until substrate is sufficiently dry.
 6. Broom clean substrate immediately prior to application.
 7. Use additional insulation to fill depressions and low spots that would otherwise cause ponding water.
 8. Verify that temporary roof has been completed.

3.3 INSTALLATION

- A. Base Layer(s) - Attachment with Mechanical Fasteners:
 1. Approved insulation board shall be fully attached to the deck with an approved mechanical fastening system. As a minimum, the amount of fasteners shall be in accordance with manufacturer's recommendation for FM I-90 system. Otherwise, a minimum of one fastener per two square feet shall be installed.
 2. Filler pieces of insulation require at least two fasteners per piece if size of insulation is less than four square feet.
 3. Spacing pattern of fasteners shall be as per manufacturer's recommendations to meet the FM requirements. Placement of any fastener from edge of insulation board shall be a minimum of three inches, and a maximum of six (6) inches.
 4. Minimum penetration into deck shall be as recommended by the fastener manufacturer. There is a one (1) inch minimum for metal, wood and structural concrete decks where not specified by the manufacturer. For gypsum and cement-wood fiber decks, penetration shall be determined from pull-out test results with a minimum penetration of one and one-half (1½) inches.
 5. Gypsum and cementitious wood fiber decks: Where the roof deck is visible from the building interior, the contractor shall ensure no penetration of fasteners through underside of the deck. Any holes or spalling caused by fastener installation shall be

repaired by the roofing contractor. Where the new roof system thickness exceeds an amount so that a minimum of 1 ½ of penetration cannot be achieved with an Olympic TB Fastener, or approved equivalent, then (and only then) toggle bolts may be used to secure installation to the deck.

6. Tape joints of insulation as per manufacturer's requirements.
- B. Top Layer - Attachment with Insulation Adhesive Approved by Factory Mutual (FM):
1. Ensure all surfaces are clean, dry, free of dirt, debris, oils, loose ore embedded gravel, unadhered coatings, deteriorated membrane and other contaminants that may inhibit adhesion.
 2. Apply insulation adhesive directly to the substrate using a ribbon pattern with one quarter to one half (1/4-1/2) inch wide beads 12 inches o.c., using either the manual applicator or an automatic applicator, at a rate of one (1) gallon per one hundred (150) square feet per cartridge.
 3. Immediately place insulation boards into wet adhesive. Do not slide boards into place. Do not allow the adhesive to skin over before installing insulation boards.
 4. Briefly step each board into place to ensure contact with the adhesive. Substrates with irregular surfaces may prevent the insulation board from making positive contact with the adhesive. Relief cuts or temporary weights may be required to ensure proper contact.
 5. All boards shall be cut and fitted where the roof deck intersects a vertical surface. The boards shall be cut to fit a minimum of one quarter (1/4) inch away from the vertical surface.
 6. Tape joints of insulation as per manufacturer's requirements.

3.4 CLEANING

- A. Remove debris and cartons from roof deck. Leave insulation clean and dry, ready to receive roofing membrane.

3.5 CONSTRUCTION WASTE MANAGEMENT

- A. Remove and properly dispose of waste products generated during installation. Comply with requirements of authorities having jurisdiction.

END OF SECTION 07 22 00

SECTION 07 54 19 PVC THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section is related to work pertaining to the roofing system, including mechanical, plumbing and electrical items penetrating the roof system and includes:
 - 1. Installation of adhered PVC Thermostatic roofing membrane with flashings and other components to comprise a roofing system.
 - 2. Flashing and caulking.
 - 3. Tapered roof insulation.
 - 4. Crickets.
 - 5. Cover board.
 - 6. Wood nailers and shims.
 - 7. Sheet metal terminations
 - 8. Walkway protection.
 - 9. Expansion Joints.
 - 10. Deck repair/replacement.
 - 11. Other work incidental to the complete and proper installation of a watertight roofing system as shown on the Drawings and specified herein, and in accordance with all applicable requirements of the Contract Documents.

- B. Related Sections:
 - 1. Section 06 10 00: Rough Carpentry.
 - 2. Section 07 21 00: Thermal Insulation.
 - 3. Section 07 62 00: Sheet Metal Flashing and Trim
 - 4. Section 07 92 00: Joint Sealants.
 - 5. Section 07 95 00: Expansion Control.

- C. Reference Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. A385: Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
 - b. D570: Water Absorption of Plastics.
 - c. D751: Method of Testing Coated Fabrics.
 - d. D4434: Poly (Vinyl Chloride) Sheet Roofing.
 - e. E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
 - f. E108 (Rev. A): Fire Tests of Roof Coatings.
 - 2. ASCE-7 Wind uplifts requirements for geographical area.
 - 3. National Roofing Contractors Association (NRCA):
 - a. Roofing and Waterproofing Manual.
 - 4. Single Ply Roofing Institute (SPRI).
 - 5. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA):
 - a. Architectural Sheet Metal Manual.
 - 6. California Building Code (CBC).
 - 7. Underwriter's Laboratories Inc. (UL):
 - a. UL RMSD - Roofing Materials and Systems Directory, Current Edition.
 - b. UL 790 - Fire Resistance of Roofing Coverings Materials, Current Edition.
 - c. Exterior Fire Exposure Classification: Class A, ASTM E108, for application and

- slopes shown.
d. UL 90 — Wind uplift requirements.

1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 PERFORMANCE REQUIREMENTS

- A. General Requirements: Provide an installed thermoplastic single ply roofing system, flashing and related work that is watertight and will not permit the passage of liquid water, able to withstand wind loads, thermally induced movement and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application, as demonstrated by roofing system Manufacturer based on testing and field experience.
- C. Roofing System Design - Comply with SPRI "Wind Design Guide for Fully Adhered Roofing Systems" for the following ground roughness exposure and system design:
1. Exposure: City, suburban areas, towns and wooded terrain.
 2. Mechanically Attached.
- D. American National Standards Institute (ANSI).
- E. American Architectural Manufacturer's Association (AAMA).
- F. Occupational Safety and Health ACT (OSHA).
- G. 2019 California Building Code (CBC).

1.5 SUBMITTALS

- A. Product Data: For each type of product. MSDS sheets. Manufacturer's printed instructions, schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, adhesive, and accessories to be used in the Work.
- B. Shop Drawings:
1. Furnish from copies of the Manufacturer's literature or from copies of NRCA "Roofing and Waterproofing Manual", fourth edition:
 - a. For roofing system, include plans, elevations, sections, details, and attachments to other work, including:
 - 1) Base flashings and membrane terminations.
 - 2) Tapered insulation, including slopes.
 - 3) Roof plan showing orientation of steel roof deck and orientation of roofing, fastening spacing, and patterns for mechanically fastened roofing.
 - 4) Insulation fastening patterns for corner, perimeter, and field-of-roof locations including roof drains and roof access panels, per ASCE-7.
 - 5) Furnish project sequencing, staging, material loading, manpower plans, and project construction schedule for approval.
- C. Samples:
1. Furnish samples of roof membrane.
 2. Furnish sample of metal edge to be installed.

- D. Research/Evaluation Reports for components of roofing system, from ICC-ES.
- E. Sample Warranties for manufacturer's special warranties.
- F. Certifications:
 - 1. Manufacturer's written certification that installer is approved and licensed to install specified roofing system (submit a copy with Proposal Form).
 - 2. Manufacturer's affidavits that materials used in Project contain no asbestos.
 - 3. Installer shall submit resume and project experience list for proposed system for Project Manager and job site superintendent.
 - 4. Installer shall submit written certification that there are no undocumented workers being employed by them or any subcontractor on this project and that covers all workers on this project by workmen's compensation.
 - 5. Installer shall submit list of all subcontractors with evidence of subcontractor's insurance coverage in compliance with contract requirements.
 - 6. Manufacturer's written certification of approval / acceptance of these specifications and details.
- G. Referenced Standards: Two (2) copies of each referenced standard and retain approved copies at site.
- H. Upon Substantial Completion of Work, submit the following to Architect for his submission to Owner:
 - 1. Manufacturer's Warranty: Manufacturer's written warranty as specified.
 - 2. Contractor's Warranty: Contractor's written warranty as specified.
 - 3. Maintenance Procedures: Three (3) copies of roof system Manufacturer's printed instructions for Owner's use regarding care and maintenance of roof. Refer to Section 01 78 23: Operation and Maintenance Data.
 - 4. Affidavits from material manufacturers, suppliers and sub-contractors for release of liens.
 - 5. Refer to sections: 01 77 00: Closeout Procedures and 01 78 39: Project Record Documents for additional requirements of close-out documents.
 - 6. Maintenance Data: For roofing system to include in maintenance manuals.
 - 7. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is ISO 9001 certified for roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
- C. Regulatory Requirements:
 - 1. Classification by Underwriters' Laboratories, Inc. as a Class A roof covering.
 - 2. Roof must meet Class A surface flame spread and smoke density measurements, per ASTM E84: Flame spread 0-25, smoke-developed 0-450.
 - 3. Roofing system shall be installed in accordance with ASCE-7 wind uplift requirements for geographical location and a 90 MPH 3-second gust wind speed zone with an importance factor of 1.15 based on CBC requirements. Wind- resistance loads listed below have a safety factor of 2.0 incorporated into the calculation.
 - 4. Follow local, state, and federal regulations of safety standards and codes. Refer to applicable building code or California Building Code for roofing system installation requirements and limitations.

- D. Installer shall be an experienced single firm specializing in the type of roofing and sheet metal work required, employing only experienced workers for the class of work in which they are employed, having at least five (5) years successful experience on projects similar in size and scope and acceptable and licensed as applicators by the material Manufacturer.
- E. Application of materials shall be in accordance with the Manufacturer's recommendations. In the instance of a conflict between these specifications and those of the Manufacturer, the most stringent shall take precedence.
- F. Pre-installation Conference:
 - 1. Pre-installation Roofing Conference is to be conducted at Project site:
 - a. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - b. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - c. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - d. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - e. Review structural loading limitations of roof deck during and after roofing.
 - f. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 - g. Review governing regulations and requirements for insurance and certificates if applicable.
 - h. Review temporary protection requirements for roofing system during and after installation.
 - i. Review roof observation and repair procedures after roofing installation.

1.7 WARRANTY

- A. Manufacturer System Warranty:
 - 1. Provide fifteen (15) year System Warranty. The System Warranty shall provide for the roof membrane, all accessories that comprise a roof system and contractor labor. The Warranty shall be Non-prorated provide for No Dollar Limit (NDL), and shall not exclude ponding water and no time limited shall be assigned for any such ponding water during the warranty period.
- B. Installer Warranty:
 - 1. Provide separate 5-year (Five) workmanship warranty. In the event any work related to roofing, flashing, or metal is found to be within the Installer warranty term defective or otherwise not in accordance with the Contract Documents, the Installer shall repair that defect to the Owner and copy be sent to the manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in Manufacturer's original unopened packaging with all tags and labels intact and legible. Carton and can labels, shall indicate appropriate warnings, storage conditions, lot numbers, and usage instructions. Handle and store materials and equipment in such a manner as to avoid damage. The proper storage of materials is the sole responsibility of the contractor. Materials damaged in shipping or storage shall not be used. Wet or damaged roofing materials shall be discarded, removed from job site, and replaced with new materials prior to application.

- B. Manufacturer's packaging and / or roll plastic is not acceptable for exterior storage. Tarpaulin with grommets shall be accepted minimum for exterior coverings. All materials stored, as above shall be minimum of four (4) inches off the substrate, and the tarpaulin tied off with rope.
- C. Moisture sensitive products shall be maintained in dry storage areas or properly covered. Roofing insulation and felts must always be covered or stored in a dry area when not being used.
- D. Products liable to degrade as a result of being frozen shall be maintained above 40° F in heated storage.
- E. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- F. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. PVC Thermoplastic Membrane Roofing is subject to compliance with requirements; provide either the named product or a comparable product by one of the other manufactures specified:
 - 1. G410 Feltback, 80mil by Sika Corp. (Basis of Design).
 - 2. Or Equal (reference Section 01 25 00 Product Substitution Procedures).

2.2 ROOF ASSEMBLY

- A. Class A roofing (assembly from bottom up):
 - 1. New roof structure:
 - a. Metal roof decking.
 - b. Rigid insulation (sloped).
 - c. Separation Board (1/4" DensDeck min).
 - d. Membrane Roofing.
- B. Single ply membrane system shall be a complete system, all components of which are provided by one manufacturer:
 - 1. G410 Feltback fiberglass reinforced membrane with an integral factory-applied lacquer coating to repel dirt and sustain reflectivity and factory applied 9 oz. geotextile felt backing:
 - a. Membrane shall conform to ASTM D4434, classification type II, Grade I.
- C. Color: EnergySmart feltback White, initial reflectivity of 0.83, initial emissivity .092, solar reflective index (SRI) of >104.
- D. Provide textured walkway material three feet wide meeting OSHA requirements and provided by the membrane manufacturer (see spec this section).
- E. General - Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing:
 - 1. Wall/Curb Flashing:
 - a. G410 Membrane; 48 mil fiberglass reinforced membrane adhered to approved

- substrate using adhesive.
- b. Clad: PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. Clad to be 25 gauge min, G90 galvanized metal sheet with a 20 mil unsupported membrane laminated on one side. The dimensions of Clad are 4 ft X 8 ft or 4 ft X 10 ft.
- 2. Perimeter Edge Flashing:
 - a. Clad: PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. Clad to be 25 gauge min, G90 galvanized metal sheet with a 20 mil unsupported membrane laminated on one side.
 - b. Non-typical Edge: Project-specific perimeter edge detail reviewed and accepted for one-time use by the Sarnafil/Sika Technical Department. Manufacturer to review prior to start of work.
- 3. Miscellaneous Flashing:
 - a. Flashing: Prefabricated expansion joint cover made from the membrane. Flash is designed for securement to wall or horizontal surfaces to span and accommodate the movement of the new and existing expansion gaps, refer to roof expansion details.
 - b. Reglet: A heavy-duty, extended aluminum flashing termination reglet used at wall and large curbs. Reglet is produced from 6063-T5, 0.10 inch – 0.12 inch thick extruded aluminum. Reglet profile as detailed and provide min 10 ft lengths. Use prefabricated Reglet mitered inside and outside corners where wall intersect.
 - c. Stack: Prefabricated vent pipe flashing made from 0.048 inch thick g410 membrane.
 - d. Circle- "G": Circular 0.048 inch thick G410 membrane patch welded over T-Joints formed by overlapping thick membranes.
 - e. Corner: Prefabricated outside and inside flashing corners made of 0.060 inch (60 mil) thick membrane that are heat-welded to membrane of Clad base flashings. Size appropriate to site conditions.
 - f. Multi-Purpose Sealant: A sealant used at flashing terminations approved by manufacturer.
 - g. StaBond Adhesive: Solvent based and provided by roofing manufacturer to attach membrane to flashing substrate.
 - h. Felt: Non-woven polyester or polypropylene mat cushion layer that is behind G410 or Flashing membrane when the flashing substrates are rough-surfaced or incompatible with the flashing membrane.
- F. Substrate cover board or Separation Board:
 - 1. Fiberglass mat gypsum roof boards to be Den Deck Prime by Georgia Pacific, complying with ASTM C1177:
 - a. ¼-inch thickness.
- G. Miscellaneous Accessories: Provide concrete splashblocks at roof leader terminated 6-inches above roof. Coordinated bird and bug screens. Roof hatch access steps and flashing. Mechanical equipment curbs and access panels.
- H. Tapered Board Insulation (ASTM C578):
 - 1. Provide one of the following:
 - a. Expanded polystyrene (EPS) Insulation board.
 - b. Rigid isocyanurate (ISO) foam insulation with black mat facers.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

- A. Weather Limitations - Proceed with installation only when existing and forecasted weather

conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements:

1. Environmental Requirements:
 - a. Apply roofing in dry weather.
 - b. Do not expose roof components and flashing in inclement weather or when it is predicted 30% or more possibility for inclement weather.
 - c. When ambient temperature is below 40 degrees Fahrenheit, expose only enough sensitive cements, sealants, and adhesives as required for use within a four-hour period.
 - d. Do not expose membrane and accessories to a constant temperature of 180 degrees Fahrenheit.

- B. Inspections/Tests:
 1. The Owner's, Architect's, and Manufacturer's representative shall at all times have access to the job site and work areas. The contractor will provide proper and safe facilities for such access and inspection:
 - a. Owner / Architect Inspections:
 - 1) Provide periodic inspections throughout the duration of the project. Representative shall inspect after completion of each major phase of construction for approval.
 - b. Manufacturer Inspections:
 - 1) An inspection shall be made by a representative of the material Manufacturer four (4) times per month during performance of Work and at all major phases of construction, to ensure that said project is installed in accordance with the Manufacturer's specifications and illustrated details. Daily written reports by the Manufacturer shall be turned over to the Architect, on each Monday following the inspection.
 - 2) The authorized material Manufacturer's field representative shall be responsible for:
 - a) Keeping the Architect informed after periodic inspections as to the progress and quality of the work observed.
 - b) Calling to the attention of the contractor those matters observed which are considered to be in violation of the contract requirements.
 - c) Reporting to the Architect, in writing, any failure or refusal of the contractor to correct unacceptable practices called to his attention.
 - d) Confirming, after completion of the work and based on his observation and test, that he has observed no application procedures in conflict with these specifications. Final payment will not be released until the Architect has received all specified warranties.
 2. Any failure by the Owner's, Architect's or Manufacturer's Representative to detect, pinpoint, or object to any defect or noncompliance of these specifications of work in progress or completed work shall not relieve the contractor, or reduce, or in any way limit, his responsibility of full performance of work required of him under these specifications.
 3. Architect may require tests and inspections as necessary to verify quality of roofing materials and workmanship. Laboratory tests will be performed in accordance with ASTM standard procedures.

- C. Existing Conditions:
 1. Examine existing building and new construction to determine existing physical conditions that affect installation of new roofing. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
 - a. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 - b. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at

- penetrations and terminations and that nailers match thicknesses of insulation.
 - c. Verify that minimum drying period recommended by roofing system manufacturer has passed.
 - d. Verify all roof surfaces are smooth and free of dirt, debris and incompatible materials.
 - e. Verify all roof surfaces shall be free of water.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.
- E. Protection:
- 1. Provide special protection and avoid traffic on completed areas of membrane installation.
 - 2. Restore to original condition or replace work or materials damaged during handling of roof materials.
 - 3. Take precautions as required to protect adjacent work and structures.
- F. Emergency Equipment: Maintain on site equipment necessary to apply emergency temporary edge seal in event of sudden storms or inclement weather.
- G. Restrictions:
- 1. Comply with General Requirements on use of site.
 - 2. Smoking is prohibited on all roof areas or in existing buildings.
 - 3. Maintain facility and all utility services in a functional condition.
 - 4. Provide sanitary facilities for employees.
- H. Examine and verify that receiving substrate surfaces of the structure have no defects or errors, which would result in poor or potentially defective application or cause latent defects in workmanship:
- 1. Examine substrate to which roofing material is to be applied to ensure that its condition is satisfactory for roofing application. Do not permit voids greater than 1/4 inch wide in the substrate. Substrates for roofing materials shall be dry and free of oil, dirt, grease, sharp edges, and debris. Inspect substrates, and correct defects before application of thermoplastic sheets.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Base Flashing: Fully adhere base flashings to the substrate in manufacturer provided bonding adhesive. Install termination bar and sealant at the top of base flashing.

- D. Install roofing and auxiliary materials to tie in to existing roofing where applicable to maintain weather-tightness of transition and to not void warranty for existing roofing system.

3.4 INSULATION INSTALLATION

- A. General:
 - 1. Manufacturer's Instructions: In regard to attachment, the Manufacturer's instructions or specifications shall determine the suitability for an application.
 - 2. Precautions: The surface of the insulation must not be ruptured or damaged prior to installation of the roof membrane. Replace damaged boards.
 - 3. Thermal insulation boards shall be laid on the substrate in parallel rows with end joints staggered and butted as close as possible. All joints shall be tight and at the roof perimeter and roof penetrations, insulation shall be cut neatly and fitted to reduce openings to a minimum. All openings 1/4 inch or larger shall be filled with insulation.
 - 4. Insulation shall be tapered or feathered at drains and scuppers to provide proper drainage (if applicable).
 - 5. No more insulation shall be installed than can be covered by the completed roof system by the end of the day or the onset of inclement weather.
 - 6. Tapered insulation and crickets, when specified, shall be placed in accordance with the drawings and / or as required NRCA standards.
- B. Install tapered insulation under area of roofing to provide positive drainage.
- C. Install insulation under area of roofing to achieve designed thickness:
 - 1. Where overall insulation thickness is 3 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
- D. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- E. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
- F. Install cover board over the insulation, staggering joints a minimum of 12" in all directions. Mechanically attach to the deck a minimum of 8 fasteners per board.

3.5 FLASHING INSTALLATION

- A. Install sheet flashings and performed flashing accessories and adhere to substrate according to roofing system Manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of flashing sheet at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with sheet flashing as recommended by Manufacturer.
- D. Clean seam areas, overlap seams, and firmly roll flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.
- E. Test lap edges with probe to verify seam weld continuity. Apply lap sealant, if required by roofing Manufacturer, and seal exposed edges of sheet flashing terminations per Manufacturer's requirements.

- F. Terminate and seal top sheet flashings and mechanically anchor to substrate through termination bars.

3.6 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate according to roofing system manufacturer's written instructions. Leave 3 inches of space between adjacent walkway.
- B. Install around mechanical units and roof top units.

3.7 FIELD QUALITY CONTROL

- A. Owner's Inspector of Record to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and furnish reports to Architect prior to install of finished roof materials. If conditions are not met, contractor to repair and request re-inspection for verification.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.
- E. Manufacturer's Quality Control Inspection: The Manufacturer's Technical Representative shall review the on-going work on a minimum of one time every 10 working days. All defects noted non-compliance with the specifications or the recommendations of the thermoplastic Manufacturer should be itemized in a punch list. These items must be corrected immediately by the contractor to the satisfaction of the owner's representative and the thermoplastic Manufacturer.

3.8 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Immediately remove all spots, smears, stains, residues, adhesives, etc., from the Work of this Section and / or upon adjacent areas or surfaces, which result from the Work of this Section.
- C. Upon completion of the Work of this Section, dispose of, away from the Site, all debris, trash, containers, residue, roofing remnants and scraps which results from the Work of this Section.
- D. Correct deficiencies in or remove roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair sheet flashings to a condition free of damage and deterioration at the time of Substantial Completion and according to warranty requirements.
- E. All warranties, as required for the project by this specification, shall be submitted for approval prior to final payment.

- F. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.9 ACCEPTANCE

- A. Prior to demobilization from the site, the Owner / Project Manager, Architect and installer shall review the work. All defects noted noncompliance with the specifications or the recommendations of the thermoplastic Manufacturer should be itemized in a punch list. These items must be corrected immediately by the contractor prior to demobilization to the satisfaction of the Owner / Project Manager and the thermoplastic Manufacturer.
- B. Notify Architect and Owner 48 hours in advance of the date and time of inspection.

END OF SECTION 07 54 19

SECTION 07 62 00 SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. It is the intent of this Section that the Work shall:
 - 1. Conform to all applicable DSA and building code requirements.
 - 2. Include all shop and field formed sheet metal work shown on drawings, specified or required, including, but not limited to:
 - a. Roof penetration sleeves, collars, hood, and umbrella counterflashing.
 - b. Metal counterflashing.
 - c. Expansion joint.
 - d. Metal perimeter edge.
 - e. Gutters, Downspouts, Splash Blocks and Splash Pans.
 - f. One-way roof moisture relief vents.
 - g. Metal gravity vents.
 - h. Metal heat exhaust vents.
 - i. Sanitary vent pipes.
 - j. Pipe box.
 - k. Copings, trim and miscellaneous sheet metal accessories.
- B. Related Sections:
 - 1. Section 05 50 00: Metal Fabrications.
 - 2. Section 07 92 00: Joint Sealants.
 - 3. Division 22 Plumbing.
 - 4. Division 23 Mechanical.
- C. Reference Standards:
 - 1. ASTM International (ASTM):
 - a. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - b. B32, Standard Specification for Solder Metal.
 - c. C1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
 - 2. National Association of Architectural Metal Manufacturers (NAAMM).
 - 3. National Roofing Contractors Association (NRCA):
 - a. Roofing and Waterproofing Manual.
 - 4. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA):
 - a. Architectural Sheet Metal Manual.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
 - 2. Manufacturer's installation instructions.
- B. Shop Drawings: Indicating sizes, configurations, details of attachment to related and

adjacent work, materials, and finishes.

- C. Samples:
 - 1. Full range of finish colors for Architect's selection.
 - 2. 12 inch long sample of each specified item with approved finish.
 - 3. Provide full size mockup of all shop built assemblies.

1.4 QUALITY ASSURANCE

- A. Single Source Responsibility: Fabricator and installer of roof-related flashing and accessories shall be the same as the membrane roof installer.
- B. Comply with governing codes and regulations of authorities having jurisdiction.
- C. Installation Conference:
 - 1. Refer to Section 01 31 00: Project Management and Coordination.

1.5 WARRANTY

- A. Manufacturer's Product Warranty:
 - 1. Manufacturer's standard 20 year Kynar 500 or Hylar 5000 Finish warranty signed by the manufacturer, with guarantee covering any failure of the fluoropolymer finish during the warranty period.
 - 2. Failure is defined to include, but not be limited to:
 - a. Deterioration of finish, such as fading, discoloring, peeling, cracking, corroding, etc.
 - 3. Correction may include repair or replacement of failed product.
- B. Roofing Contractor's Warranty:
 - 1. Contractor shall warrant the sheet metal work and related work to be free from defects in workmanship and materials, and that the metal flashings will be and remain watertight, for a period of five (5) years from date of Substantial Completion.
 - 2. Defects shall include, but not be limited to:
 - a. Leaking water or bitumen within building or construction.
 - b. Becoming loose from substrate.
 - c. Loose or missing parts.
 - d. Finish failure as defined above.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Handle and store materials and equipment in such a manner as to avoid damage.
- C. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day. Any exception must be in written form. Do not place materials or equipment in such a manner as to overload structure.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

- A. Manufacturers named within specification are approved for use on the Project providing:
 - 1. Their products meet or exceed the specifications.
 - 2. Company has a minimum of five (5) years' experience manufacturing products of the type specified.

3. Products have been tested in conjunction with roofing membrane system as an assembly and as such has obtained the same approval and rating as the roofing membrane system.
 4. Products are approved for use by the roofing membrane manufacturer.
- B. Substitutions shall be in accordance with Division 01 requirements regarding substitutions.

2.2 SHEET METAL MATERIALS

- A. General Requirements: Roofing sheet metal system shall have been tested in conjunction with roofing membrane system as an assembly and have the same approval and rating as the roofing membrane system.
- B. Prefinished Aluminum Sheet:
1. Precoated type, aluminum conforming to Fed. Spec. QQ-A-250, ASTM B209.
 2. Finish: Kynar 500, color as selected by Architect from manufacturer's standard colors.
 3. Thickness: Minimum 0.040 inch, except as otherwise indicated.
- C. Sheet Lead: Four (4) pound minimum for use at roof drains and soil stacks.
- D. Stainless Steel: Type 302/304 Soft Temper, No. 2D finish. Minimum thickness 24 gauge, except as otherwise noted.

2.3 FASTENERS

- A. Same metal as flashing/sheet metal or other non-corrosive metal or as noted below.
- B. Exposed fasteners shall be self-sealing and gasketed for weathertight installation (ZAC type).
- C. Match finish of exposed heads with material being fastened.
- D. Mechanical Fasteners:
1. Nails: Stainless Steel Ring shank, minimum 1-1/2 inches in length with 1/2 inch diameter head.
 2. Washers: Steel washers with bonded rubber sealing gasket.
 3. Screws: Self-tapping sheet metal type of stainless steel or compatible with material being fastened, with hooded integral EPDM washers (ZAC type).
 4. Rivets: Stainless steel and cadmium plated material, closed end type of sizes recommended by sheet metal manufacturer to suit application.
- E. Clips:
1. Continuous Cleat (coping/fascia): Minimum 20 gauge, G-90 galvanized, stainless steel, or aluminum. Match material of coping/fascia and provide one (1) gauge heavier.

2.4 RELATED MATERIALS

- A. Solder: ASTM B32, alloy grade 58, 50 percent tin, 50 percent lead.
- B. Flux:
1. Phosphoric acid type, manufacturer's standard:
 - a. For Use with Steel or Copper: Rosin flux.
 - b. For Use with Stainless Steel: Acid-chloride type flux, except use rosin flux over tinned surfaces.

- C. Underlayment:
 - 1. 48 mil minimum, non-reinforced, homogeneous, waterproof, impermeable elastomeric sheeting manufactured by Nervastral, Inc. or Lexsuco.
- D. Adhesives: Type recommended by flashing sheet manufacturer seaming and adhesive application of flashing sheet to ensure adhesion and watertightness.
- E. Metal Accessories: Sheet metal clips, straps, anchoring devices, clamps and similar accessories required for the complete installation of work, matching or compatible with material being installed, non-corrosive, size and gauge recommended by installer to suit application and performance.
- F. Sealant:
 - 1. Type A:
 - a. Type: One-part, non-sag, moisture-curing polyurethane sealant.
 - b. Approved Products/Manufacturers: "Chem-Calk 900" manufactured by Bostik Construction Products Division, "Vulkem 921" manufactured by Mameco International, Inc., "Dynatrol I" manufactured by Pecora Corporation, "NP 1" manufactured by Sonneborn Building Products, or approved equal.
 - 2. Type B:
 - a. Type: One-part, neutral-curing, medium-modulus silicone sealant for sealing metal to metal surfaces, i.e. metal edge, cover plates, etc.
 - b. Approved Products/Manufacturers: "Chem-Calk 1200" manufactured by Bostik Construction Products Division, "795 Silicone Building Sealant" manufactured by Dow Corning Corporation, "895 Silicone" manufactured by Pecora Corporation, "Omniseal" manufactured by Sonneborn Building Products, "Spectrem 2" manufactured by Tremco Incorporated, or approved equal.
- G. Termination Bar:
 - 1. Material: Extruded aluminum bar with flat profile.
 - 2. Size: 1/8 inch thick by one (1) inch wide with factory punched 1/4 inch x 3/8 inch oval holes spaced six (6) inches on center.
 - 3. Approved Product/Manufacturer: "TB 125" manufactured by TruFast Corp., or approved equal.
- ~~H. Pipe Hangers and Supports: Refer to Section 07-72-00: Roof Accessories.~~
- I. Splash Blocks: Concrete type, of size and profiles indicated; minimum 3,000 psi compressive strength at 28 days, with minimum five (5) percent air entrainment. Use at locations where roof drainage dumps on ground.
- J. One-Way Moisture Relief Vents: Shall be fabricated from spun aluminum as recommended by Roofing Manufacturer.

2.5 FABRICATION

- A. Except as otherwise indicated, fabricate work in accordance with SMACNA Architectural Sheet Metal Manual and other recognized industry practices and reviewed shop drawings. Form all flashings, receivers and counterflashings in accordance with standards set forth in the NRCA roofing manual and SMACNA.
- B. Comply with manufacturer's installation instructions and recommendations.
- C. Unless noted otherwise, fabricate perimeter edge/fascia, scuppers, gutters, downspouts, copings, counterflashings, wind clips, and trim from pre-finished aluminum sheet steel.

- D. Shop fabricate work to greatest extent possible. Fabricate inside and outside corners for metal edges, counterflashing, and coping caps of equal length – minimum 2 foot lengths.
- E. Fabricate items to size and dimensions as indicated on the drawings. Limit single-piece lengths to ten (10) feet.
- F. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work sufficient to permanently prevent leakage, damage or deterioration of the work.
- G. Integrate flashing in a manner consistent with detailing. Form work to fit substrates.
- H. Make angle bends and folds for interlocking metal with full regard for expansion and contraction to avoid buckling or fullness in metal after installation.
- I. Fabricate items with straight lines, sharp angles, smooth curves, and true levels. Avoid tool marks, buckling, and oil canning.
- J. Fold back edges on concealed side of exposed edge to form hem.
- K. Unless noted otherwise, lap joints minimum one (1) inch. Rivet and solder joints on parts that are to be permanently and rigidly assembled.
- L. Seams:
 - 1. Wherever possible, fabricate non-moving seams in sheet metal with flat-lock seams and end joints.
 - 2. Pre-finished Galvanized Steel: Seal pre-finished metal seams with rivets and silicone sealant.
 - 3. Metal Other than Aluminum: Tin edges to be seamed, form seams, and solder.
- M. On Kynar 500 or Hylar 5000 pre-finished metal, surface sand metal flanges prior to applying any primers. Prime all metal in contact with bituminous material.
- N. Backpaint all concealed metal surfaces with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals.
- O. Expansion Provisions: Where lapped or bayonet type expansion provisions in work cannot be used or would not be sufficiently waterproof or weatherproof, form expansion joints of intermeshing hooked flanges, not less than one (1) inch deep filled with mastic sealant concealed within joints.

2.6 FABRICATED ITEMS

- A. Metal Flashings (Minimum ten (10') foot lengths):
 - 1. Through wall Receiver Tray: Minimum 24 gauge stainless steel, through wall receivers shall not extend past the face of the exterior veneer more than $\frac{3}{4}$ ".
 - 2. Counterflashing: Minimum 24 gauge stainless steel.
- B. Wind Clips: Minimum 24 gauge stainless steel (or match material of counterflashing), one (1) inch wide by length to engage counterflashing a minimum of 1/2 inch. To be installed at all wall flashings and at curb flashing lengths longer than 5 feet.
- C. Roof Penetrations:
 - 1. Umbrella Counterflashing: Two-piece construction of minimum 24 gauge stainless steel, fabricated in accordance with drawings or project requirements.

- D. Metal Edge:
 - 1. Minimum 0.040 inch thick pre-finished aluminum formed in maximum ten (10) foot lengths, with six (6) inch wide cover plates of same profile, four (4) inch flange, maximum seven (7) inch fascia, 3/4 inch gravel stop.
 - 2. Provide expansion slip joints at maximum 20 feet on center.
 - 3. Shop fabricate all interior and exterior corners. Fabricate exterior corners with 18 inch minimum to four (4) foot maximum legs. Lap, rivet, and seal prior to delivery to jobsite.
 - 4. Fabricate to sizes and dimensions as indicated on drawings with a minimum one (1) inch coverage past top of wall. Refer to SMACNA Fig. 2-5A.
 - 5. Provide mock-up for Architect's approval prior to fabrication.
- E. Continuous Cleats: Continuous strips, same material and profile, minimum one gauge heavier of item which cleats attach.
- F. Vent Hoods, Sleeves, Penetration Flashings, and Accessories: Minimum 24 gauge stainless steel, or as shown or directed otherwise.
- G. Angle Termination Bar: Aluminum pressure bar 1/8 inch x one (1) inch.
- H. Vent Pipe Flashing: Four (4) pound lead. Provide proper size to fold down inside of pipe a minimum of one (1) inch.
- I. Roof Drain Flashing: Four (4) pound lead, minimum 30 inches by 30 inches.
- J. Coping:
 - 1. Minimum 0.040 inch thick pre-finished aluminum, with six (6) inch wide cover plates of same profile.
 - 2. Fabricate as outlined in SMACNA; Refer to Figure 3-4 A.
 - 3. Provide tapered substrate to slope to one (1) side, and cover with waterproof membrane.
 - 4. Install with continuous cleat one (1) side and fasten other side.
- K. Gutters/Downspouts/Collector Heads:
 - 1. Gutters and Downspouts: Minimum 0.040 inch thick pre-finished aluminum formed in maximum ten (10) foot lengths, with six (6) inch wide cover plates. Minimum five (5) inch by six (6) inch box gutter (verify size meets rainfall data per SMACNA).
 - 2. Gutter Straps: Minimum 0.040 inch thick pre-finished (match color) aluminum. Hem both sides.
 - 3. Gutter Supports: Minimum 0.040 inch thick pre-finished (match color) aluminum hemmed around 1/8 inch galvanized bent steel bracket.
 - 4. Gutter Screen: Stainless steel 1/4 inch diamond wire screen enclosed in a pre-finished frame.
 - 5. Collector Heads: Minimum 0.040 inch thick pre-finished (match color) aluminum. As outlined in SMACNA; Refer to Figure 1-25F and Figure 1-28 with alternate Section A-A.
- L. Pipe Box Cover: 24 gauge stainless steel.
- M. Heat Exhaust Curbs and Hoods: 22 gauge stainless steel.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrates are smooth and clean to extent required to perform sheet metal work.

- B. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set in place.
- C. Verify that reglets, nailers, cants, and blocking to receive sheet metal are in place and free of concrete and soil.
- D. Do not start work until conditions are satisfactory.

3.2 PREPARATION

- A. Field measure site conditions prior to fabrication work.
- B. Install starter and edge strips and cleats before starting installation.

3.3 INSTALLATION

- A. Install sheet metal with lines, arises, and angles sharp and true, and plane surfaces free from objectionable wave, warp, or buckle. Exposed edges of sheet metal shall be folded back to form 1/4 inch hem on concealed side from view. Finished work shall be free from water retention and leakage under all weather conditions. Pre-fabricated corners or transitions are required at changes in direction, elevation, or plane and at intersections. Locate field joints not less than 12 inches, nor more than three (3) feet from actual corner. Laps shall be one (1) inch, riveted and soldered at following locations:
 - 1. Pre-fabricated corners.
 - 2. Transitions.
 - 3. Changes in direction, elevation, and plane.
 - 4. At intersections.
- B. Anchor units of work securely in place to prevent damage or distortion from wind or buckling. Provide for thermal expansion of metal units; conceal fasteners wherever possible; and set units true to line and level as indicated. Install work with laps, joints, and seams which are permanently watertight and weatherproof.
- C. Install fabricated sheet metal items in accordance with manufacturer's installation instructions and recommendations and with SMACNA Architectural Sheet Metal Manual.
- D. Separations: Provide for separation of metal from dissimilar metal or corrosive substrates by coating concealed surfaces with zinc chromate, bituminous coating, or other permanent separation at locations of contact as recommended by manufacturer or fabricator. Do not use materials which are incompatible with roofing system.
- E. Continuous Cleat: At exposed edges of perimeter edge, fascias, cap flashings, and where required, attach continuous cleat at six (6) inches on center with appropriate fasteners.
- F. Counterflashing:
 - 1. Do not use surface mount counterflashing except as noted in drawings.
 - 2. Set in through wall with receiver and spring lock counterflashing, as detailed in drawings and to NRCA roofing manual, SMACNA standards.
 - 3. Coordinate installation of through-wall flashing with the masonry contractor.
 - 4. Seal through-wall in conjunction with masonry wall waterproofing.
 - 5. Install wind clips 30 inches o.c. at all counterflashing over five (5) feet in length.
- G. Sanitary Vent Stacks:
 - 1. Prime top and bottom flanges of lead flashing sleeve. Set flange in uniform troweling of plastic roof cement. Prime top side of flange to receive strip-in membrane.

2. Fold lead sleeve down inside of pipe a minimum of one (1) inch. Apply a continuous bead of sealant on inside of pipe prior to folding lead sleeve.

H. Gutters

1. Install gutters as detailed.
2. End Caps, Downspout Outlets and Gutter. Support Brackets and joint fasteners to be manufactured to suit profile and dimension of gutter.
3. Install all anchoring devices as outlined in SMACNA.
4. Expansion Joints: Lap or Butt type per SMACNA, locate every 50 linear feet.

I. Coping:

1. Install wood nailers as shown on drawings.
2. Install metal cleats with appropriate fasteners spaced six (6) inches on center.
3. Install underlayment over the wood substrate. Lap ends minimum of six (6) inches and secure membrane in place. Seal laps with appropriate adhesive.
4. Install metal coping allowing 1/2 inch spaces between segments. Lock coping onto cleat and install appropriate fasteners through the interior fascia spaced 24 inches on center in enlarged holes.
5. Install cover plate centered over coping joint in continuous beads of specified Type B sealant, placed approximately one (1) inch from cover edges. Refer to SMACNA for alternate joints as required by length.
6. Install appropriate fastener through neoprene washer and cover plate between coping segments.
7. Accommodate building wall expansion joints by terminating coping joints and cleats either side of expansion joint. Do not run coping or cleats continuous across joints. Install coping cover plate to span across joint and lap coping on each side of joint a minimum of four (4) inches. Fasten cover plate on one (1) side of joint only (provide wall flashing membrane up and over parapet wall in accordance with manufacturer's detail).

3.4 CLEANING AND PROTECTION

- A. Remove flux and residual acid immediately by neutralizing with baking soda and washing with clean water. Leave work clean of stains.
- B. Remove scraps and debris and leave work area clean.
- C. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes. Paint areas where finish is damaged on pre-finished metal by painting with a compatible paint in color to match undamaged finish.
- D. Prime soldered area of phosphatized metal after cleaning to prevent rusting.
- E. Paint metal flashings that have been soiled with bitumen with aluminized paint.
- F. Clean other work damaged or soiled by Work of this Section.
- G. Protect finished work from damage.

END OF SECTION 07 62 00

SECTION 07 92 00 JOINT SEALANTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Control and expansion joints on exposed interior and exterior surfaces.
 - 2. Perimeter joints between wall surfaces and frames of interior and exterior doors and openings.
 - 3. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - 4. Joints indicated or as necessary.
 - 5. Accessories necessary for a complete installation.
- B. Related Sections:
 - 1. Section 05 50 00: Metal Fabrications.
 - 2. Section 08 11 13: Hollow Metal Doors and Frames.
 - 3. Section 08 80 00: Glazing.
 - 4. Section 09 90 00: Painting and Coating.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Technical data for each joint sealant product. Data to indicate elasticity and durability of each joint sealant product. Submit written certification from manufacturers of sealants attesting products are suitable for use indicated, verified through in house testing laboratory:
 - a. Written certification from manufacturers of joint sealants attesting that products comply with specification requirements and suitable for use indicated verified through manufacturers testing laboratory within the past 36 months or since most recent reformulation, whichever is most recent:
 - 1) Complete instructions for handling, storage, mixing, priming, installation, curing and protection of each type of sealant.
 - 2) Manufacturer's letter, clearly indicating proposed lot numbers of each sealant supplied and expiration date sequence.
 - 3) Instructions for handling, storage, mixing, priming, installation, curing, and protection of each type of sealant.
 - 2. Recycled Content:
 - a. Indicate recycled content; indicate percentage of preconsumer and postconsumer recycled content per unit of product.
 - b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
 - c. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
 - d. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
 - 3. Local/Regional Materials:
 - a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

- b. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
 - c. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
 - d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
4. VOC Data: Submit manufacturer's product data for sealants. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits.
 5. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.
- B. Samples:
1. Provide color samples from full manufacturer's full range for each type of sealant specified for Architect's review.
- C. Certificates and Reports:
1. Product Certificates: Manufacturer's product certificate for each kind of joint sealant and accessory.
 2. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
 3. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
 4. Preconstruction Compatibility and Adhesion Test Reports:
 - a. From sealant manufacturer, indicating the following:
 - 1) Materials forming joint substrates and sealant backings have been tested for compatibility and adhesion with sealants.
 - 2) Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
 5. Preconstruction Field Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified.
 6. Field Adhesion Test Reports: For each sealant application tested.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
1. Firm having minimum 5 years documented experience and specializes in the installation of sealants:
 - a. Exposed sealant work (sealants used for air and weatherseals external at perimeter, metal panel to panel joints) shall be performed by a single (i.e. one) firm specializing in the installation of sealants who has successfully produced work comparable to project.
 - b. Concealed sealant work (sealants which are internal to skylights, and providing an air seal) shall be the responsibility of the subcontractor providing erection of the respective system.
- B. Source Limitations: Obtain each type of joint sealant from a single manufacturer.
- C. Product Testing:
1. Test joint sealants using a qualified testing agency:
 - a. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
 - b. Test according to SWRI Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion

under cyclic movement, adhesion in peel, and indentation hardness.

- D. Environmental Requirements:
 - 1. Toxicity/IEQ:
 - a. Comply with applicable regulations regarding toxic and hazardous materials:
 - 1) VOC Content of Interior Sealants - Sealants and sealant primers complying with limits for VOC content for SCAQMD when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a) Sealants: 250 g/L.
 - b) Sealant Primers for Nonporous Substrates: 250 g/L.
 - c) Sealant Primers for Porous Substrates: 775 g/L.
 - b. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.

1.5 WARRANTY

- A. Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealant work which has failed to provide a weathertight system within specified warranty period:
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Written warranties (weatherseal and stain resistance), signed by sealant manufacturer agreeing to furnish joint sealants to repair or replace those that fail to provide airtight and watertight joints, or fail in adhesion, cohesion, abrasion resistance, stain resistance, weather resistance, durability, or appear to deteriorate in manner not specified in the manufacturer's data as an inherent quality of the material within specified warranty period:
 - 1. Warranty Period: 5 years from date of Substantial Completion.
- C. Warranties specified exclude deterioration or failure of sealants from:
 - 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer written instructions to prevent deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Compatibility: Provide joint sealants, backings, and related materials compatible with one another and with joint substrates under conditions of service and application, as stated by sealant manufacturer's published data, and as substantiated by the manufacturer for each application through testing.

- B. Liquid Applied Sealants: Comply with ASTM C 920 and requirements indicated for each liquid applied sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- C. Stain Test Response Characteristics: For sealants in contact with porous substrates, provide nonstaining products that have undergone testing according to ASTM C 1248 and do not stain porous joint substrates.
- D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- E. Colors: For fully concealed joints, provide standard color of sealant that has the best overall performance characteristics for the application shown. For exposed joints, submit color samples to architect for approval, from manufacturer's full line of standard colors.
- F. Manufacturer's Representative: Use sealant produced by manufacturer who agrees to send a qualified technical representative to site upon request for the purpose of rendering advice concerning the recommended installation of manufacturer's materials.
- G. Sealants: Self leveling compounds for horizontal joints in pavements and nonsag compounds elsewhere except as shown or specified.
- H. Silicone Sealant:
 - 1. Comply with ASTM C920, Type M, Grade NS, Class 25; use NT, M, A and O:
 - a. Use: Typical joints between masonry, metals, glass and plastics (Two part silicone sealants).
 - b. Properties: Performance: Nonstain, nonbleed, nonstreaking to sealed and adjacent substrates. The minimum pli value after 7 day immersion shall not be less than 13 when tested in strict accordance with ASTM C794 Adhesion and Peel.
 - c. Cure System and Oil Content: Neutral Cure System specifically manufactured with controlled oil content to eliminate oil migration into sealed substrates and residue rundown over and onto adjacent substrates.
 - d. Product and Manufacturer: Dow Corning; 756 Silicone Building Sealant - HP with Additive.
- I. Silicone Sealant:
 - 1. ASTM C 920, Type S, Grade NS, Class 50, for Use NT:
 - a. Use: Typical joints between masonry, metals, glass and plastics (Single component sealants).
 - b. Properties: Performance: Nonstain, nonbleed, nonstreaking to sealed and adjacent substrates.
 - c. Cure System and Oil Content: Neutral Cure System specifically manufactured with controlled oil content to eliminate oil migration into sealed substrates and residue rundown over and onto adjacent substrates.
 - d. Product and Manufacturer:
 - 1) BASF Building Systems; Omniseal 50.
 - 2) Dow Corning Corporation; 756 SMS, 791, 795, 995 as applicable.
 - 3) GE Advanced Materials, Silicones; SilGlaze II SCS2800, SilPruf NB SCS9000, SilPruf SCS2000, or UltraPruf II SCS2900 as applicable.
 - 4) Pecora Corporation, as applicable.
 - 5) Sika Corporation, Construction Products Division; SikaSil-C995.
 - 6) Tremco, as applicable.
 - 7) Comparable product.
- J. Polyurethane Sealants:

1. ASTM C920, Type M, Grade NS, Class 25; use NT, M, A and O:
 - a. Use: Typical Wall and Floor Joints (Two part polyurethane sealants). Use at concrete joints.
 - b. Properties: Performance: Nonstain, nonbleed, nonstreaking to sealed and adjacent substrates.
 - c. Products and Manufacturers:
 - 1) BASF Building Systems; Sonolastic NP-2.
 - 2) Pecora Corporation; Dynatred.
 - 3) Sika Corporation, Construction Products Division; Sikaflex 2c NS or Sikaflex 2c NS TG as applicable.
 - 4) Tremco, as applicable.
 - 5) Comparable product.

- K. Two Part Polyurethane Sealants:
 1. ASTM C920, Type M, Grade NS, Class 50; use NT, M, A and O:
 - a. Use: Typical Wall and Floor Joints (Two Part Polyurethane Sealants).
 - b. Properties: Performance: Nonstain, nonbleed, nonstreaking to sealed and adjacent substrates. The minimum pli value after 7 day immersion shall not be less than 13 when tested in strict accordance with ASTM C794 Adhesion in Peel.
 - c. Products and Manufacturers:
 - 1) BASF Construction Chemicals; NP 2.
 - 2) Pecora Corporation, as applicable.
 - 3) Schnee-Morehead, Inc.; Permathane SM 7200.
 - 4) Sika Corporation, Inc.; Sikaflex - 2c NS TG.
 - 5) Tremco, as applicable.
 - 6) Comparable product.

- L. Mildew Resistant Silicone Sealant:
 1. ASTM C920, Type S, Grade NS, Class 25, Use NT, Substrate uses G, A, and O; and containing fungicide for mildew resistance; acid curing:
 - a. Use: One-part mildew-resistant silicone, formulated with fungicide for sealing interior joints of nonporous substrates around ceramic tile, plumbing fixtures, showers.
 - b. Products - Provide one of the following:
 - 1) BASF Building Systems; Omniplus.
 - 2) Dow Corning; 786 Mildew Resistant Silicone Sealant.
 - 3) GE Silicones; Sanitary SCS 1700.
 - 4) Pecora Corporation, as applicable.
 - 5) Sika Corporation, Inc., as applicable.
 - 6) Tremco, as applicable.
 - 7) Comparable product.

- M. Latex Sealant:
 1. Nonelastomeric, one part, nonsag, paintable latex sealant that is recommended for exposed applications on the interior. Complying with ASTM C 834, Type OP (opaque sealants):
 - a. Products are subject to compliance with requirements; provide one of the following:
 - 1) BASF; Sonolastic Sonolac.
 - 2) Pecora Corporation; AC-20 + Silicone.
 - 3) Sika Corporation, Inc., as applicable.
 - 4) Tremco, as applicable.
 - 5) Comparable product.

- N. Acoustical Joint Sealant:
 1. Nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings

in building construction as demonstrated by testing representative assemblies according to ASTM E 90:

- a. Products are subject to compliance with requirements; provide one of the following:
 - 1) BASF, as applicable.
 - 2) Pecora Corporation; AC-20 FTR or AIS-919.
 - 3) Sika Corporation, Inc., as applicable.
 - 4) Tremco, as applicable.
 - 5) USG Corporation; SHEETROCK Acoustical Sealant.
 - 6) Comparable product.

- O. Sealant Backing:
 1. Provide sealant backings that are nonstaining, compatible with joint substrates, sealants, primers, and joint fillers, and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing:
 - a. Cylindrical Sealant Backings: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding backings of flexible plastic foam complying with ASTM C 1330, and of type indicated below. Select shape and density of cylindrical sealant backings in consultation with the manufacturer for proper performance in specific condition of use in each case.
 - b. Type C - Closed cell polyethylene foam material with surface skin, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state; provide one of the following:
 - 1) BASF, as applicable.
 - 2) HBR Closed Cell Backer Rod; Nomaco, Inc.
 - 3) Pecora Corporation, as applicable.
 - 4) Sonolastic Closed-Cell Backer-Rod; BASF Construction Chemicals.
 - 5) Tremco, as applicable.
 - 6) Comparable product.

- P. Miscellaneous Materials:
 1. Primer: Material recommended, as verified through compatibility and adhesion testing, by joint sealant manufacturer for the substrates indicated to be sealed.
 2. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
 3. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and which will not stain nor mar the finish of surface adjacent to joints to which it is applied.
 4. Cork Joint Filler: Resilient and nonextruding, ASTM D1752, Type II.
 5. Bond Breaker Tape: Polyethylene, TFE fluorocarbon, or plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Environmental Limitations:
 1. Do not proceed with installation of joint sealants under the following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 degrees F (4.4 degrees C).
 - b. When joint substrates are wet. Should joints or backing materials become wet, remove and replace backing material with new.

- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

3.2 EXAMINATION

- A. Examine joints indicated to receive joint sealants for compliance with requirements for joint configuration, installation tolerances, and conditions affecting sealant performance. Proceed with installation after unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. Surface Cleaning of Joints:
 - 1. Clean out joints immediately before installing joint sealants to comply with the recommendations of joint sealant manufacturer and requirements:
 - a. Remove foreign material from joint substrates interfering with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), existing joint sealants, oil, grease, water, surface dirt, and frost.
 - b. Clean concrete, masonry, unglazed surfaces of tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil free compressed air.
 - c. Remove laitance and form-release agents from concrete.
 - d. Clean metal, glass, porcelain enamel, glazed surfaces of tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming (Elastomeric Sealants Only): Prime joint substrates where recommended in writing by joint sealant manufacturer, based on prior testing and experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.4 INSTALLATION

- A. Silicone Glazing Sealants: Refer to Section 08 80 00: Glazing.
- B. Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- C. Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants applicable to materials, applications, and conditions indicated.
- D. Sealant Backings:
 - 1. Install sealant backings to support sealants during application and at position necessary to produce cross sectional shapes and depths of installed sealants relative

- to joint widths that allow optimum sealant movement capability:
- a. Do not leave gaps between ends of sealant backings. Trim for tight fit around obstructions or elements penetrating the joint.
 - b. Do not stretch, twist, puncture, or tear sealant backings.
 - c. Remove absorbent sealant backings that become wet before sealant application and replace with dry sealant backings.
 - d. Install bond breaker tape behind sealants where backings are not used between sealants and back of joints.
- E. Weeps and Vents: Install weeps and vents into joints at the same time sealants are being installed. Locate weeps and vents spaced recommended by sealant manufacturer and the window and curtain wall fabricator and erector. Do not install weeps and vents at outside building corners. Do not install vents at horizontal joints immediately below shelf angles, sills, and through wall flashings.
- F. Sealants:
1. Install sealants by proven techniques resulting in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at same time sealant backings are installed:
 - a. Apply sealants in depth in accordance with manufacturer's recommendations and recommended general proportions and limitations.
 - b. Apply elastomeric sealants, in joints not subject to traffic or abrasion, to a depth equal to 50% of the joint width, but not less than 1/4 inch (6 mm) and not more than 1/2 inch (13 mm).
 - c. Apply nonelastomeric sealants to a depth approximately equal to the joint width.
- G. Tooling of Nonsag Sealants:
1. Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform, beads to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces. Tool exposed surfaces of sealants to the profile shown, or if none is shown, tool slightly concave:
 - a. Use masking tape to protect adjacent surfaces of recessed tooled joints.
 - b. Provide a slight wash on horizontal joints where horizontal and vertical surfaces meet.
 - c. Against rough surfaces or in joints of uneven widths avoid the appearance of excess sealant or compound by locating the compound or sealant well back into joint wherever possible.
- H. Acoustical Sealant Installation: At sound rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer written recommendations.

3.5 FIELD QUALITY CONTROL

- A. Field Adhesion Testing:
1. Field test exterior wall joint sealant adhesion to joint substrates:
 - a. Extent of Testing - Test completed and cured sealant joints:
 - 1) Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
 - 2) Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test

per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer field adhesion hand pull test criteria.
 4. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure original sealant surfaces are clean and new sealant contacts original sealant.
- B. Evaluation of Field Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.6 SITE ENVIRONMENTAL PROCEDURES

- A. Indoor Air Quality: Provide temporary ventilation during work. Coordinate interior application of sealants with interior finishes schedule.

3.7 CLEANING AND PROTECTION

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.
- B. Protect joint sealants during and after curing from contact with contaminating substances and from damage so sealants are without deterioration or damage at time of Substantial Completion. If, despite protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 07 92 00

SECTION 07 95 00 EXPANSION CONTROL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Expansion joint cover assemblies.
 - 2. Accessories necessary for a complete installation.
- B. Related Sections:
 - 1. Section 05 50 00: Metal Fabrications
 - 2. Section 07 62 00: Roof Related Sheet Metal.
 - 3. Section 09 21 16: Gypsum Board Assemblies.
 - 4. Section 09 24 00: Cement Plastering.

1.3 PERFORMANCE REQUIREMENTS

- A. Expansion Joint Design Criteria:
 - 1. Type of Movement: Thermal and wind sway.
 - 2. Refer to Drawings for placement in wall types and location of expansion joints.

1.4 SUBMITTALS

- A. Product Data: Technical data for each type of product including construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.
- B. Shop Drawings:
 - 1. Submit for each expansion joint cover assembly:
 - a. Include plans, elevations, sections, details, splices, block out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
 - b. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
- C. Expansion Joint Cover Assembly Schedule:
 - 1. Prepared by or under the supervision of the supplier. Include the following information in tabular form:
 - a. Manufacturer and model number for each expansion joint cover assembly.
 - b. Expansion joint cover assembly location cross-referenced to Drawings.
 - c. Nominal, minimum, and maximum joint width.
 - d. Movement direction.
 - e. Materials, colors, and finishes.
 - f. Product options.
 - g. Fire resistance ratings.
- D. Product Test Reports: For each fire resistance rated expansion joint cover assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Fire Resistance Ratings:
 - a. Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E1966 by a qualified testing agency:
 - 1) Hose Stream Test: Wall-to-wall and wall-to-ceiling assemblies shall be subjected to hose stream testing.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Aluminum: ASTM B221, Alloy 6063-T5 for extrusions; ASTM B209, Alloy 6061-T6 for sheet and plate. Apply protective coating on aluminum surfaces in contact with cementitious materials.
- B. Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.
- C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.
- D. Moisture Barrier: Flexible elastomeric material. Continuous, waterproof membrane within joint and attached to substrate on sides of joint. Provide where indicated on Drawings.
- E. Nonmetallic, Shrinkage Resistant Grout: ASTM C1107/C1107M, factory packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
- F. Fasteners: Recommended attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.2 WALL EXPANSION JOINT COVERS

- A. Metal Plate Wall Joint Cover:
 - 1. Metal cover plate fixed on one side of joint gap and free to slide on other:
 - a. Manufacturers are subject to compliance with requirements, provide products by one of the following:
 - 1) Architectural Art Manufacturing Inc., a division of Pittcon Architectural Metals, LLC.
 - 2) Construction Specialties, Inc.
 - 3) InPro Corporation (IPC).
 - 4) MM Systems Corporation.
 - 5) Watson Bowman Acme Corp.
 - 6) Balco.
 - b. Application: Wall to wall.
 - c. Fire Resistance Rating: Not less than indicated on Drawings and adjacent construction.
 - d. Exposed Metal: Aluminum, clear anodic, Class I.

- B. Flexible Wall Joint Cover
 - 1. Flexible cover plate fixed on one side of joint gap and free to slide on other:
 - a. Basis-of-Design Product: Construction Specialties, Inc. model FWF, FWF-M
 - b. Type: Flat Seal
 - a. Exposed Metal Aluminum
 - b. Finish: Mill
 - c. Seal Material: Santoprene
 - d. Color: As selected by Architect from manufacturer's standard range
 - e. Fire Resistance Rating: Not less than indicated on Drawings and adjacent construction.

2.3 CEILING EXPANSION JOINT COVERS

- A. Metal Plate Ceiling Joint Cover:
 - 1. Metal cover plate fixed on one side of joint gap and free to slide on other:
 - a. Manufacturers are subject to compliance with requirements, provide products by one of the following:
 - 1) Architectural Art Manufacturing Inc.
 - 2) Construction Specialties, Inc.
 - 3) InPro Corporation (IPC).
 - 4) MM Systems Corporation.
 - 5) Balco.
 - b. Application: Wall to ceiling.
 - c. Fire Resistance Rating: Not less than indicated on Drawings and adjacent construction.
 - d. Exposed Metal: Aluminum, Clear anodic, Class I.

Flexible Ceiling Joint Cover:

- 2. Flexible cover plate fixed on one side of joint gap and free to slide on other:
 - e. Basis-of-Design Product: Construction Specialties, Inc. model FWF, FWF-M
 - f. Type: Flat Seal
 - a. Exposed Metal Aluminum
 - b. Finish: Mill
 - g. Seal Material: Santoprene
 - h. Color: As selected by Architect from manufacturer's standard range
 - i. Fire Resistance Rating: Not less than indicated on Drawings and adjacent construction.

2.4 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the work.
- B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.
- C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.
- C. Furnish units in longest practicable lengths to minimize field splicing.
- D. Include factory fabricated closure materials and transition pieces, T joints, corners, curbs, cross connections, and other accessories as required to provide continuous expansion joint cover assemblies.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.
- B. Metal Frames:
 - 1. Perform cutting, drilling, and fitting required to install expansion joint cover assemblies:
 - a. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage resistant grout.
 - b. Install frames in continuous contact with adjacent surfaces.
 - c. Shimming is not permitted.
 - d. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - e. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
 - f. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 - g. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.
- C. Seals:
 - 1. Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints:
 - a. Provide in continuous lengths for straight sections.
 - b. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
 - c. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure sensitive tape as recommended by manufacturer.
- D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.
- E. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.
- F. Fire Resistance Rated Assemblies:
 - 1. Coordinate installation of expansion joint cover assembly materials and associated

work so complete assemblies comply with performance requirements:

- a. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.
- G. Moisture Barrier Drainage: If indicated, provide drainage fittings and connect to drains.

3.4 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION 07 95 00

SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Provide items shown on the drawings and specified, including, but not limited to the following:
 - 1. Standard steel doors
 - 2. Steel frames for doors

- B. Related Sections:
 - 1. Section 07 92 00: Joint Sealants.
 - 2. Section 08 80 00: Glazing.
 - 3. Section 09 21 16: Gypsum Board Assemblies.
 - 4. Section 09 24 00: Cement Plastering.
 - 5. Section 09 90 00: Painting and Coating.

- C. Reference Standards:
 - 1. American National Standards Institute (ANSI):
 - a. A115.IG, Installation Guide for Doors and Hardware.
 - b. A224.1, Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors & Frames.
 - c. A250.8, Recommended Specifications for Standard Steel Doors and Frames. (Formerly SDI-100).
 - d. A250.11, Recommended Erection Instructions for Steel Frames (Formerly SDI-105).
 - 2. ASTM International (ASTM):
 - a. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - b. A924, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - c. A1008, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - d. A1011, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - e. C1363 - Standard Test Method for the Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
 - f. E283 – Standard Test Method for Determining the rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - g. E413 - Standard Classification for Rating Sound Insulation.
 - 3. Hollow Metal Manufacturers Association (HMMA):
 - a. HMMA 802 - Manufacturing of Hollow Metal Doors and Frames.
 - b. HMMA 810 - Hollow Metal Doors.
 - c. HMMA 830 - Hardware Preparation and Locations for Hollow Metal Doors and Frames.
 - d. HMMA 840 - Installation and Storage of Hollow Metal Doors and Frames.

- e. HMMA 850 - Fire Rated Hollow Metal Doors & Frames.
- f. HMMA 890 - Technical Summary of Hollow Metal by HMMA.
- 4. National Fire Protection Association (NFPA):
 - a. 80, Fire Doors and Fire Windows.
 - b. 252, Fire Tests of Door Assemblies.
- 5. Steel Door Institute – Current Standards:
 - a. Technical Data Series.
- 6. Underwriters Laboratories Inc. (UL):
 - a. Building Materials Directory.
 - b. Listing and Labeling.
 - c. 10B and 10C, Fire Tests of Door Assemblies.
 - d. 1784, Air Leakage Tests of Door Assemblies.
- 7. Intertek Testing, Services (Warnock Hersey, Inc. (WHI):
 - a. Listing and Labeling.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's standard details and catalog data demonstrating compliance with specifications and referenced standards.
 - 2. Manufacturer's installation instructions.
- B. Shop Drawings:
 - 1. Indicate complete schedule in detail for each steel door and frame using the same reference number for details and openings as those on the Contract Drawings. If any door is not by the steel door manufacturer only the door opening number should be shown along with the type of door (wood, plastic laminate faced, etc.):
 - a. Show details of construction, installation, connections, anchors, hardware reinforcement, hardware preparation, louvers, and floor and threshold clearances.
- C. Samples are required from non-Steel Door Institute members:
 - 1. 12 inch x 12 inch sample of a fire-rated and non-rated door, cut from corner of door, showing door construction.
 - 2. 12 inch x 12 inch sample of each type of door louver specified or required, showing louver construction.
 - 3. 6 inch long sample of a fire-rated, non-rated frame, and each type of glass stop specified or required, showing corner and construction.
- D. Certificates:
 - 1. Manufacturer's certification that oversized openings are in compliance with specifications.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: If other than a manufacturer listed under Paragraph 2.1 is proposed for use on the Project, it shall be a company specializing in the manufacturer of steel doors and frames of the type specified for this Project with a minimum of five (5) years' experience.
- B. All steel doors and frames shall be by a single manufacturer, shop drawings to be submitted with manufacturer's insignia which is being supplied.
- C. Furnish steel doors and frames to meet current ANSI/Steel Door Standards.
- D. ANSI/SDI-A250.13 (2003) Testing and Rating of Sever Windstorm Resistant Components

for Swing Door Assemblies.

- E. ASTM E 330-97, Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
- F. Comply with ASTM E 283 – Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- G. Wind Loads: Provide hollow metal and door hardware assemblies approved by DSA, including anchorage, capable of withstanding wind load design pressures which are calculated for this project by a registered Architect or Engineer and is part of the construction documents per CBC.
- H. Accessibility Requirements:
 - 1. Comply with applicable requirements:
 - a. Americans with Disability Act of 1990, as amended:
 - 1) 2010 ADA Standards.
 - b. CBC 2019 California Building Code. CCR Title 24, Part 2, as adopted and amended by DSA.
- I. Pre-installation Conference:
 - 1. Refer to Section 01 31 00: Project Management and Coordination.

1.5 WARRANTY

- A. Warrant the Work specified herein for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship.
- B. Defects shall include, but not be limited to:
 - 1. Use of incorrect materials in opening.
 - 2. Incorrect labeled components installed within opening.
 - 3. Noisy, rough or difficult operation.
 - 4. Failure to meet specified quality assurance requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in accordance with manufacturer's instructions, and as follows:
 - 1. In manufacturer's original, clearly labeled, undamaged containers or wrappers.
 - 2. Containers or wrappers shall list the name of the manufacturer and product.
- B. Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.
- C. Protect products from moisture, construction traffic, and damage:
 - 1. Store under cover in a clean, dry place, protected from weather and abuse.
 - 2. Store in a manner that will prevent rust or damage.
 - 3. Store doors in a vertical position, spaced with blocking to permit air circulation.
 - 4. Do not use non-vented plastic or canvas shelters.
 - 5. Should containers or wrappers become wet, remove immediately.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

- A. Manufacturers listed below whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must comply with Paragraph 1.5, A, Manufacturer Qualifications, must manufacture equivalent products to those specified and comply with requirements of Section 01 25 13: Product options and Substitutions, regarding substitutions to be considered:
1. CECO Door Products, Brentwood, TN; (615) 661-5030.
 2. Curries Company, Mason City, IA; (515) 423-1334.
 3. Pioneer Industries, Inc., Kewanee, IL; (309) 856-6000.
 4. Republic Builders Products Company, McKenzie, TN; (800) 733-3667.
 5. Steelcraft Mfg. Co., Cincinnati, OH; (513) 745-6400.
 6. Approved equal.

2.2 MATERIALS, GENERAL

- A. Steel requirements, all frames to be manufactured of commercial quality, stretcher leveled flatness, cold rolled steel per ASTM-A1008 general requirements. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM-A1011. Exterior frames and interior frames where shown on drawings or required in damp, moist, humid, and wet areas, i.e., toilets, locker rooms, showers, etc., to be manufactured of commercial quality, stretcher leveled flatness, cold rolled steel and galvanized to 'A-60' minimum coating weight standard per ASTM-A653 and A924, with coating weight of not less than 0.60 ounce per square foot (0.30 ounce per square foot per side).

2.3 FRAME FABRICATION

- A. Minimum Gauges:
1. Interior Openings:
 - a. Less than 4 feet-0 inches in Width: 16 gauge.
 - b. 4 feet-0 inches in Width and greater: 14 gauge.
 2. Exterior Openings: 14 gauge
- B. Design and Construction:
1. Frames shall be custom made, welded units with integral trim of sizes and shapes shown on approved shop drawings. Frame profile shall match wall thickness where practical, i.e.
 2. Frames shall be strong and rigid, neat in appearance, square, true and free of defects, warp and buckle. Molded members shall be clean cut, straight and of uniform profile throughout their length.
 3. Jamb depths, trim, profile and backbends shall be as shown on approved shop drawings.
 4. Corner joints, including face and inside corners, shall have contact edges closed tight, with trim faces mitered and continuously welded, and stops butted. The use of gussets shall not be permitted. Face of frame shall be ground smooth. Knockdown (KD) frames are not permitted.
 5. Minimum depth of stops shall be 5/8 inch.
 6. Frames for multiple openings shall have mullion and rail members which are closed tubular shapes having no visible seams or joints. Joints between faces of abutting members shall be securely welded and finished smooth. Mullions shall be key locked removable type. Keys shall be master keyed to Owner's Best system.
 7. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inch and wider with mortise/butt type hinges only at top hinge location to deter against hinge reinforcement sag.
 8. Provide countersunk flat or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops; provide security head screws at

- exterior locations.
9. Provide A60 Galvannealed coating at frames in restrooms and locker rooms with showers/Jacuzzi, clean areas such as kitchen rooms.
 10. Electrical Knock Out Boxes:
 - a. Factory weld 18 gage electrical knock out boxes to frame for electrical hardware preps; included but not limited to electric thru wire hinges, electrical raceways, door position switches, electric strikes, jamb mount card readers, and magnetic licks as noted in door hardware sets in Division 08 Openings:
 - 1) Electrical knock out boxes are required at door position switches, electric strikes, card readers, and middle hinge locations Openings.
 - 2) Provide electrical knock out boxes with 3/4-inch knockouts.
 - 3) Conduit to be coordinated and installed in field from middle hinge box and strike box to door position box.
 - 4) Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Openings.
 - 5) Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
 - 6) Provide field installed conduit per Division 28 section for standardized plug connectors to accommodate up to twelve (12) wires as required for electrified door hardware specified in hardware sets in Division 8 Openings. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Wire nut connections are not acceptable.
 11. Hardware Reinforcements:
 - a. Frames shall be mortised, reinforced, drilled and tapped at factory for fully template mortised hardware in accordance with approved hardware schedule and templates provided by Section 08 71 00: Door Hardware. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates only.
 - b. Minimum thickness of hardware reinforcing plates shall be as follows:
 - 1) Hinge and pivot reinforcements (1-1/4 inch x 10 inch minimum size): 7 gauge.
 - 2) Strike reinforcements: 12 gauge stiffeners.
 - 3) Flush bolt reinforcements: 12 gauge.
 - 4) Closer reinforcements: 12 gauge.
 - 5) Reinforcements for surface-mounted hardware, hold-open arms, surface panic devices: 12 gauge.
 12. Floor Anchors: Minimum 14 gauge, securely welded inside each jamb, with holes for floor anchorage.
 - c. Frames for installation in wood stud partitions shall be provided with steel anchors of suitable approved design, not less than 16 gauge thickness, securely welded inside each jamb as follows:
 - 1) Frames up to 7 feet-6 inch height - Four (4) anchors.
 - 2) Frames 7 feet-6 inch to 8 feet-0 inch height - Five (5) anchors.
 - 3) Frames over 8 feet-0 inch height - Four (4) anchors plus one (1) additional for each 2 feet or fraction thereof over 8 feet-0 inches.
 13. Dust Cover Boxes: Shall be of not less than 26 gauge steel and shall be provided at all mortised hardware items.
 14. Steel Spreader: Shall be provided on all frames, temporarily attached to bottoms of both jambs for bracing during shipping and handling.
 15. Loose Glazing Stops: Shall be of cold rolled steel, not less than 20 gauge, butted at corner joints and secured to the frame with countersunk cadmium or zinc-plated screws. Loose stops at exterior frames shall be placed on the interior side of the frames.
- C. Frame Color: Field painted under Section 09 90 00: Painting and Coating to match face of door.

2.4 DOOR FABRICATION

- A. Minimum Gauges:
 - 1. Interior Doors: 0.047 inch or 18 gauge (16 gauge for high frequency doors).
 - 3. Exterior Doors: 0.059 inch or 16 gauge (14 gauge for windstorm rated doors).

- B. Design and Construction:
 - 1. Types: Doors shall be custom fabricated, of types and sizes shown on approved shop drawings, and shall be seamless face construction with no visible seams or joints on vertical edges with fully welded seams free from blemishes and defects. Thickness: Shall be 1-3/4 inch, unless specifically noted or shown otherwise.
 - 4. Exterior Doors: Provide doors with 22 gage steel z-channels placed at 6 inches apart with foamed in place polyurethane core, with a thermal insulation calculated R factor of 11.01 per ASTM C518 Standards.
 - 5. Fabrication:
 - a. Doors shall be strong, rigid and neat in appearance, free from warpage and buckle.
 - b. Corner bends shall be true and straight and of minimum radius for gage of metal used.
 - c. Provide stiffeners with polystyrene core spaced maximum six (6) inches on center and extending full height of door.
 - d. Fill interior with noncombustible fiberglass insulation. Use mineral board filler as required for labeled doors.
 - e. Faces shall be joined at vertical edges of door by a continuous weld extending full height of door. Welds shall be ground, filled and dressed smooth to provide a smooth flush surface.
 - f. Top and bottom edges of doors shall be closed with a continuous recessed steel channel not less than 16 gauge, extending full width of door and spot weld to both faces. Exterior doors shall have an additional flush closing channel at top and bottom edges. Openings shall be provided in the bottom closure channel at top and bottom edges. Openings shall be provided in the bottom closure of exterior doors to permit the escape of entrapped moisture.
 - g. Electrical Raceways: Provide raceways for standardized plug connectors to accommodate up to twelve (12) wires as required for electrified door hardware specified in hardware sets in Division 8 Openings. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Wire nut connections are not acceptable.
 - h. Doors within in wet or humid areas shall have a top cap and solid foam interior core to prevent internal moisture accumulation and galvanized.
 - i. Edge profile shall be provided on both vertical edges of door as follows:
 - 1) Single-Acting Swing Doors: Beveled 1/8 inch in 2 inches.
 - j. Hardware Reinforcements:
 - 1) Doors shall be mortised, reinforced, drilled and tapped at factory for fully template hardware, in accordance with the approved hardware schedule and templates provided by Section 08 71 00: Door Hardware. Where surface-mounted hardware is to be applied, doors shall have reinforcing plates only.
 - 2) Minimum gauges for hardware reinforcing plates shall be as follows:
 - a) Hinge & pivot reinforcements: 7 gauge.
 - b) Reinforcements for lock face, flush bolts, concealed holders, concealed or surface-mounted closers: 12 gauge.
 - 6. Glass Moldings and Stops: Loose stops shall be not less than 20 gauge steel, with butt corner joints, secured to frame opening by countersunk screws. Snap-on attachments will not be acceptable.
 - 7. Louvers: Shall be inverted "V" blade, sightproof type, unless noted otherwise.
 - 8. Edge Clearances:
 - a. Between Door and Frame at Head and Jambs: 1/8 inch.
 - b. At DoorSills with No Threshold: 5/8 inch to 3/4 inch above finished floor.

- c. At Door Sills with Threshold: As required to suit threshold.
 - d. Between Meeting Edges of Double Doors: 1/8 inch.
- C. Finish:
- 1. Shop paint steel (whether galvanized or ungalvanized) stops and accessories as follows:
 - a. Clean surfaces free of mill scale, rust, oil, grease, dirt and other foreign matter.
 - b. Chemically treat surfaces and apply one (1) coat of an approved baked-on rust-inhibitive primer paint to provide a minimum 0.5 mil dry film thickness.
 - 2. Field painted under Section 09 90 00: Painting and Coating.

PART 3 EXECUTION

3.1 COORDINATION

- A. Coordinate the Work of this Section.
- B. Coordinate hardware installation with opening construction. Finish hardware is specified in Section 08 71 00.
- C. Coordinate doors, frames, and windows with glazing specified in Section 08 80 00: Glazing.
- D. Coordinate doors and frames with painting specified in Section 09 90 00: Painting and Coating.

3.2 INSTALLATION

- A. Separate dissimilar metals. Protect against galvanic action.
- B. Frames:
 - 1. Anchorage and Connections: Secure to adjacent construction. Where practical, interior door frames shall be flush with the pull side wall to minimize or eliminate the reveal and allow full 180 degree door swing.
 - 2. Install frames in accordance with manufacturer's instructions and install labeled frames in accordance with NFPA 80.
 - 3. Frame Spreader Bars: Leave intact until frames are set perfectly square and plumb and anchors are securely attached.
 - 4. Remove hardware, with the exception of prime-coated items, tag box, and reinstall after finish paint Work is completed. Do not remove or paint over labels on labeled frames.
- C. Doors:
 - 1. Install hardware in accordance with hardware manufacturer's templates and instructions.
 - 2. Install doors in accordance with manufacturer's instructions and install labeled doors in accordance with NFPA 80.
 - 3. Adjust operable parts for correct function.
 - 4. Remove hardware, with the exception of prime-coated items, tag, box, and reinstall after finish paint Work is completed. Do not remove or paint over labels on labeled doors.

3.3 ADJUST AND CLEAN

- A. Adjust doors for proper operation, free from binding or other defects.

- B. Clean and restore soiled surfaces.
- C. Remove scraps and debris, and leave site in clean condition.

END OF SECTION 08 11 13

SECTION 08 31 13 ACCESS DOORS AND FRAMES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes access doors in gypsum board, masonry partitions, and plaster/stucco soffits, where shown or required.
- B. Related Sections:
 - 1. Section 05 50 00: Metal Fabrications.
 - 2. Section 06 10 00: Rough Carpentry.
 - 3. Section 08 11 13: Hollow Metal Doors and Frames.
 - 4. Section 09 21 16: Gypsum Board Assemblies.
 - 5. Section 09 30 00: Tiling.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's literature, including schedules, charts, installation instructions, and illustrations to indicate the performance, fabrication, procedures, product variations, and accessories.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years' experience manufacturing access doors meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions in order to be considered:
 - 1. J. L. Industries, Commerce, CA (Basis of Design for Rated Floors).
 - 2. Karp Associates, Inc., Melville, NY (Basis of Design).
 - 3. The Bilco Company, New Haven, CT.
 - 4. Babcock-Davis, San Lorenzo, CA.
 - 5. Larsen's Manufacturing Co., Minneapolis, MN.
 - 6. Milcor, Grand Rapids, MI.
 - 7. Approved Equal.

2.2 PRODUCTS

- A. Standard type flush steel access door for plaster/stucco soffit construction:
 - 1. Size: As shown on the drawings.
 - 2. Hinges: Concealed continuous piano type hinges.
 - 3. Finish: Phosphate dipped and prime coated for field painting per Section 09 90 00.
 - 4. Frames: 16-gauge galvanized steel with 22-gauge galvanized plaster casing bead
 - 5. Doors: 14-gauge galvanized steel.
 - 6. Lock: Flush screw driver operated cam.

- B. Non-Rated Wall Access Door:
 - 1. Listing: Not required.
 - 2. Size: As shown on the drawings.
 - 3. Hinges: Heavy-Duty Type 316 Stainless Steel Butt hinge.
 - 4. Finish: 20-Gauge galvanized finish with gray primer on exterior frame, field painting per Section 09 90 00.
 - 5. Frames: 20-Gauge Galvanized Steel. Anchor to wood floor.
 - 6. Doors: Single Leaf.
 - 7. Lock: Knurled knob/key operated latch bolt.
 - 8. Hold open door.

- C. Ceiling Access Door:
 - 1. Listing: Not required.
 - 2. Size: As shown on the drawings.
 - 3. Hinges: Heavy-Duty Type 316 Stainless Steel Butt hinge.
 - 4. Finish: 20-gauge galvanized finish with gray primer on exterior frame, field painting per Section 09 90 00.
 - 5. Frames: Extruded Aluminum. Anchor to wood floor.
 - 6. Doors: Single Leaf.
 - 7. Lock: Knurled knob/key operated latch bolt.
 - 8. Hold open door.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Locate and provide Access Doors in walls (and floors) to construct the wall as indicated on drawings, and provide access doors and panels to fit the wall condition. Maintain designated wall types as indicated on Drawings.

3.2 LOCATIONS

- A. Provide where required by code and where needed to service and maintain equipment.
- B. If not shown on the drawings, consult the Architect before locating in finished spaces.

END OF SECTION 08 31 13

SECTION 08 71 00 DOOR HARDWARE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
- B. Related Sections:
 - 1. Section 08 11 13: Hollow Metal Doors and Frames.
- C. Reference Standards:
 - 1. Comply with the version year adopted by the Authority Having Jurisdiction:
 - a. CBC – California Building Code 2019 ed.: Section 11B-404.
 - b. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - c. NFPA 70 - National Electrical Code.
 - d. NFPA 80 - Fire Doors and Windows.
 - e. NFPA 101 - Life Safety Code.
 - f. NFPA 105 - Installation of Smoke Door Assemblies.
 - g. State Building Codes, Local Amendments, if applicable.
 - 2. All hardware specified herein shall comply with the following industry standards:
 - a. ANSI/BHMA Certified Product Standards - A156 Series
 - b. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 DEFINITIONS

- A. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule:
 - 1. Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware:
 - a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - b. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

- c. Content: Include the following information:
 - 1) Type, style, function, size, label, hand, and finish of each door hardware item.
 - 2) Manufacturer of each item.
 - 3) Fastenings and other pertinent information.
 - 4) Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - 5) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 6) Mounting locations for door hardware.
 - 7) Door and frame sizes and materials.
 - 8) Warranty information for each product.
 - d. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- D. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.5 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. Source Limitations:
 - 1. Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated:
 - a. Electrified modifications or enhancements made to a source manufacturer's

product line by a secondary or third party source will not be accepted.

- E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- F. Keying Conference:
 - 1. Conduct conference to comply with requirements in Division 01. Keying conference to incorporate the following criteria into the final keying schedule document:
 - a. Function of building, purpose of each area and degree of security required.
 - b. Plans for existing and future key system expansion.
 - c. Requirements for key control storage and software.
 - d. Installation of permanent keys, cylinder cores and software.
 - e. Address and requirements for delivery of keys.
- G. Pre-Submittal Conference:
 - 1. Conduct coordination conference in compliance with requirements in Division 01 with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware:
 - a. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - b. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 - c. Review sequence of operation narratives for each unique access controlled opening.
 - d. Review and finalize construction schedule and verify availability of materials.
 - e. Review the required inspecting, testing, commissioning, and demonstration procedures
- H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.
- I. Regulatory Requirements:
 - 1. Doors and doorways as part of an accessible route shall comply with CBC Sections 11B-404.
 - 2. Locate latching hardware between 34 inches to 44 inches above the finished floor, per-2019 California Building Code, Section 11B-404.2.7:
 - a. Panic hardware: locate between 36 inches to 44 inches above the finished floor.
 - 3. Handles, pull, latches, locks, other operable parts:
 - a. Readily openable from egress side with one hand and without tight grasping, tight pinching, or twisting of the wrist to operate. 2019 California Building Code Section 11B-309.4.
 - b. Force required to activate the operable parts: 5.0 pounds maximum, per 2019 California Building Code Section 11B-309.4.
 - 4. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2019 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds:
 - a. Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leaves or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.
 - 5. Low-energy powered doors - comply with ANSI/BHMA A156.19; 2019 California

Building Code Section 11B-404.2.9, Exception 2:

- a. Where powered door serves an occupancy of 150 or more, provide back-up battery power or stand-by generator power, capable of supporting a minimum of 100 cycles.
 - b. Actuators, vertical bar type: minimum 2-inches wide, 30-inches high, bottom located minimum 5-inches above floor or ground, top located minimum 35-inches above floor or ground. Displays International Symbol of Accessibility, per 2019 California Building Code Section 11B-703.7.
 - c. Actuators, plate type: use two at each side of the opening. Minimum 4-inches diameter or 4-inches square. Displays International Symbol of Accessibility, per 2019 California Building Code Section 11B-703.7. Locate centerline of lower plate between 7- and 8-inches above floor or ground, and upper plate between 30- and 44-inches above floor or ground.
 - d. Actuator location: conspicuously located, clear and level floor/ground space for forward or parallel approach.
6. Adjust door closer sweep periods so that from an open position of 90 degrees, the door will take at least 5 seconds to move to a point 12 degrees from the latch, measured to the landing side of the door, per 2019 California Building Code Section 11B-404.2.8:
 - a. Spring hinges: adjust for 1.5 seconds minimum for 70 degrees to fully-closed.
 7. Smooth surfaces at bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests, per 2019 California Building Code Section 11B-404.2.10:
 - a. Applied kickplates and armor plates: bevel the left and right edges; free of sharp or abrasive edges.
 - b. Tempered glass doors without stiles: bottom rail may be less than 10 inches if top leading edge is tapered 60 degrees minimum.
 8. Door opening clear width no less than 32 inches, measured from face of frame stop, or edge of inactive leaf of pair of doors, to door face with door opened to 90 degrees. Hardware projection not a factor in clear width if located above 30 inches and below 80 inches, and the hardware projects no more than 4 inches. 2019 California Building Code Section 11B-404.2.3:
 - a. Exception: In alterations, a projection of 5/8 inch (15.9 mm) maximum into the required clear width shall be permitted for the latch side stop.
 - b. Door closers and overhead stops: not less than 78 inches above the finished floor or ground, per 2019 California Building Code 11B-307.4.
 9. Thresholds: Floor or landing no more than 0.50 inches below the top of the threshold of the doorway, per 2019 California Building Code Section 11B-404.2.5. Vertical rise no more than 0.25 inches, change in level between 0.25 inches and 0.50 inches: beveled to slope no greater than 1:2 (50 percent slope). 2019 California Building Code Section 11B-303.2 & ~.3.
 10. Floor stops: Do not locate in path of travel. Locate no more than 4 inches from walls, per DSA Policy #99-08 (Access).
 11. Pairs of doors with independently-activated hardware both leafs: limit swing of right-hand or right-hand-reverse leaf to 90 degrees to protect persons reading wall-mounted tactile signage, per 2019 California Building Code Section 11B-703.4.2.
 12. Door and door hardware encroachment:
 - a. When door is swung fully-open into means-of-egress path, the door may not encroach/project more than 7 inches into the required exit width, with the exception of door release hardware such as lockset levers or panic hardware. These hardware items must be located no less than 34-inches and no more than 48-inches above the floor/ground. 2019 California Building Code, Section 1005.7.1:
 - 1) In I-2 occupancies, latch release hardware is not permitted to project in the required exit width, regardless of its mounting height, per 2019 California Building Code, Section 1005.7.1 at Exception 1.

1.6 WARRANTY

- A. General Warranty: Reference Division 01. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period:
 - 1. Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of the hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: Two years from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Locksets; Three (3) years.
 - 2. Extra Heavy Duty Cylinder Locks: Seven (7) years.
 - 3. Exit Devices: Three (3) years mechanical, one (1) year electrical.
 - 4. Closures: Ten (10) years mechanical, One (1) year electrical.
 - 5. Hinges: One (1) year.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

PART 2 PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
- C. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

- D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges - ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets:
1. Quantity - Provide the following hinge quantity, unless otherwise indicated:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 2. Hinge Size - Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 3. Hinge Weight and Base Material - Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 4. Hinge Options - Comply with the following where indicated in the Hardware Sets or on Drawings:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
 - b. Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise architect if 8-inch width is insufficient.
 5. Acceptable Manufacturer:
 - a. **Schlage** (Basis of Design)
 - b. Manufacturer representative: Chris Clark Chris.clark@allegion.com (626) 390-0599.

2.3 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years' experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, Schlage; unless otherwise indicated.
- C. Cylinders:
1. Original manufacturer cylinders complying with the following:
 - a. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
 - b. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - c. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 - d. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - e. Keyway: Match Facility Standard.

- D. Keying System:
 - 1. Schlage Everest 29 Primus IC Core (Keying by District):
 - a. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
 - b. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by District.
 - c. Existing System: Key locks to Owner's existing system.
- E. Key Quantity:
 - 1. Provide the following minimum number of keys:
 - a. Change Keys per Cylinder: Two (2)
 - b. Master Keys (per Master Key Level/Group): Five (5).
 - c. Construction Keys (where required): Ten (10).
- F. Construction Keying: Provide construction master keyed cylinders.
- G. Key Registration List (Bitting List):
 - 1. Provide keying transcript list to District representative in the proper format for importing into key control software.
 - 2. Provide transcript list in writing or electronic file as directed by the District.

2.4 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Locksets, Grade 1 (Heavy Duty):
 - 1. ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body:
 - a. Acceptable Manufacturers:
 - 1) Schlege, Mortise type.
 - 2) Schlege L Series Mortise Indicators "N" Escutcheons.
 - 3) Outward opening doors will have Schlege LG13 Astragals.

2.5 LOCK AND LATCH STRIKES

- A. Strikes:
 - 1. Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 - a. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - b. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - c. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 - d. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards:
 - 1. Comply with the following:
 - a. Strikes for Mortise Locks and Latches: ANSI/BHMA A156.13.
 - b. Strikes for Bored Locks and Latches: ANSI/BHMA A156.2.
 - c. Strikes for Auxiliary Deadlocks: ANSI/BHMA A156.36.
 - d. Dustproof Strikes: ANSI/BHMA A156.16.

2.6 CONVENTIONAL EXIT DEVICES

- A. General Requirements:
1. All exit devices specified herein shall meet or exceed the following criteria:
 - a. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 - b. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 - c. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 - d. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 - e. Lever Operating Trim - Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts:
 - 1) Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - 2) Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 - f. Vertical Rod Exit Devices: Where concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 - g. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 - h. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 - i. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 - j. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty):
1. ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature:
 - a. Acceptable Manufacturers:
 - 1) Von Duprin 99 Series (Basis of Design).

2.7 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
 4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
 5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Commercial Duty):
1. ANSI/BHMA 156.4, Grade 1 certified surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard:
 - a. Acceptable Manufacturers (Basis of Design): L.C.N. (Grade 1 4040XP).

2.8 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers:
1. ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders:
 - a. Acceptable Manufacturers (Basis of Design): Trimco (TC).

2.9 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Acceptable Manufacturers: Pemko Manufacturing (PE).
- C. Smoke Labeled Gasketing:
1. Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784:
 - a. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- D. Fire Labeled Gasketing:
1. Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL10C:
 - a. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- E. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

- F. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- G. Thresholds: Must comply "Path of Travel" requirements and CBC Section 11B-404.2.5.
- H. On all exterior doors exposed to weather (No cover) provide Rain Guard full width of door.

2.10 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.11 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 EXECUTION

3.1 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

3.2 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.3 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

3.4 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications:
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights:
 - 1. Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - a. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - b. Where indicated to comply with accessibility requirements, CBC Section 11B-309.4 for mounting heights, and/or comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - c. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Section 07 92 00: Joint Sealants.
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.5 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.6 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.

3.7 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of

owner occupancy.

3.8 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.9 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

3.10 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should 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 and functionality.

HARDWARE GROUP NO. 01

For use on Door #(s):

A140-1

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|------------------|----------------------------|--------|-----|
| 1 | EA | CONT. HINGE | 112XY | 313AN | IVE |
| 1 | EA | PANIC HARDWARE | CDSI-PA-AX-35A-L-NL-360-06 | 313 | VON |
| 1 | EA | RIM CYLINDER | 20-057 ICX | 643e | SCH |
| 1 | EA | MORTISE CYLINDER | 20-061 ICX XQ11-948 36-083 | 643e | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 622 | SCH |
| 1 | EA | CONCEALED CLOSER | 2030 BUMP WMS | 693 | LCN |
| 1 | EA | THRESHOLD | THRESHOLD AS DETAILED | | |
| 1 | EA | DOOR SWEEP | 39D | D | ZER |

PERIMETER SEAL BY DOOR/FRAME MANUFACTURER

HARDWARE GROUP NO. 02

For use on Door #(s):

A140-2

Provide each PR door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-----|----|------------------|----------------------------------|--------|-----|
| 2 | EA | CONT. HINGE | 112XY | 313AN | IVE |
| 1 | EA | PANIC HARDWARE | CDSI-PA-AX-3549A-L-DT-06-LBL | 313 | VON |
| 1 | EA | PANIC HARDWARE | CDSI-PA-AX-3549A-L-NL-360-06-LBL | 313 | VON |
| 1 | EA | RIM CYLINDER | 20-057 ICX | 643e | SCH |
| 2 | EA | MORTISE CYLINDER | 20-061 ICX XQ11-948 36-083 | 643e | SCH |
| 3 | EA | FSIC CORE | 23-030 EV29 T | 622 | SCH |
| 2 | EA | CONCEALED CLOSER | 2030 BUMP WMS | 693 | LCN |
| 1 | EA | THRESHOLD | THRESHOLD AS DETAILED | | |
| 2 | EA | DOOR SWEEP | 39D | D | ZER |

PERIMETER SEAL BY DOOR/FRAME MANUFACTURER

PBK Architects
Project No. 20190

B600 College Center Expansion
Imperial Community College District

HARDWARE GROUP NO. 03

For use on Door #(s):

A140-3

Provide each SGL door(s) with the following:

| QTY | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|-------------------------------|-------------|----------------|--------|-----|
| HARDWARE BY DOOR MANUFACTURER | | | | |

HARDWARE GROUP NO. E1

For use on Door #(s):

A106-1 A112-1 A113-1

Provide each SGL door(s) with the following:

| QTY | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|--------------------|-------------|----------------|--------|-----|
| EXISTING TO REMAIN | | | | |

END OF SECTION 08 71 00

SECTION 08 80 00 GLAZING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 1. Float glass.
 2. Tempered glass.
 3. Insulated glass.
 4. Glazing sealants.
 5. Accessories necessary for a complete installation.

1.3 DEFINITIONS

- A. Glass Thickness: Indicated by thickness designations in millimeters according to ASTM C 1036.
- B. Interspace: Space between lites of an insulating glass unit.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design glass panels including comprehensive engineering analysis by a qualified professional engineer lawfully licensed in the State of California, using performance requirements and design criteria indicated.
- B. Installed Glazing: Design glazing systems to withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- C. Structural Performance:
 1. Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the CBC and ASTM E 1300:
 - a. Design Wind Pressures: Indicated on Structural Drawings.
 - b. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings:
 - 1) Wind Design Data: As indicated on Drawings.
 - 2) Basic Wind Speed: 104 mph.
 - 3) Importance Factor: 1.0.
 2. Exposure Category: D.
 3. Design Snow Loads: Indicated on Drawings.
 4. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
 5. Maximum Lateral Deflection: For glass supported on all four edges, limit center of glass deflection at design wind pressure to not more than 1/50 times the short side length or 1 inch (25 mm), whichever is less.

- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties:
 - 1. Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - a. For monolithic glass lites, properties are based on units with lites 6 mm thick.
 - b. For insulating glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - c. U-Factors: Center of glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
 - d. Solar Heat Gain Coefficient and Visible Transmittance: Center of glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 - e. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

1.5 SUBMITTALS

- A. Product Data: Technical data for each type of product including recommended installation and cleaning procedures.
- B. Glass Samples: For each type of glass required. Prepare samples from same material to be used for Work.
- C. Glazing Schedule: List glass types and thickness for each size opening and location. Use same designations indicated on Drawings.
- D. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Product Certificates:
 - 1. Submit glass product certificates required by Code:
 - a. Glass Manufacturer Certificate: The glass manufacturer shall submit a letter certifying it has reviewed the glazing details proposed for the project, including the use of gaskets and sealants, and that each product furnished is recommended for the application shown and compliance with the Code.
- F. Thermal Stress and Wind Load Analyses:
 - 1. Submit the following from the glass manufacturer:
 - a. Thermal stress analysis for each exterior glass unit type, each building elevation. The analysis shall clearly indicate the expected service temperature ranges and the effects of partial and full shading on the glass:
 - 1) Attach to the thermal stress analysis a statement from the glass manufacturer that based upon this analysis that the resulting thermal stresses will not reduce the specified statistical probability of breakage.
 - 2. Wind load analysis for each glass unit type, each building elevation. The analysis shall indicate the statistical probability of breakage at the design wind pressure does not exceed the specified statistical probability of breakage.
- G. Product Test Reports:
 - 1. Submit test reports for insulating glass and glazing sealants, for tests performed by a qualified testing agency:
 - a. Glazing Sealants: Provide test reports based on testing current sealant

- formulations within previous 36 month period.
- c. Glazing Sealants: Preconstruction adhesion and compatibility test report.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. Comply with applicable requirements of the CBC for glazing.
 2. Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies:
 - a. As a minimum provide Category II materials complying with testing requirements in 16 CFR 1201 (Consumer Product Safety Commission *Safety Standard for Architectural Glazing Materials*, published in the Code of Federal Regulations) and ANSI Z97.1.
 - d. Permanently mark safety glass with certification label of Safety Glazing Certification Council.
 3. Insulating Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
 4. Comply with published recommendations of glass product organizations:
 - a. GANA: Glazing Manual.
 - e. IGMA: SIGMA TM-3000 Vertical Glazing Guidelines.
 - f. GANA: Laminated Glazing Reference Manual.
 - g. AAMA: AAMA GDSG-1 Glass Design for Sloped Glazing.
 - h. AAMA: TIR A7 Sloped Glazing Guidelines.
 - i. IGMA for Sloped Glazing: IGMA TB-3001 Guidelines for Sloped Glazing.
 - j. IGMA for Insulating Glass: SIGMA TM-3000 North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use.
 5. Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated:
 - a. Minimum Glass Thickness for Exterior Lites: 1/4 inch (6 mm).
 - k. Thickness of Tinted Glass: Provide same thickness for each tint color indicated.
 6. Where annealed float glass is indicated, provide annealed float glass, heat strengthened float glass, or fully tempered float glass necessary to comply with performance requirements:
 - a. Where heat strengthened float glass is indicated, provide heat strengthened float glass or fully tempered float glass necessary to comply with performance requirements.
 - l. Where fully tempered float glass is indicated, provide fully tempered float glass.
- B. Manufacturer Qualifications for Insulating Glass Units with Sputter Coated, Low E Coatings: Insulating glass manufacturer who is approved and certified by coated glass manufacturer.
- C. Installer Qualifications, Glazer: Experience entity having minimum 5 years documented experience and who employs glass installers certified under the National Glass Association's Certified Glass Installer Program.
- D. Installer Qualifications, Decorative Film: Experience entity having minimum 5 years documented experience in the installation of glass films.
- E. Source Limitations for Glass and Glass Accessories: Obtain each type of glass and glass accessories from a single source.
- F. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- G. Sealant Testing Agency Qualifications: An independent testing agency qualified according to

ASTM C 1021 to conduct the testing indicated.

- H. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
- I. Install glazing in mockups specified to match glazing systems required for Project, including glazing methods:
 - 1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- J. Preconstruction Adhesion and Compatibility Testing:
 - 1. Test each glass product, tape sealant, gasket, glazing accessory, and glass framing member for adhesion to and compatibility with elastomeric glazing sealants:
 - a. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - m. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - n. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - o. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 - p. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.
- K. Pre-installation Conference: Conduct conference at site.

1.7 WARRANTY

- A. Written warranty, executed by glass manufacturer agreeing to repair or replace **glass** units that fail in materials and workmanship or deteriorate within warranty period. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to decorative glass manufacturer's published instructions:
 - 1. Warranty Period: Five (5) years from date of Substantial Completion.
- B. Written warranty signed by manufacturer in which glass manufacturer agrees to replace **coated glass** units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating:
 - 1. Warranty Period: Ten (10) years from date of Substantial Completion.
- C. Written warranty signed by manufacturer in which manufacturer agrees to replace **insulating glass** units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass:
 - 1. Warranty Period: Ten (10) years from date of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage

to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

- B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by manufacturer.
- D. Exercise exceptional care to prevent edge damage to glass, and damage/deterioration to coating on glass.
- E. Comply with insulating glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1. Glass:
 - a. PPG Industries
 - b. Cardinal Glass Industries.
 - c. Guardian Industries Corp.
 - d. Pilkington North America.
- B. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Comply with ASTM 1300 for design load resistance of glass type, thickness, dimensions and maximum lateral deflection of support glass.
 - 2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 - 3. Glass thicknesses listed are minimum.
- C. Thermal and Optical Performance: Provide glass products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
 - 4. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 - 5. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 - 6. Solar Optical Properties: Comply with NFRC 300 test method.
- C. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- D. Ultraclear Float Glass: ASTM C 1036, Type I, Class I (clear), Quality-Q3.

- E. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.
- F. Fully Tempered Float Glass:
 - 1. ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3:
 - a. Fabrication Process: By horizontal (roller hearth) process with roll wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- G. Heat Strengthened Float Glass:
 - 1. ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3:
 - a. Fabrication Process: By horizontal (roller hearth) process with roll wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- H. Pyrolytic Coated, Low Maintenance Glass: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.
 - a) .
- I. Adhered Backing:
 - 1. Adhered scrim backing to ceramic coated surface; provide backed units identical to materials which, while possibly developing cracks and fissures, show no shear nor develop any openings large enough for the unobstructed penetration of 3 inch diameter sphere when tested by approved independent testing laboratory:
 - a. Mount test specimens consisting of 3 glass assemblies, 34" x 76" (plus zero or minus 3/16 inch), for testing as specified in ANSI Z-97.1.
 - q. Expose specimens to 100 cycles of the following conditions:
 - 1) 1 hour at 0 degrees F, ambient humidity.
 - 2) 3 hours increase from 0 degrees F to 140 degrees F, 95 to 100 percent relative humidity.
 - 3) 1 hour at 140 degrees F, 95 to 100 percent relative humidity.
 - 4) 3 hours decrease from 140 degrees F to 0 degrees F, ambient humidity.
 - r. Break glass by springloaded prick punch at midpoint of either vertical edge.
 - s. After breaking glass, subject it to pressure of 4 lbf per sq. ft. for 5 minutes to simulate wind load.
 - t. Inorganic Opacifier: Provide polyethylene opacifier where no insulation and other backing material is applied directly to spandrel glass. Use polyester where direct attachment does occur.
 - u. Fallout Resistance: Provide spandrel units identical to those passing fallout resistance test for spandrel glass specified in ASTM C 1048.
- J. Silicone Coated Spandrel Glass: ASTM C 1048, Type I, Condition C, Quality-Q3.

2.2 INSULATING GLASS

- A. Factory assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
- B. Performance Properties:
 - 1. Basis of Design Product: PPG industries, Tint : Solarbronze (warm-bronze)
 - 2. Overall Unit Thickness: 1 inch (25 mm).
 - 3. Minimum Thickness of Each Glass Lite: 1/4 inch (6 mm).
 - 4. Outdoor Lite: Fully tempered float glass.
 - 5. Interspace Content: Air .
 - 6. Indoor Lite: Fully tempered float glass.

7. Safety glazing required.
- C. Sealing System:
 1. Dual seal, with polyisobutylene and silicone primary and secondary sealants:
 - a. Spacer: Aluminum with black, color anodic finish. Thermally broken aluminum.
 - v. Manufacturers: Subject to compliance with requirements, provide products by Technoform Glass Insulation NA, Inc.
 - w. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.3 GLAZING ACCESSORIES

- A. Compatibility: Provide glazing sealants compatible with one another and with other materials in contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of service and application, demonstrated by sealant manufacturer based on testing and field experience.
- B. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
- C. Colors of Exposed Glazing Sealants: Selected by Architect.
- D. Glazing Sealant - Neutral curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT:
 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Dow Corning Corporation.
 - x. GE Construction Sealants; Momentive Performance Materials Inc.
 - y. May National Associates, Inc.; a subsidiary of Sika Corporation.
 - z. Pecora Corporation.
 - aa. Sika Corporation.
- E. Glazing Sealant - Neutral curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT:
 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. BASF Corporation; Construction Systems.
 - bb. Dow Corning Corporation.
 - cc. GE Construction Sealants; Momentive Performance Materials Inc.
 - dd. May National Associates, Inc.; a subsidiary of Sika Corporation.
 - ee. Pecora Corporation.
 - ff. Polymeric Systems, Inc.
 - gg. Sika Corporation.
- F. Glazing Sealant - Neutral curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT:
 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Bostik, Inc.
 - hh. Dow Corning Corporation.
 - ii. GE Construction Sealants; Momentive Performance Materials Inc.
 - jj. May National Associates, Inc.; a subsidiary of Sika Corporation.
 - kk. Polymeric Systems, Inc.
 - ll. Schnee-Morehead, Inc., an ITW company.
 - mm. Sika Corporation.

- G. Glazing Sealant - Acid curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. BASF Corporation; Construction Systems.
 - nn. Bostik, Inc.
 - oo. Dow Corning Corporation.
 - pp. GE Construction Sealants; Momentive Performance Materials Inc.
 - qq. May National Associates, Inc.; a subsidiary of Sika Corporation.
 - rr. Pecora Corporation.
 - ss. Polymeric Systems, Inc.
 - tt. Schnee-Morehead, Inc., an ITW company.
 - uu. Sika Corporation.
- H. Glazing Sealants for Fire rated Glazing Products - Neutral curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Dow Corning Corporation.
 - vv. GE Construction Sealants; Momentive Performance Materials Inc.
 2. Colors of Exposed Glazing Sealants: Selected by Architect.
- I. Back Bedding Mastic Glazing Tapes:
1. Preformed, butyl based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 - a. AAMA 804.3 tape, where indicated.
 - b. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - c. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- J. Expanded Cellular Glazing Tapes:
1. Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.
- K. Miscellaneous Glazing Accessories:
1. Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with proven record of compatibility with surfaces contacted in installation:
 - a. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
 - b. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
 - c. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 - d. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

- e. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- f. Perimeter Insulation for Fire Resistive Glazing: Product approved by testing agency listed and labeled fire resistant glazing product with which it is used for application and fire protection rating indicated.

2.4 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements:
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components:
 - a. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.
 - 2. Edge and Surface Conditions: Comply with the recommendations of *AAMA Structural Properties of Glass* for clean cut edges, except comply with manufacturer's recommendations.
 - 3. Exposed Glass Edges and Surface Condition: Finish edges flat with an arrissed edge profile (small bevel of uniform width not exceeding 1.5 mm at an angle of approximately 45 degrees to the surface of the glass) with polished (surface is reflective in appearance similar to the major surface of the glass) surface.
- B. Cutting: Wheel cut or sawed edges and seamed at manufacturer's option. For site cut glass, provide glass 2 inches (50.8 mm) larger than required in both dimensions to facilitate cutting of clean cut edges without the necessity of seaming or nipping. Do not cut, seam, nip or abrade heat treated glass.
- C. Butt Glazing: Clean cut or flat grind vertical edges of butt glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- D. Edges: Grind smooth and polish exposed glass edges and corners.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

- A. Environmental Limitations:
 - 1. Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes:
 - a. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 degrees F (4.4 degrees C).
- B. Field Measurements: Verify actual dimensions of openings and construction contiguous with decorative glass by field measurements before fabrication.

3.2 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

3.3 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.4 PREPARATION

- A. Clean glazing channels and framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates:
 - 1. Comply with manufacturer instructions for wiping of surfaces immediately before application of primers.
 - 2. Wipe metal surfaces with IPA (isopropyl alcohol) unless otherwise required by compatibility and adhesion testing results.
- B. Inspect each piece of glass immediately before installation. Do not install pieces improperly sized or with damaged edges, scratches, abrasion, or evidence damage. Remove labels from glass immediately after installation.
- C. Examine glazing units to locate exterior and interior surfaces. Label or mark units so exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.
- D. Seal vent (breather or capillary) tubes in insulating glass units in accordance with insulating glass manufacturer written recommendations.

3.5 GLAZING

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm):
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets

- and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8 inch (3 mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement:
1. Square cut wedge shaped gaskets at corners and install gaskets as recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.
- K. Tape Glazing:
1. Position tapes on fixed stops so that, when compressed by glass, the exposed edges are flush with or protrude slightly above sightline of stops:
 - a. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make tapes fit opening.
 - b. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
 - c. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
 - d. Do not remove release paper from tape until right before each glazing unit is installed.
 - e. Apply heel bead of elastomeric sealant.
 - f. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
 - g. Apply cap bead of elastomeric sealant over exposed edge of tape.
- L. Gasket Glazing (Dry):
1. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation:
 - a. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
 - b. Installation with Drive in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
 - c. Installation with Pressure Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure glazing stops, applying pressure uniformly to

compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

- d. Install gaskets to protrude past face of glazing stops.

M. Sealant Glazing (Wet):

1. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance:
 - a. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
 - b. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

N. Erection Tolerances:

1. Maximum Deviation from Vertical: 1/8 inch in any story and 1/4 inch in any 45 foot run.
2. Maximum Deviation from Horizontal: 1/8 inch in any 30 foot run.
3. Maximum Deviation from True Alignment: 1/32 inch for any two (2) abutting units. Allow no edge projections.
4. Maximum Joint Gap: 1/32 inch.

O. Insulating-Glass Unit(s)

1. Double Glazed Tinted Solar Control Insulating Glass Unit Solarban® 60 on Solexia® 6mm (2) | Air 1/2" (12.7mm) | Clear 6mm:
 - a. Conformance: ASTM E 2190
 - b. Outdoor Lite: Solexia® Tinted Float Glass as manufactured by Vitro Architectural Glass:
 - 1) Conformance: ASTM C 1036, Type 1, Class 2, Quality q3.
 - 2) Glass Thickness: 6mm (1/4")
 - 3) Magnetic Sputter Vacuum Deposition Coating (MSVD): ASTM C 1376.
 - 4) Coating: Solarban® 60 on Surface # 2
 - 5) Heat-Treatment: Heat-strengthened, ASTM C 1048, Kind HS, Tempered; ASTM C 1048, Kind FT; Safety Glazing meets ANSI Z97.1 and CPSC 16CFR-1201
 - c. Interspace Content: Air 1/2" (12.7mm)
 - d. Indoor Lite:
 - 1) Clear float glass as manufactured by Vitro Architectural Glass:
 - a) Conformance: ASTM C 1036, Type 1, Class 1, Quality q3.
 - b) Heat-Treatment: Tempered; ASTM C 1048, Kind FT; Safety Glazing meets ANSI Z97.1 and CPSC 16CFR-1201.
 - c) Glass Thickness: 6mm (1/4")
 - e. Performance Requirements:
 - 1) Visible Light Transmittance: 61 percent minimum.
 - 6) Winter Nighttime U-Factor: 0.29 (Btu/hr*ft²*°F) maximum.
 - 7) Summer daytime U-Factor: 0.27 (Btu/hr*ft²*°F) maximum.
 - 8) Shading Coefficient: 0.37 maximum.
 - 9) Solar Heat Gain Coefficient: 0.32 maximum.
 - 10) Outdoor Visible Light Reflectance: 9 percent maximum.

3.6 GLAZING SCHEDULE

A. GLASS MATERIALS

1. Float Glass: Provide float glass based glazing unless noted otherwise.
annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
 - a. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and FT.
 - b. Fully Tempered Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria.
 - c. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality-Q3, color and performance characteristics as indicated.
 - d. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. INSULATING GLASS UNITS

1. Insulating Glass Units Manufacturers: Basis of design
 - a. PPG Industries, Inc: www.ppgideascales.com.
2. Insulating Glass Units: Types as indicated.
 - a. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 - b. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 - c. Spacer Color: Aluminum.
 - d. Edge Seal:
 - e. Color: Black.
 - f. Purge interpane space with dry air, hermetically sealed.

C. BASIS OF DESIGN - INSULATING GLASS UNITS

1. Type: Insulating Glass Units: Vision glazing, with Low-E coating.
 - a. Applications: Exterior insulating glass glazing unless otherwise indicated.
 - b. Space between lites filled with argon.
 - c. Total Thickness: 1 inch.
 - d. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.29, nominal.
 - e. Visible Light Transmittance (VLT): 42 percent, nominal.
 - f. Solar Heat Gain Coefficient (SHGC): 0.32, nominal.
 - g. Glazing Method: Dry glazing method, gasket glazing.
 - h. Basis of Design - PPG Industries, Inc: www.ppgideascales.com.
 - i. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
 - 1) Tint: Solarbronze (warm-bronze).
 - j. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick.
 - 2) Low-E Coating: PPG Solarban 60 on #3 surface.
 - 3) Tint: Clear.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains:
 1. If contaminating substances come into contact with glass, remove substances

immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

PART 4 SCHEDULE

4.1 GLAZING SCHEDULE

- A. G-1 Insulated Glass: 1 inch (25 mm) sealed insulated unit consisting of an exterior lite of 1/4 inch (6 mm) low-e tinted tempered float glass, 1/2 inch gas filled air space, and 1/4 inch (6 mm) clear tempered float glass interior lite.

END OF SECTION 08 80 00

SECTION 09 21 16 GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 1. Gypsum Board.
 2. Reinforced Gypsum Board Sheathing (Tile Backer Board).
 3. Cementitious Backer Units.
 4. Accessories necessary for a complete installation.
- B. Related Sections:
 1. Section 05 50 00: Metal Fabrications.
 2. Section 06 10 00: Rough Carpentry.
 3. Section 08 11 13: Hollow Metal Doors and Frames.
 4. Section 08 31 13: Access Door and Frames.
 5. Section 09 30 00: Tiling.
 6. Section 09 90 00: Painting and Coating.

1.3 PERFORMANCE REQUIREMENTS

- A. Comply with manufacturer's load tables and the following design pressures and deflections:
 1. Stairs, Elevator Hoistways, and Vertical Shafts: 1/120 at 10 psf.
 2. Ground Floor Lobbies: 1/120 at 15 psf.
 3. Partitions Receiving Lath and Plaster, or Plaster Veneer: 1/360 at 15 psf.
 4. Partitions Receiving Monitors, Televisions, Heavy Audio/Visual Equipment: 1/360 at 15 psf.
 5. Typical Partitions: 1/240 at 5 psf.
 6. Other Partitions: 1/240 at 5 psf.
 7. Maximum Deflection:
 - a. L/240 at 5 lbf per sq. ft.
 - b. L/120 at 5 lbf per sq. ft.
 - c. L/120 at 7.5 lbf per sq. ft.
 - d. L/120 at 10 lbf per sq. ft.
- B. Fire Resistance Rated Assemblies: For fire resistance rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- C. STC Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.4 SUBMITTALS

- A. Product Data: Submit For each type of drywall including calculations for loadings and stresses of exterior walls and specially fabricated framing based on manufacturer's load tables.

- B. Shop Drawings: Indicate locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.
- C. Samples:
 - 1. Trim Accessories: Full size Sample in 12 inch (300 mm) long length for each trim accessory indicated.
 - 2. Textured Finishes: 12 inch by 12 inch (300 mm by 300 mm) for each textured finish indicated and on same backing indicated for Work.
- D. Calculations: Submit calculations verifying steel partition stud minimum base metal thickness and depth compliance with Code and ASTM C645 for height, load, and deflection.
- E. Evaluation Reports: ICC-ES reports for dimpled steel studs and runners and firestop tracks.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
 - a. CBC– Chapter 7, Fire Resistant Materials and Construction
 - b. CBC – Chapter 19A, Concrete
 - c. CBC – Chapter 25, Gypsum Board and Plaster.
 - 2. Division of the State Architect, Interpretation of Regulations (DSA-IR):
 - a. DSA-IR 25-3, Drywall Ceiling Suspension Conventional Construction-One Layer.
 - b. DSA-IR 25-2.13, Metal Suspension Systems for Lay in Panel Ceilings.
 - 3. Fire Resistance Rated Assemblies: For fire resistance rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
 - 4. Fire Resistance Rated Assemblies: For fire resistance rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. Single Source Responsibility:
 - 1. Wood Framing Members: Refer to drawing S0.03 Standard General Notes.
 - 2. Steel Framing Members: Obtain steel framing members from single manufacturer.
 - 3. Panel Products: Obtain each type of gypsum board and other panel products from single manufacturer.
 - 4. Finishing Materials: To the extent possible, obtain finishing materials from same manufacturer supplying gypsum board products. When not possible, obtain materials from manufacturer acceptable to gypsum board manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1. Gypsum Board.
 - 2. Cementitious Board:
 - a. USG Corporation; Durock Brand Cement Board.

- B. Gypsum Board - ASTM C 1396/C 1396M, applicable to type of gypsum board indicated and whichever is more stringent:
 - 1. Core - Use Type X throughout:
 - a. Thickness: 5/8 inch (15.9 mm).
 - b. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
 - 2. Ceiling Type - Manufactured for sag resistance:
 - a. Thickness: 1/2 inch (13mm).
 - b. Long Edges: Tapered.
 - 3. Moisture and Mold Resistant Type - Type X with moisture and mold resistant core and surfaces. Core:
 - a. Thickness: 5/8 inch (15.9 mm).
 - b. Long Edges: Tapered.

- C. Reinforced Gypsum Sheathing (Tile Backer Board) - ASTM C 1278/C 1278M, standard edges. Cellulose fiber reinforced panels may be used in lieu of cementitious board:
 - 1. Core and Thickness: 1/2 inch (12.7 mm) or 5/8 inch (15.9 mm) to match conditions, Type X.
 - 2. Long Edge: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

- D. Cementitious Backer Units - ANSI A118.9 and ASTM C 1288 or ASTM C 1325:
 - 1. Thickness: 1/2 inch (12.7 mm) and 5/8 inch (15.9 mm) to match conditions, Type X
 - 2. Long Edges: Standard.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

- E. Interior Trim - ASTM C 1047, galvanized or aluminum coated steel sheet, rolled zinc, plastic, or paper faced galvanized steel sheet:
 - 1. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC Bead: J shaped; exposed long flange receives joint compound.
 - d. L Bead: L shaped; exposed long flange receives joint compound.
 - e. U Bead: J shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.

 - 2. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Pittcon Industries.
 - b. Fry Reglet Corp.
 - c. Gordon, Inc.

- F. Continuous Corner - Extruded Aluminum, continuous integral fin for surface contact with gypsum board; 7/8 inch (22 mm) wide, tapered to edge; punched with holes staggered to accept screw fastening. Prime with corrosion resistant primer. Provide Pittcon Softforms (Basis of Design) or Schluter:
 - 1. Subject to compliance with requirements, provide basis of design or comparable by one of the following:
 - a. Pittcon Industries.
 - b. Fry Reglet Corporation.
 - c. Schluter.

- G. Joint Treatment - ASTM C 475/C 475M:
1. Joint Tape:
 - d. Interior Gypsum Board: USG Sheetrock Brand Paper Tape.
 - d. Cementitious Board: USG Durock Tape.
 2. Joint Compound:
 - a. Gypsum Board – Prefilling - At open joints, rounded or beveled panel edges, and damaged surface areas, use setting type taping compound: USG Sheetrock Brand Easy Sand Setting-Type Joint Compound:
 - 1) Embedding and First Coat - For embedding tape and first coat on joints, fasteners, and trim flanges, use setting type taping compound. USG Sheetrock Brand All Purpose Joint Compound:
 - a) Use setting type compound for installing paper faced metal trim accessories: USG Sheetrock Brand All Purpose Joint Compound.
 - 2) Fill Coat: For second coat, use setting type, sandable topping compound: USG Sheetrock Brand Topping Joint Compound.
 - 3) Finish Coat: For third coat, use setting type, sandable topping compound: USG Sheetrock Brand Topping Joint Compound.
 - 4) Skim Coat: For final coat of Level 4 finish, use setting type, sandable topping compound: USG Sheetrock Brand Topping Joint Compound.
 - b. Cementitious Units: USG Sheetrock Brand Easy Sand Setting-Type Joint Compound.
 - c. Tile Backing Panels: USG Sheetrock Brand Easy Sand Setting-Type Joint Compound.
 - d. Water Resistant Gypsum Backing Board: Use setting type taping compound and setting-type, sandable topping compound: USG Sheetrock Brand Easy Sand Setting-Type Joint Compound.
- H. Auxiliary Gypsum Materials - Comply with referenced installation standards and manufacturer's written recommendations:
1. Steel Drill Screws: ASTM C 1002, use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 2. Sound Attenuation Blankets:
 - a. ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool:
 - 1) Fire Resistance Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 3. Acoustical Sealant:
 - a. Nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90:
 - 1) USG Corporation; Sheetrock Brand Acoustical Sealant

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Environmental Limitations:
1. Comply with ASTM C840 for gypsum board manufacturer's written instructions, whichever are more stringent:
 - a. Do not install paper faced gypsum panels until installation areas are enclosed and conditioned.
- B. Room Temperatures: Maintain minimum 40 degrees F (4 degrees C). For adhesive

attachment and finishing of gypsum board, maintain minimum 50 degrees F (10 degrees C) for 48 hours before application and continuously after until dry. Do not exceed 95 degrees F (35 degrees C) when using temporary heat sources.

- C. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.
- D. Do not install panels that are wet, moisture damaged, and mold damaged:
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or blotchy surface contamination and discoloration.

3.2 EXAMINATION

- A. Examine areas and substrates including welded hollow metal frames, cast in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation after unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.4 INSTALLATION

- A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
- B. Gypsum Board Assemblies: Comply with requirements in ASTM C 840 applicable to framing installation.
- C. Sound Insulation: Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
- D. Gypsum Panels:
 - 1. Comply with ASTM C 840. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged:
 - a. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
 - b. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
 - c. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
 - d. Form control and expansion joints with space between edges of adjoining gypsum panels.

- e. Cover both faces of support framing with gypsum panels in concealed spaces, except in chases braced internally:
 - 1) Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - 2) Fit gypsum panels around ducts, pipes, and conduits.
 - 3) Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4 inch to 3/8 inch (6.4 mm to 9.5 mm) wide joints to install sealant.
 - f. Isolate perimeter of gypsum board applied to nonload bearing partitions at structural abutments, except floors. Provide 1/4 inch to 1/2 inch (6.4mm to 12.7mm) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
 - g. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- E. Gypsum Board:
- 1. Install interior gypsum board where indicated on drawings:
 - a. Single Layer Application:
 - 1) On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2) On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire resistance rated assembly, and minimize end joints. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - 3) Fastening Methods: Apply gypsum panels to supports with steel drill screws.
 - 2. Multilayer Application:
 - a. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - b. On Z shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 - c. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- F. Backing Panels:
- 1. Cementitious Backer Units: ANSI A108.11; install where indicated with 1/4 inch (6.4 mm) gap where panels abut other construction or penetrations. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.
- G. Trim Accessories:
- 1. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Attach trim according to manufacturer's written instructions:
 - a. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
 - b. Exterior Trim: Install in the following locations:
 - 1) Cornerbead: Use at outside corners.
 - 2) LC Bead: Use at exposed panel edges.

- c. Interior Trim - Install in the following locations:
 - 1) Cornerbead: Use at outside corners, unless otherwise indicated.
 - 2) Bullnose Bead: Use at outside corners.
 - 3) LC Bead: Use at exposed panel edges.
 - 4) L Bead: Use where indicated or necessary.
 - 5) U Bead: Use at exposed panel edges.

- H. Gypsum Board Finishing:
 - 1. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces:
 - a. Prefill open joints, rounded or beveled edges, and damaged surface areas.
 - b. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
 - c. Gypsum Board Finish Levels - Finish panels to levels indicated below and according to ASTM C 840:
 - 1) Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2) Level 2: Panels that are substrate for tile.
 - 3) Level 3: Surfaces be coated with drywall primer prior to final finishes. Heavy or medium texture finishes before final painting, or where heavy-grade wall coverings are to be applied as the final decoration. This level of finish is not recommended where smooth painted surfaces, or light to medium weight wall coverings as specified.
 - 4) Level 4: For surfaces receiving wall covering and flat paints.
 - 5) Level 5: For surfaces receiving gloss or semigloss paint and surfaces subjected to severe lighting. To be used in Kitchen areas and food service areas only.

- I. Installation Tolerances:
 - 1. Suspension System: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.
 - 2. Installation Tolerances, Suspension System: Install suspension systems level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

- B. Remove and replace panels that are wet, moisture damaged, and mold damaged:
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 21 16

SECTION 09 24 00 CEMENT PLASTERING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Exterior plasterwork (stucco).
 - 2. Metal framing and accessories.
 - 3. Metal lath and furring.
 - 4. Accessories necessary for a complete installation.
- B. Related Sections:
 - 1. Section 05 50 00: Metal Fabrications.
 - 2. Section 06 10 00: Rough Carpentry.
 - 3. Section 07 92 00: Joint Sealants.
 - 4. Section 09 21 16: Gypsum Board Assemblies.
 - 5. Section 09 90 00: Painting and Coating.

1.3 SUBMITTALS

- A. Product Data: Submit technical data for product and accessory, including construction details and material descriptions.
- B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Building Code:
 - a. Comply with applicable provisions of the CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
 - 1) CBC 2019, 2507.3 Attachment requirements.
 - 2. Fire Resistance Ratings: Where indicated, provide cement plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E 119 by a qualified testing agency.
- B. Pre-installation Conference: Conduct conference at site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cementitious materials in original packages, containers, or bundles, labeled with manufacturer's name, product brand name, and lot number.
- B. Store materials inside under cover, and keep them dry and protected against damage from weather, moisture, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturers are subject to compliance with requirements; provide products of one of the following:
1. Metal Lath and Accessories:
 - a. Alabama Metal Industries.
 - b. CEMCO.
 - c. ClarkDietrich Building Systems.
 - d. Marino/WARE.
 - e. Phillips Manufacturing.
 2. Wire Fabric Lath:
 - a. Davis Wire.
 - b. Jaenson Wire Company.
 - c. Keystone Steel and Wire Co.
 - d. K-Lath.
 3. Plastic Accessories:
 - a. Alabama Metal Industries.
 - b. Phillips manufacturing.
 - c. Plastic Components.
 - d. Vinyl Corp.
 4. Ready Mixed Finish Coat Plaster:
 - a. Omega Products International.
 - b. California Stucco Product.
 - c. El Rey Solutions.
 - d. Florida Stucco.
 - e. Quikrete.
 - f. Shamrock Stucco.
- B. Metal Lath:
1. Expanded Metal Lath:
 - a. ASTM C 847, cold rolled carbon steel sheet with ASTM A 653/A 653M, G60 (Z180), hot dip galvanized zinc coating:
 - 1) Diamond Mesh Lath: Self furring, 3.4 lb/sq. yd. (1.8 kg/sq. m).
 - 2) Comply with DSA IR 25-4 for the installation of Self-Furring Metal Lath.
 2. Building Wrap:
 - a. Spun-bounded high density polyethylene fibers. No binders or fillers. As manufactured by: Dupont Tyvek Commercial Wrap or approved equal.
- C. Accessories:
1. Comply with ASTM C 1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required:
 - a. Metal Accessories:
 - 1) Foundation Weep Screed: Fabricated from hot dip galvanized steel sheet, ASTM A 653/A 653M, G60 (Z180) zinc coating.
 - 2) Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot dip galvanized-zinc coating.
 - 3) Outside Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot dip galvanized zinc coating.
 - 4) Cornerbeads - Fabricated from zinc or zinc coated (galvanized) steel:
 - a) Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
 - 5) Casing Beads: Fabricated from zinc or zinc coated (galvanized) steel; square edged style; with expanded flanges.

- D. Miscellaneous Materials:
 - 1. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
 - 2. Fiber for Base Coat: Alkaline resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in cement plaster.
 - 3. Bonding Compound: ASTM C 932.
 - 4. Fasteners for Attaching Metal Lath to Substrates: ASTM C 1063.
 - 5. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475 inch (1.21 mm) diameter unless otherwise indicated.

- E. Plaster Materials:
 - 1. Portland Cement - ASTM C 150/C 150M, Type I or II:
 - a. Color for Finish Coats: Match existing.
 - 2. Colorants for Job Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color selected by Architect.
 - 3. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
 - 4. Sand Aggregate - ASTM C 897:
 - a. Color for Job Mixed Finish Coats: White.
 - 5. Exposed Aggregates for Finish Coats: Match existing.
 - 6. Ready Mixed Finish Coat Plaster:
 - a. Mill mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
 - 1) Color: Selected by Architect.

2.2 PLASTER MIXES

- A. Comply with ASTM C 926 for applications indicated:
 - 1. Fiber Content: Add fiber to base coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. (0.6 kg of fiber/cu. m) of cementitious materials.

- B. Base Coat Mixes for Use over Metal Lath:
 - 1. Scratch and brown coats for three coat plasterwork:
 - a. Portland Cement Mix:
 - 1) Scratch Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - 2) Brown Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

- C. Job Mixed Finish Coat Mixes:
 - 1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.

- D. Factory Prepared Finish Coat Mixes: For ready mixed finish coat plasters or acrylic based finish coatings, comply with manufacturer's written instructions.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Comply with applicable requirements of ASTM C 926.

- B. Environmental Requirements: Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after plaster application.
- C. Cold Weather Requirements: Provide heat and protection, temporary or permanent, as required to protect each coat of plaster from freezing for at least 24 hours after application. Distribute heat uniformly to prevent concentration of heat on plaster near heat sources; provide deflection or protective screens.
- D. Warm Weather Requirements: Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial. Apply and cure plaster as required by climatic and job conditions to prevent dry out during cure period. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.
- E. Ventilation: Provide natural or mechanical means of ventilation to properly dry interior spaces after portland cement plaster has cured.
- F. Exterior Plasterwork:
 - 1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
 - 2. Apply plaster when ambient temperature is greater than 40 degrees F (4.4 degrees C).
 - 3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.
- G. Protect contiguous Work from soiling and moisture deterioration caused by plastering. Provide temporary covering and take precautions necessary to minimize spattering of plaster on adjacent Work.
- H. Factory Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

3.2 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Proceed with installation after correcting unsatisfactory conditions.

3.3 PREPARATION

- A. Protect adjacent Work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Prepare smooth, solid substrates for plaster according to ASTM C 926.

3.4 INSTALLATION

- A. Metal Lath:
 - 1. Install according to ASTM C 1063:
 - a. Partition Framing and Vertical Furring: Flat diamond mesh lath.
 - b. Horizontal Framing: Flat diamond mesh lath.
- B. Accessories:
 - 1. Install according to ASTM C 1063 and at locations indicated on Drawings:

- a. Reinforcement for External (Outside) Corners:
 - 1) Install cornerbead at exterior locations.

3.5 PLASTER APPLICATION

- A. Comply with ASTM C 926:
 - 1. Do not deviate more than plus or minus 1/4 inch in 10 feet (6 mm in 3 m) from a true plane in finished plaster surfaces when measured by a 10-foot (3-m) straightedge placed on surface.
 - 2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
 - 3. Provide plaster surfaces ready to receive field applied finishes indicated.
- B. Flat Surface Tolerances: Do not deviate more than plus or minus 1/8 inch in 10 feet (3 mm in 3 m) from a true plane in finished plaster surfaces, measured by a 10 foot (3m) straightedge placed at any location on surface.
- C. Walls; Base Coat Mixes for Use over Metal Lath:
 - 1. For scratch and brown coats, for three coat plasterwork with 3/4 inch (19 mm) total thickness:
 - a. Portland cement mixes.
- D. Plaster Finish Coats: Apply to provide dash finish.
- E. Concealed Exterior Plasterwork: Where plaster application is used as a base for adhered finishes, omit finish coat.

3.6 PLASTER REPAIRS

- A. Repair or replace Work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.
- B. Cut, patch, replace, repair, and point up plaster as necessary to accommodate other Work. Repair cracks and indented surfaces. Point up finish plaster surfaces around items that are built into or penetrate plaster surfaces. Repair or replace Work to eliminate blisters, buckles, check cracking, dry outs, efflorescence, excessive pinholes, and similar defects. Repair or replace work as necessary to comply with required visual effects.

3.7 TOLERANCES

- A. Maximum Variation from True Lines and Levels: 1/8 inch in 10 feet (3mm in 3 m).
- B. Maximum Variation from True Position: 1/8 inch (3mm).

3.8 CLEANING AND PROTECTION

- A. Remove temporary protection and enclosure of Work after plastering is complete. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.
- B. Remove unused materials, containers, equipment, and plaster debris.

- C. Protect plaster and maintain conditions ensuring finished plaster is without damage or deterioration at time of Substantial Completion.

END OF SECTION 09 24 00

SECTION 09 30 00 TILING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Ceramic mosaic tile.
 - 2. Porcelain tile.
 - 3. Accessories required for indicated installation.
- B. Related Sections:
 - 1. Section 09 21 16: Gypsum Board Assemblies.
- C. Reference Standards:
 - 1. American National Standards Institute (ANSI).
 - 2. Tile Council of North America (TCNA):
 - a. Reference TCNA method numbers for tile assemblies.
 - 3. Comply with Health Department requirements for tile in food service facilities

1.3 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction:
 - 1. Level Surfaces: Minimum 0.6.
 - 2. Ramp Surfaces: Minimum 0.8.
- B. Ceramic Tile Flooring should be stable, firm, and slip resistant, pursuant to CBC Section 11B-302.1.

1.4 SUBMITTALS

- A. Product Data: Technical data including data sheets, installation recommendation, and recommended joint widths.
- B. Shop Drawings - Show locations of each type of tile and tile pattern:
 - 1. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples - Submit samples showing full range of color and texture variations expected:
 - 1. Full size units of each type and composition of tile and for each color and finish required.
 - 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required; minimum 12 inches (300 mm) square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed work.
 - 3. Waterproof membrane in 6 x 6-inch sample.
 - 4. Thresholds in 6 inch (150 mm) lengths.
- D. Test Reports: Submit test reports from qualified independent testing laboratory indicating

and interpreting test results relative to compliance of tile products with requirements for slip resistance.

- E. Maintenance Instructions: Submit maintenance instructions for each type of product specified.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Building Code: Comply with applicable requirements for the CBC for interior finishes.
 - 2. Surface Burning Characteristics - ASTM E84; identify products with appropriate markings of applicable testing agency:
 - a. Flame Spread Index: 25 or less.
 - b. Smoke Developed Index: 450 or less.
 - 3. Accessibility Requirements - Comply with applicable requirements:
 - a. Americans with Disabilities Act of 1990, as amended:
 - 1) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design
 - b. CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
 - 1) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
- B. Source Limitations for Tile: Obtain tile of same type and color or finish from one source or producer. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- D. Source Limitations for Other Products:
 - 1. Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
 - a. Stone thresholds.
 - b. Waterproofing.
 - c. Joint sealants.
 - d. Metal edge strips.
- E. Mockups:
 - 1. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
 - a. Build mockup of each type of floor tile installation.
 - b. Build mockup of each type of wall tile installation.
 - c. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 WARRANTY

- A. Warrant the work specified, including backer boards but not limited to, for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels

intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided. Store liquid materials in unopened containers and protected from freezing.
- C. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

PART 2 PRODUCTS

2.1 MATERIALS

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated. Provide tile complying with Standard grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting - For factory mounted tile, provide back or edge mounted tile assemblies as standard with manufacturer unless otherwise indicated:
 - 1. Where tile is indicated for installation on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.2 TILE PRODUCTS

- A. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1. Ceramic Tile:
 - a. Crossville, Inc.
 - b. Daltile.
 - c. Or approved equal.
 - 2. Porcelain Tile:
 - a. American Olean
 - b. Crossville, Inc.
 - c. Daltile.
 - d. Or approved equal.
- B. Porcelain Floor Tile - Unglazed tile with through color:
 - 1. Basis of Design Product/Manufacturer: **Daltile**
 - 2. Finish: Unpolished and light polished finish (50% unpolished / 50% light polished)
 - 3. Module Size: 8 inches, square.
 - 4. Thickness: 1/2 inch (12.7 mm).
 - 5. Colors: Match existing, Grey
 - 6. Tile Trims and Shapes: Select tile that has the required trim in matching colors.

7. Grout Color: Match existing.
- C. Ceramic Floor Tile - Factory mounted unglazed ceramic mosaic tile:
1. Basis of Design Product/Manufacturer: **Daltile**
 2. Type: Refer to finish schedule.
 3. Module Size: 8 inches, square.
 4. Thickness: 1/4 inch (6.4 mm).
 5. Face: Plain with cushion edges.
 6. Surface: Smooth, without or slip resistant, with abrasive admixture.
 7. Tile Color and Pattern: Match existing, Grey
 8. Grout Color: Match existing,
- D. Ceramic Wall Tile - Glazed tile:
1. Basis of Design Product/Manufacturer: **Daltile**
 2. Composition: Impervious natural clay tile.
 3. Module Size: 6 inches, square.
 4. Thickness: 5/16 inch (8 mm).
 5. Face: Plain with cushion edges.
 6. Surface: Matte glazed.
 7. Base: Six (6) inch high x Six (6) inch wide ceramic tile cove base to match wall tile.
 8. Tile Color and Pattern: Match existing, white and grey accent
 9. Grout Color: Selected by Architect unless noted otherwise.
 10. Trim Units - Coordinated with sizes and coursing of adjoining flat tile where applicable matching characteristics of adjoining flat tile. Provide shapes selected from standard shapes:
 - a. Wainscot Cap for Thinset Mortar Installations: Surface bullnose, module size 1 inch by 1 inch (25.4 mm by 25.4 mm) or 2 inch by 1 inch (50.8 mm by 25.4 mm) or 2 inch by 2 inches (50.8 mm by 50.8 mm).
 - b. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
 - c. External Corners for Thinset Mortar Installations: Surface bullnose, module size 1 inch by 1 inch (25.4 mm by 25.4 mm) or 2 inch by 1 inch (50.8 mm by 25.4 mm) or 2 inch by 2 inches (50.8 mm by 50.8 mm).
 - d. Internal Corners: Cove, module size 1 inch by 1 inch (25.4 mm by 25.4 mm) or 2 inches by 1 inch (50.8 mm by 25.4 mm).
 - e. Internal Corners: Field-buttet square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.
 - f. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch (12.7 to 6.4 mm) across nominal 4 inch (100 mm) dimension.

2.3 WATERPROOF MEMBRANE

- A. Waterproof membrane recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fluid Applied Membrane - Liquid latex rubber or elastomeric polymer:
1. Basis of Design - **Laticrete 9235 Waterproofing Membrane:**
 - a. Subject to compliance with requirements, provide basis if design or comparable product by one of the following:
 - 1) Laticrete International, Inc.
 - 2) MAPEI Corporation.
 - 3) TEC; H.B. Fuller Construction Products Inc.
- C. Fabric Reinforced, Fluid Applied Membrane:

1. System consisting of liquid latex rubber or elastomeric polymer and continuous fabric reinforcement.
 - a. Basis of Design - **Laticrete 9235 Waterproofing Membrane** and reinforcing Fabric. Subject to compliance with requirements, provide basis if design or comparable product by one of the following:
 - 1) Laticrete International, Inc.
 - 2) MAPEI Corporation.
 - 3) Merkrete by Parex USA, Inc.
- D. Latex Portland Cement Waterproof Mortar:
 1. Flexible, waterproof mortar consisting of cement based mix and latex additive:
 - a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) C-Cure.
 - 2) MAPEI Corporation.
 - 3) TEC; H.B. Fuller Construction Products Inc.
- E. Liquid Latex Waterproofing/Crack Isolation Membrane:
 1. Single Component, self-curing, load bearing liquid rubber polymer that forms a flexible seamless combined waterproofing membrane and crack isolation membrane:
 - a. Basis of Design - **Hydroban by Laticrete International**. Subject to compliance with requirements, provide basis of design or comparable product by one of the following:
 - 1) Laticrete International, Inc.
 - 2) MAPEI Corporation.
 - 3) TEC; H.B. Fuller Construction Products Inc.

2.4 CRACK ISOLATION MEMBRANE

- A. Crack isolation membrane for standard performance and recommended by manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fabric Reinforced, Modified Bituminous Sheet – Self-adhering, modified bituminous sheet with fabric reinforcement facing; 0.040-inch (1 mm) nominal thickness:
 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Custom Building Products.
 - b. MAPEI Corporation.
- C. Fluid Applied Membrane - Liquid latex rubber or elastomeric polymer:
 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Custom Building Products.
 - b. Laticrete International, Inc.
 - c. MAPEI Corporation.
 - d. Merkrete by Parex USA, Inc.
 - e. TEC; H.B. Fuller Construction Products Inc.
- D. Fabric Reinforced, Fluid Applied Membrane - System consisting of liquid latex rubber or elastomeric polymer and fabric reinforcement:
 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Bonsal American, an Oldcastle company.
 - b. Bostik, Inc.
 - c. Custom Building Products.

- d. Laticrete International, Inc.
- e. MAPEI Corporation.
- f. Merkrete by Parex USA, Inc.

2.5 SETTING MATERIALS

- A. Dry Set Mortar (Thinset):
 - 1. Mortar Bed - Proportions of 1 part Portland Cement to 5 parts sand:
 - a. Portland Cement: ASTM C150, Type 1.
 - b. Sand: ASTM C144.
 - c. Water: Potable.
 - 2. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Custom Building Products.
 - b. Laticrete International, Inc.
 - c. MAPEI Corporation.
 - 3. Wall Applications: Provide mortar complying with requirements for non-sagging mortar.
- B. Portland Cement Mortar (Thickset) Installation Materials:
 - 1. Mortar Bed - Proportions of 1 part Portland Cement to 5 parts sand:
 - a. Portland Cement: ASTM C150, Type 1.
 - b. Sand: ASTM C144.
 - c. Water: Potable.
 - 2. Cleavage Membrane: Asphalt felt, ASTM D226/D226M, Type I (No. 15); or polyethylene sheeting, ASTM D4397, 4.0 mils (0.1 mm) thick.
 - 3. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57 mm) diameter; comply with ASTM, except for minimum wire size.
 - 4. Expanded Metal Lath - Diamond mesh lath complying with ASTM C847:
 - a. Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
 - b. Base Metal and Finish for Exterior Applications: Zinc coated (galvanized) steel sheet.
 - c. Configuration over Studs and Furring: Flat.
 - d. Configuration over Solid Surfaces: Self furring.
 - e. Weight: 3.4 lb/sq. yd. (1.8 kg/sq. m).
 - 5. Latex Additive: Styrene-butadiene-rubber water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex additive manufacturer for use with field mixed Portland cement and aggregate mortar bed.

2.6 GROUT MATERIALS

- A. Water Cleanable Epoxy Grout:
 - 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Polyblend Tile Grout with 100% Solids Epoxy; Custom Building Products.
 - b. SpectraLOCK PRO Stainless Grout; Laticrete International, Inc.
 - c. MAPEI Corp., Kerapoxy or Kerapoxy CQ Epoxy Grout.
 - 2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 degrees F and 212 degrees F (60 degrees and 100 degrees C), respectively, and certified by manufacturer for intended use.

2.7 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex modified, Portland cement-based formulation provided or approved by manufacturer of tile setting materials for installations indicated.
- B. Vapor Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils (0.1 mm) thick.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- D. Tile and Grout Sealer - Sealer for sealing grout joints and that does not change color or appearance of grout:
 - 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Custom Building Products.
 - b. Summitville Tiles, Inc.
 - c. TEC; H.B. Fuller Construction Products Inc.
- E. Sealant - Silicone sealant; refer to Section 07 92 00:
 - 1. Top of Wainscot: Bullnose

2.8 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.
- B. Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacture approved moisture barrier prior to installation of all flooring products.
- C. Maintain temperatures at 50 degrees F or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

3.2 EXTRA MATERIALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents:
 - 1. Tile and Trim Units: Furnish quantity of full size units equal to 2 percent of field tile and 5 percent of amount installed trims, accent tiles, and shapes, composition, color,

- pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 2 percent of amount installed for each type, composition, and color indicated.

3.3 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed for compliance with requirements for installation tolerances and other conditions affecting performance of the work:
 1. Verify substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108 for installations indicated.
 2. Verify concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108 for installations indicated:
 - a. Verify surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify protrusions, bumps, and ridges have been removed by sanding or grinding.
 3. Verify installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 4. Verify joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.4 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108 and is sloped 1/4 inch per foot (1:50) toward drains.
- C. Blending: For tile exhibiting color variations, verify tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at site before installing.

3.5 INSTALLATION

- A. Comply with TCNA *Handbook for Ceramic, Glass, and Stone Tile Installation* for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series *Specifications for Installation of Ceramic Tile* that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used:
 1. For the following installations, comply with ANSI A108 series procedures for tile installation standards for providing 95 percent mortar coverage:
 - a. Exterior tile floors.
 - b. Tile floors in wet areas.
 - c. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
 - d. Tile floors consisting of rib-backed tiles.
- B. Grout:
 1. Floor: 100 percent solid epoxy grout.

2. Walls: Non-sanded grout.
 3. Grout to be sealed 28 days after installation.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- E. Provide trim shapes where necessary to eliminate exposed tile edges.
- F. Where accent tile differs in thickness from field tile, vary setting bed thickness so tiles are flush.
- G. Jointing Pattern:
1. Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated:
 - a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- H. Joint Widths - Unless otherwise indicated, install tile with the following joint widths:
1. Ceramic Mosaic Tile: 1/8 inch (3.2 mm).
 2. Porcelain Tile: 1/4 inch (6.4 mm)
- I. Lay out tile wainscots to dimensions indicated.
- J. Expansion Joints:
1. Provide expansion joints and sealant filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installing tiles:
 - a. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- K. Thresholds:
1. Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated:
 - a. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in improved modified dry set mortar (thinset).
 - b. Do not extend cleavage membrane waterproofing or crack isolation membrane under thresholds set in standard dry set, modified dry set or improved modified dry set mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane, waterproofing, or crack isolation membrane with elastomeric sealant.
- L. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile and no threshold is indicated.

- M. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors according to floor sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- N. Waterproofing:
 - 1. Install waterproofing to manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate:
 - a. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.
- O. Crack Isolation Membrane:
 - 1. Install crack isolation membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate:
 - a. Allow crack isolation membrane to cure before installing tile or setting materials over it.
- P. Floor Tile - Install tile to comply with requirements in the TCNA installation methods and ANSI A108 series of tile installation standards:
 - 1. Back Buttering - For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
 - a. Tile floors in wet areas, including showers.
 - b. Tile floors composed of rib backed tiles.
 - 2. Tile Installation Method:
 - a. Interior Floor Installations, Concrete Subfloor:
 - 1) TCNA F121; cement mortar bed (thickset) on waterproof membrane.
 - 2) TCNA F122; thinset mortar on waterproof membrane.
 - b. Interior Floor Installations, Wood Subfloor:
 - 1) TCNA F144; thinset mortar on waterproof membrane on cementitious backer.
- Q. Wall Tile Installation:
 - 1. Install types of tile designated for wall installations to comply with requirements, including those referencing TCNA installation methods and ANSI setting bed standards:
 - a. Back Buttering - For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
 - 1) Tile wall installations in wet areas, including showers.
 - 2) Tile installed with chemical resistant mortars and grouts.

3.6 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning - On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter:
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.7 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09 30 00

SECTION 09 51 10 ACOUSTICAL CEILING TILES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Acoustical Tiles
 - 2. Accessories necessary for a complete installation.

1.3 SUBMITTALS

- A. Product Data: Technical data for each product including installation instructions.
- B. Samples:
 - 1. Acoustic Panel: Set of 6 inch (150 mm) square samples of each type, color, pattern, and texture.
- C. Coordination Drawings:
 - 1. Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - a. Size and location of initial access modules for acoustical panels.
 - b. Items penetrating finished ceiling including but not limited to the following:
 - 1) Lighting fixtures.
 - 2) Air outlets and inlets.
 - 3) Speakers.
 - 4) Sprinklers.
 - 5) Access panels.
 - c. Perimeter moldings.
- D. Maintenance Data: Manufacturer data for finishes for inclusion in maintenance manuals.
- E. Submit one copy of ICC-ES Reports.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Building Code:
 - a. Comply with applicable requirements of the CBC for interior finishes:
 - 1) DSA Interpretation of Regulations – IR 25-2.13 Metal Suspension Systems for Lay-in Panel Ceilings.
 - 2) CBC – 2019 California Building Code.
 - 3) Chapter 19A, 2019 California Building Code.
 - 4) Chapter 23, 2019 California Building Code.
 - 5) Acoustical Panel Standard: ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance:
 - a) Mounting Method for Measuring NRC: Plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.

2. Surface Burning Characteristics:
 - a. Ceiling panels with surface burning characteristics complying with CBC and ASTM E 1264 for Class A materials determined by testing identical products in accordance with ASTM E 84:
 - 1) Flame Spread Index : 25 or less.
 - 2) Smoke Developed Index: 450 or less.
- B. Source Limitations:
 1. Acoustical Ceiling Tile: Obtain each type through one source from a single manufacturer.
- C. Comply with applicable regulations regarding toxic and hazardous materials:
 1. Coating Based Antimicrobial Treatment: Provide acoustical tiles with face and back surfaces coated with antimicrobial treatment; and showing no mold or mildew growth when tested in accordance with ASTM D3273.
 2. Tile Based Antimicrobial Treatment: Provide acoustical panels manufactured with antimicrobial treatment in the panels.
- D. Pre-installation Conference: Conduct conference at site.

1.5 WARRANTY

- A. Standard Ceiling Tiles: Warrant ceiling panels to be free from sagging, warping, shrinking, buckling, or delaminating as a result of manufacturing defects for a period of one (1) year from the date of Substantial Completion.
- B. Sag Resistant Ceiling Tiles: warrant products to be free from sagging, warping, shrinking, buckling, or delaminating as a result of manufacturing defects for a period of ten (10) years from the date of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to site in original, unopened packages and store in a fully enclosed, conditioned space protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical tiles, allow panels to attain room temperature and a stabilized moisture content.
- C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturers are subject to compliance with requirements; provide ceiling tiles and adhesive by one of the following:
 1. Acoustical Ceiling Tile:
 - a. Armstrong World Industries, Inc.
 - b. CertainTeed Corporation.
 - c. USG Interiors.
 2. Adhesive:
 - a. Loctite
 - b. Henry

c. Titebond

B. Acoustical Tile Colors and Patterns:

1. Match appearance characteristics indicated for each product type:
 - a. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.2 ACOUSTICAL TILES

A. Acoustic Tile:

1. Basis of Design Product: No. 257 by Armstrong World Industries.
2. Classification - Provide tiles complying with ASTM E 1264 for type, form, and pattern:
 - a. Type and Form: Type III, mineral fiber with painted finish.
3. Color: White.
4. LR: Not less than 0.80.
5. CAC: Not less than 30.
6. Surface Color: White
7. Surface Pattern: Sand Pebble
8. Edge/Joint Detail: Angled Tegular (tongue and groove)
9. Thickness: 1/2 inch.
10. Modular Size: 12 by 12 inches.
11. Mold Resistance: Standard
12. Class A per CBC 2019 Section 803: Flame spread index 0-25, Smoke-developed index 0-450

2.3 ADHESIVE

A. Acoustic Adhesive

1. Acceptable products
 - 1) Power Grab Adhesive as manufactured by Loctite
 - 2) Acoustical Ceiling Tile Adhesive as manufactured by Henry
 - 3) Acoustical Ceiling Tile Adhesive as manufactured by Titebond
2. Classification: Provide adhesive complying with ASTM D-1779
3. Fire Rating: NFPA Class A fire rating when tested in accordance with ASTM E-84

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use:

3.2 EXTRA MATERIALS

- A. Furnish extra materials matching products installed and packaged with protective covering for storage and identified with labels describing contents:

1. Acoustical Ceiling Tiles: Full size panels equal to 2 percent of quantity installed or one box whichever is a larger quantity.

3.3 EXAMINATION

- A. Examine substrates, areas, and conditions, for compliance with requirements specified that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical tile ceilings.
- B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation after correcting unsatisfactory conditions.

3.4 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less than half width tiles at borders and comply with layout shown on reflected ceiling plans.

3.5 INSTALLATION

- A. Install acoustical tile ceilings to comply with ASTM C 636/C 636M
- B. Install acoustical tiles with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit:
 1. Arrange directionally patterned acoustical tiles with pattern running in one direction parallel to long axis of space.
 2. Paint cut edges of panel remaining exposed after installation; match color of exposed tile surfaces using coating recommended in writing for this purpose by acoustical tile manufacturer.
 3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire resistance rated assembly.
 4. Apply adhesive to back of tile per manufacturer's recommendation and hold tile in place until set.

3.6 CLEANING

- A. Clean exposed surfaces of acoustical tile ceilings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 00

SECTION 09 65 13.13 RESILIENT BASE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Rubber base.
 - 2. Accessories necessary for a complete installation.

1.3 SUBMITTALS

- A. Product Data: Technical data for each type of product including manufacturer's installation instructions.
- B. Samples: Sample of Base Selected or Color Chart if none selected.
- C. Maintenance Data: Submit for inclusion in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Entity having minimum 5 years documented experience who employs workers competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store base and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F (10 degrees C) or more than 85 degrees F (29 degrees C). Store floor tiles on flat surfaces.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Basis of Design Product:
 - 1. Manufacturers and tile series, pattern, and color selections are indicated in the Finish Schedule and are a basis of design. Subject to compliance with requirements, provide product indicated in Finish Schedule or comparable product by one of the following:
 - a. Flexco Floors.
 - b. Johnsite, a division of Tarkett Group.
 - c. Mannington Commercial.
 - d. Roppe.
- B. Rubber Base - ASTM F1861:
 - 1. Material: Rubber, vulcanized, Type TS, Group I, Styles A and B.
 - 2. Manufacturing Method: Group I (solid, homogeneous).
 - 3. Style: Topset cove; minimum 100 foot coil, cut to length required.

4. Minimum Thickness: 0.125 inch (3.2 mm).
 5. Color: Selected by Architect.
 6. Height: 4 inches, unless otherwise indicated on drawings.
 7. Outside Corners: Job formed.
 8. Inside Corners: Job formed.
- C. Adhesives: Water resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- D. All materials shall meet Class 1 rated in accordance with ASTM E648 or NFPA 253

PART 3 EXECUTION

3.1 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degrees F (21 degrees C) or more than 85 degrees F (29 degrees C), in spaces to receive floor tile during the following time periods:
1. 48 hours before installation.
 2. During installation.
 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degrees F (13 degrees C) or more than 95 degrees F (35 degrees C).
- C. Close spaces to traffic for 48 hours after installation.

3.2 EXAMINATION

- A. Examine substrates for compliance with requirements for maximum moisture content and other conditions affecting performance of the work:
1. Verify that finishes of substrates comply with tolerances and other requirements specified for other work and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation after correcting unsatisfactory conditions. Installation of resilient flooring and accessories indicates acceptance of surfaces and conditions.

3.3 PREPARATION

- A. Immediately before installation, sweep clean substrates to be covered by resilient base.

3.4 INSTALLATION

- A. Comply with manufacturer's written instructions for installing flooring. Scribe and cut flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Extend flooring into toe spaces, door reveals, closets, and similar openings.
- B. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on flooring as marked on substrates. Use chalk or other nonpermanent marking device.
- C. Resilient Base:

1. Comply with manufacturer's written instructions for installing resilient base. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required:
 - a. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
 - b. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 - c. Do not stretch resilient base during installation.
 - d. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
 - e. Preformed Corners: Install preformed corners before installing straight pieces.
 - f. Job Formed Corners:
 - 1) Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
 - 2) Form without producing discoloration (whitening) at bends.
 - 3) Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length:
 - a) Miter or cope corners to minimize open joints.

END OF SECTION 09 65 13.13

SECTION 09 65 23 LUXURY VINYL TILE FLOORING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes requirements limited to:
 - 1. Luxury vinyl floor tile.
 - 2. Accessories necessary for a complete installation.
- B. Related Sections:
 - 1. Section 03 30 00: Cast-In-Place Concrete.
 - 2. Section 09 65 13.13: Resilient Base.

1.3 SUBMITTALS

- A. Product Data: Technical data for each type of product including manufacturer's installation instructions.
- B. Shop Drawings - For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built in furniture, cabinets, and cutouts:
 - 1. Show details of special patterns.
- C. Samples - Full size units of each color and pattern of floor tile required:
 - 1. Luxury Vinyl Tile (LVT) flooring: 18 inch by 18 inch (460 mm by 460 mm) tile in each color selected and 12 inch long piece of base material in each color selected for approval.
- D. Product Schedule: Submit for floor tile using same designations indicated on Drawings.
- E. Maintenance Data: Submit for inclusion in maintenance manuals.
- F. Reports: Certified Moisture Testing Results.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Fire Test Response Characteristics - For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency:
 - a. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
 - b. Smoke Density: Maximum specific optical density of 450 per ASTM E 662 or NFPA 258.
 - 2. Accessibility Requirements - Comply with applicable requirements:
 - a. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
 - b. 2010 ADA regulations.
 - c. 2019 CBC Section 11B-302.1.

- B. Installer Qualifications: Entity having minimum 5 years documented experience who employs workers competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
- C. Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacture approved moisture barrier prior to installation of all flooring products. Contractor shall provide certified moisture testing results per ASTM F2170 (*Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes*) to Architect and Owner prior to floor installation. Acceptable moisture content of concrete sub floor shall be within approved manufacture limits or lower prior to installation.
- D. Source Limitations:
 - 1. Tile: Obtain floor products of same type and color or finish from one source or producer. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
 - 2. Setting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

1.5 WARRANTY

- A. Warrant the Work specified herein for ten (10) years against becoming unserviceable or causing an objectionable appearance resulting from either defective, or nonconforming materials and workmanship.
- B. Defects shall include, but not be limited to, the following:
 - 1. Damaged tile, including broken or chipped edges.
 - 2. Loose or missing tile.
 - 3. Noticeable deterioration or discoloring of tile or grout.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F (10 degrees C) or more than 85 degrees F (29 degrees C). Store floor tiles on flat surfaces.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Basis of Design Product:
 - 1. Manufacturers and tile series, pattern, and color selections are indicated in the Finish Schedule and are a basis of design. Subject to compliance with requirements, provide product indicated in Finish Schedule or comparable product by one of the following:
 - a. Luxury Vinyl Tile (LVT):
 - 1) Mannington Commercial
 - 2) Alternates include:
 - a) Forbo
 - b) Armstrong.
 - c) Tandus Centiva.
 - d) Other comparable product.
- B. Luxury Solid Vinyl Tile - ASTM F 1700:

1. Class I, monolithic vinyl tile:
 - a. Type A: Smooth surface.
 2. Thickness: 0.125 inch (3.2 mm).
 3. Size: 18"-inch x 18"-inch
 4. Construction: Heterogeneous Resilient Flooring with .030" (30 mil) high density wear layer.
 5. Color: To be selected by the Architect
- C. Trowelable Leveling and Patching Compounds: Latex modified, portland cement based formulation provided or approved by floor tile manufacturer for applications indicated.
- D. Adhesives: Water resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- E. Acoustic Underlayment:
 1. Closed cell, polypropylens foam
 2. 2 mm minimum thickness
 3. IIC 71db delta IIC 25db
 4. STC 66db
- F. Floor Polish: Provide protective, liquid floor polish products recommended by floor tile manufacturer.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degrees F (21 degrees C) or more than 85 degrees F (29 degrees C), in spaces to receive floor tile during the following time periods:
 1. 48 hours before installation.
 2. During installation.
 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degrees F (13 degrees C) or more than 95 degrees F (35 degrees C).
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Where demountable partitions, cabinets, and similar items are indicated for installation on top of resilient tile flooring, install tile before these items are installed.
- F. Do not install flooring over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive, as determined by flooring manufacturer's recommended bond and moisture test.
- G. Install flooring after other finishing operations, including painting, have been completed.

3.2 EXTRA STOCK

- A. Furnish extra materials matching products installed and packaged with protective covering for storage and identified with labels describing contents:

1. LVT Flooring: 1 percent of quality installed or 2 full unopened containers, whichever is greater.

3.3 EXAMINATION

- A. Examine substrates for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work:
 1. Verify that finishes of substrates comply with tolerances and other requirements specified for other Work and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation after correcting unsatisfactory conditions. Installation of resilient flooring and accessories indicates acceptance of surfaces and conditions.

3.4 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates - Prepare according to ASTM F 710:
 1. Verify substrates are dry and free of curing compounds, sealers, and hardeners.
 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 4. Moisture Testing - Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum **95** percent relative humidity level.
 5. Bond Test: Bond 3' x 3' panels spaced 50 feet apart throughout subfloor area. After moisture test proves floor acceptably dry, install panels using adhesive. If panels are securely bonded after 72 hours, subfloor is sufficiently clean of foreign materials for satisfactory installation of resilient flooring.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Install underlayment per manufacturers recommendation.
- E. Do not install floor tiles until they are the same temperature as the space where they are to be installed:
 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- F. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.5 INSTALLATION

- A. Comply with manufacturer's written instructions for installing flooring. Scribe and cut flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Extend flooring into toe spaces, door reveals, closets, and similar openings.
- B. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on flooring as marked on substrates. Use chalk or other nonpermanent marking device.
- C. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one/half tile at perimeter:
 - 1. Lay tiles square with room axis.
- D. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles:
 - 1. Lay tiles with grain running in one direction.
- E. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built in furniture, cabinets, pipes, outlets, and door frames.
- F. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- H. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- I. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- J. Floor Tile - Comply with manufacturer's written instructions for installing floor tile:
 - 1. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one/half tile at perimeter:
 - a. Lay tiles square with room axis unless pattern indicated for an area.
 - 2. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles. Lay tiles with grain running in one direction.
- K. Resilient Accessories - Comply with manufacturer's written instructions for installing resilient accessories:
 - 1. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.6 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish. Apply two coat(s).
- E. Sealers and Finish Coats:
 - 1. Remove soil, visible adhesive, and surface blemishes from resilient terrazzo floor tile surfaces before applying liquid cleaners, sealers, and finish products:
 - a. Sealer: Apply two base coats of liquid sealer.
 - b. Finish: Apply two coats of liquid floor finish.
- F. Cover floor tile until Substantial Completion.
- G. Clean floor surfaces not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations:
 - 1. Before cleaning, strip protective floor polish.
 - 2. Reapply polish to floor surfaces to restore protective floor finish according to flooring manufacturer's written recommendations.

END OF SECTION 09 65 23

SECTION 09 90 00 PAINTING AND COATING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Surface preparation and field painting of exposed items and surfaces.
 - 2. Field preparation and painting of factory primed metal products and fabrications.
 - 3. Accessories necessary for a complete installation.
- B. Related Sections (Including but not limited to):
 - 1. Section 05 50 00: Metal Fabrications.
 - 2. Section 06 10 00: Rough Carpentry.
 - 3. Section 08 11 13: Hollow Metal Doors and Frames.
 - 4. Section 09 21 16: Gypsum Board Assemblies.

1.3 DEFINITIONS

- A. Standard coating terms defined in ASTM D 16 apply:
 - 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85 degree meter.
 - 2. Eggshell refers to low sheen finish with a gloss range between 20 and 35 when measured at a 60 degree meter.
 - 3. Semigloss refers to medium sheen finish with a gloss range between 35 and 70 when measured at a 60 degree meter.
 - 4. Full gloss refers to high sheen finish with a gloss range more than 70 when measured at a 60 degree meter.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Submit technical data and information for block fillers, primers, paints, and coatings, including label analysis and instructions for handling, storing, and applying each coating material proposed for use:
 - a. Indicate manufacturer's instructions for special surface preparation procedures, substrate conditions requiring special attention.
 - b. Material List: Provide inclusive list of required coating materials. Indicate each material and cross reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number, series, and general classification.
- B. Samples:
 - 1. Submit for each type of paint system and in each color and gloss of topcoat:
 - a. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
 - b. Provide list of material and application for each coat of each sample. Label each

- sample as to location and application.
- c. Submit samples on following substrates for review of color and texture only:
 - 1) Concrete: Provide two 4 inch square samples for each color and finish.
 - 2) Concrete Masonry: Provide two 4" x 8" samples of masonry, with mortar joint in the center, for each finish and color.
 - 3) Painted Wood: Provide two 12 inch square samples of each color and material on hardboard.
 - 4) Ferrous and Nonferrous Metals: Provide two 4 inch square samples of flat metal and two 8 inch long samples of solid metal for each color and finish.
 - C. Product List: Submit list of including each paint system, color, and location of application. Use same product and location designations indicated in Finish Schedule.
 - D. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with Finish Schedule, Area Detail designating where each product/color/finish was used, product/color/finish was used, product data pages, Manual Safety Data sheets, care and cleaning instructions, touchup procedures, and color samples of each color and finish used.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with Federal and local toxicity and air quality regulations and with Federal requirements on content of for heavy metals, including but not limited to, lead and mercury. Do not use solvents in paint products that contribute to air pollution.
 - 2. Comply with CARB suggested control measures using the Method 24 analysis, limiting VOC's content to those noted in ASTM 6886.
 - 3. Performance and Durability:
 - a. ASTM D 16 – "Standard Test Method for Load Testing Refractory Shapes at High Temperatures."
 - b. ASTM D 2486 – "Standard Test Method for Scrub Resistance of Interior Wall Paint."
 - c. ASTM D 2805 – "Standard Test Method for Hiding Power of Paints by Reflectometry."
 - d. ASTM D 4828 – "Standard Test Method for Practical Washability of Organic Coatings."
 - e. ASTM D 3363 – "Standard Test Method for Film Hardness by Pencil Test."
- B. Applicator Qualifications: A firm or individual having minimum 5 years documented experience in applying paints and coatings similar in material, design, and extent to those indicated.
- C. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

1.6 WARRANTY

- A. Written warranty signed by the manufacturer and the installer in which the manufacturer and installer agree to repair or replace paint and primers that fail within specified warranty period:
 - 1. Failures include, but are not limited to, the following:
 - a. Flaking or delamination of paint with the substrate.
 - b. Rust, scale, similar imperfections due to improper surface preparation.

- c. Thinning or watering of paint beyond that considered acceptable of paint manufacturer.
 - d. Failure to achieve dry film thickness (DFT) recommended by manufacturer for each coat in a paint system.
 - e. Deterioration or loss of color of paint beyond normal weathering.
2. Warranty Period: One year from date of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F (7 degrees C):
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Basis of Specifications: **Sherwin Williams** paints:
 1. Subject to compliance with requirements, provide first quality, 100% acrylic, commercial or industrial products of one of the specified manufacturers. Residential products are not permitted:
 - a. Proprietary Names:
 - 1) Paint Schedule is based on a single manufacturer for convenience with exception to the paint used in specific areas where specialized coatings are required (Refer to Drawings).
 - 2) Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that named products are required to the exclusion of comparable products of specified manufacturers.
 - 3) Furnish product technical data, including per cent solids by weight and volume: (Method 24 analysis)
 - a) VOC content limits and emissions data.
 - b) Certificates of performance for comparable paint products of specified manufacturer.
 - b. Paint Products:
 - 1) Sherwin-Williams Co.
 - 2) PPG Industries, Inc.
 - 3) Dulux
- B. Material Compatibility: Provide each paint system including block fillers, primers, and finish coats, that are compatible with one another and with substrates indicated under conditions of service and application, demonstrated by manufacturer based on testing and field experience.
- C. Material Quality: Provide manufacturer's best quality commercial paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint material containers not displaying manufacturer's product identification will not be acceptable. Residential quality paint products are not permitted.
- D. Chemical Components of Interior Paints and Coatings:
 1. Provide products complying with limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent

- by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
- b. Restricted Components: Paints and coatings shall not contain components restricted by the EPA.
- E. Accessories: Materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
- F. Patching Materials: Latex filler compatible with paint systems.
- G. Fastener Head Cover Materials: Latex filler.

2.2 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials:
- 1. Owner reserves the right to invoke to engage the services of a qualified testing agency to sample paint materials:
 - a. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to site, samples may be taken at the site. Samples will be identified, sealed, and certified by testing agency.
 - b. Testing agency will perform tests for compliance with product requirements.
 - c. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

- A. Apply waterborne paints when temperatures of surfaces to be painted and surrounding air are between 50 degrees F and 90 degrees F (10 degrees and 32 degrees C).
- B. Do not thin or add water to waterbased paints, including waterbased alkyds.
- C. Weather Conditions:
- 1. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
 - 2. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F (3 degrees C) above dew point; or to damp or wet surfaces.
 - 3. Minimum Application Temperatures for Water based Paints: Between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C).
- D. Apply solvent thinned paints when temperatures of surfaces to be painted and surrounding air are between 45 degrees F. and 95 degrees F (7 degrees F and 35 degrees C):
- 1. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.
 - 2. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

- E. Provide lighting level of 80 foot candles (860lx) measured midheight at substrate surface.
- F. Labels: Do not paint over Underwriters Laboratories, Factory Mutual, other code required labels, or equipment name, identification, performance rating, or nomenclature plates.

3.2 EXTRA MATERIALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents:
 - 1. Paint: 2 percent, but not less than 1 gallon (3.8 L) of each material and color applied.

3.3 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for maximum moisture content and conditions affecting performance of the work.
- B. Test substrates after repairing and cleaning substrates but prior to application of paint and coatings:
 - 1. Maximum moisture content of substrates, when measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Fiber Cement Board: 12 percent.
 - c. Masonry (Clay and CMUs): 12 percent.
 - d. Wood: 15 percent.
 - e. Gypsum Board: 12 percent.
 - f. Plaster: 12 percent.
 - 2. Test cementitious and plaster cement/stucco for alkalinity (pH).
- C. Gypsum Board Substrates: Verify joints are taped and finishing compound is sanded smooth.
- D. Plaster Substrates: Verify plaster has fully cured. Verify existing plaster is in good condition and can receive new paint coating.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers:
 - 1. Verify previously painted surfaces can be stripped to bare substrate, repaired if necessary, and prepared to receive new paint system consisting of primer and two top coats at a minimum:
 - a. Note: If previously painted surfaces have failed to accept new paint systems, determine cause of failure and take corrective measures to ensure each surface accepts new paint system. Failure of new paint system is not permitted.
- F. Commence paint and coating application after correcting unsatisfactory conditions and surfaces are dry. Application of coating indicates applicator's acceptance of surfaces and conditions.

3.4 ITEMS TO RECEIVE PAINT

- A. Generally, all new items that are normally painted in any typical building, including but not limited to the following list:
 - 1. All ferrous metal
 - 2. All exterior galvanized metal

3. All exterior wood
 4. All interior wood
 5. All prime coated hardware
 6. All exposed pipe, plumbing, ductwork, conduit, outlet boxes and electrical cabinets, excluding those located in mechanical rooms.
 7. All metal grilles, except aluminum, unless otherwise indicated.
 8. All exposed gypsum board surfaces, including all mechanical rooms.
 9. Miscellaneous other items which normally require painting or are scheduled to be painted.
 10. Consult plans, finish schedule, details and specifications for other trades as all items usually field painted or finish will be considered as part of the Contract.
 11. All exposed mechanical equipment and electrical equipment.
 12. Traffic lanes and parking spaces including fire lanes and crosswalks.
 13. Rolling doors.
 14. Bollards.
 15. Loose lintels.
 16. Refer to MEP specifications for additional items to receive paint.
- B. All work where a coat of material has been applied must be inspected and approved by Architect before application of succeeding specified coat, otherwise no credit for coat applied will be given. Notify Architect when a particular coat has been completed for inspection and approval. Apply coats of material in strict accordance with manufacturer's specifications except where requirements of these specifications are in excess of manufacturer's requirements. Paint all sight exposed pipe and plumbing only after all mechanical work and tests have been completed.

3.5 PREPARATION

- A. Coordination of Work:
1. Review work in which primers are provided to ensure compatibility of the total system for various substrates. Notify Architect of anticipated problems when using materials specified over substrates primed by others:
 - a. Pre-primed Substrates: Inspect existing conditions in which primers are factory applied to ensure compatibility of the total system for each substrate. Notify Architect of anticipated problems when using the materials specified over factory primed or pre-primed substrates.
 - b. Existing Painted Surfaces: Inspect previously painted surfaces to ensure compatibility of the existing paints with new paint system for each substrate. Notify Architect of anticipated problems.
 - c. Correct defects and clean surfaces affecting bond with paint system. Remove existing paints exhibiting loose surface defects showing signs of rust, scale, or delamination.
 - d. Seal marks which may bleed through surface finishes.
- B. Surface Preparation:
1. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified. Provide barrier coats over incompatible primers or remove and reprime. If removal is impractical or impossible because of size or weight of item, provide surface applied protection before surface preparation and painting:
 - a. Remove hardware and hardware accessories, plates, lighting fixtures, and similar items that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface applied protection before surface preparation and painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

- b. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface applied protection if any.
 - c. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - d. Clean and prepare surfaces to receive paint according to manufacturer's written instructions for each substrate condition and as specified. Provide barrier coats over incompatible primers, existing paint or coating, or remove and reprime.
 - e. Correct defects and clean surfaces affecting bond with paint or coating system. Remove existing coatings exhibiting loose surface defects. Seal marks which may bleed through surface finishes.
- C. Cleaning:
1. Before applying paint or surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning. Schedule cleaning and painting so dust and contaminants from the cleaning process will not fall on wet, newly painted surfaces:
 - a. Remove incompatible primers, including factory applied primers, and reprime substrate with compatible primers or apply barrier coat as necessary to produce paint systems indicated.
 - b. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
 - c. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
 - d. Galvanized Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
 - e. Aluminum Substrates: Remove surface oxidation.
- D. Mildew and Mold Removal: Remove mildew and mold by high power washing (pressure range of 1500 to 4000 psi) with solution of trisodium phosphate and bleach. If substrate is too soft for high power washing, scrub substrate with solution. Rinse with clean water and allow surface to dry.
- E. Protective Coverings: Provide protections for duration of the work, including covering furnishings and decorative items. Protect and mask adjacent finishes and components against damage, marking, overpainting, and injury. Clean and repair or replace damage caused by painting.
- F. Renovated Surfaces:
1. Clean surface free of loose dirt and dust. Except at gypsum board surfaces, remove existing paint and coatings to bare substrate and prepare substrates to receive new paint system. Test substrate to verify it will bond with primer and receive new paint system without failure. If test fails, clean surface to base substrate and apply barrier coat. Retest to verify surface will accept new paint system:
 - a. Remove surface film preventing proper adhesion and bond.
 - b. Wash glossy paint with a solution of sal soda and rinse thoroughly.
 - c. Remove loose, blistered, and defective paint and varnish; smooth edges with sandpaper.
 - d. Clean corroded iron and steel surfaces.
 - e. Repair and blend into portland cement plaster.
 - f. Prime bare surfaces.
 - g. Tone varnished surfaces with stain bringing to uniform color.
 - h. If existing surfaces cannot be put in acceptable condition for finishing by customary cleaning, sanding, and puttying operations, notify Owner and do not proceed until

correcting unsatisfactory conditions.

- G. Cementitious Substrates:
1. Prepare concrete surfaces to receive paint. Remove efflorescence, chalk, dust, dirt, grease, oils, release agents, mold, mildew, and existing paint. Roughen as necessary to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation:
 - a. Use abrasive blast cleaning methods if recommended by paint manufacturer.
 - b. Do not paint surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions:
 - 1) Determine alkalinity and moisture content of surfaces by performing appropriate pH testing. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct condition prior to application of paint.
 - 2) Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m).
 - 3) Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation after substrates have obtained percent relative humidity level recommended by paint manufacturer.
 - 4) Perform additional moisture tests when recommended by manufacturer. Proceed with installation when moisture content complies with that permitted in manufacturer's written instructions.
 - 5) Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to thoroughly dry.
 2. Clean concrete floors to receive paint or coating with a 5 percent solution of muriatic acid or etching cleaner. Flush floors with clean water to remove acid; neutralize with ammonia, rinse, allow to dry; vacuum before painting.
- H. Ferrous Metals:
1. Clean ungalvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations:
 - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
 - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
- I. Galvanized Ferrous Metal Substrates: Clean galvanized surfaces with nonpetroleum based solvents leaving surface free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- J. Shop Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop primed surfaces.
- K. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

- L. Plaster/Stucco Substrates:
 - 1. Remove contaminants, release agents, curing compounds, efflorescence, chalk, mold, mildew, and similar deterrents. Spot patch existing plaster to eliminate blisters, buckles, excessive crazing, and to check cracking, dryouts, efflorescence, sweat outs, and similar defects to prevent plaster from bonding with paint or coatings. Sand or texture repair or patch to match adjacent finish and to remove trowel marks and arises:
 - a. Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
 - b. Deep Cracks: Clean out and fill deep cracks with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
 - c. Do not paint surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions. Test for alkali using litmus paper.
 - d. Allow patching and repair compounds to set and cure before painting.
- M. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- N. Wood Substrates:
 - 1. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime, stain, or seal wood to be painted. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
 - 4. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
 - 5. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- O. Pipe Covering and Insulation: Clean to remove loose, foreign, and objectionable material before applying sealing coat.
- P. Preparation of Substrates for Wallcovering:
 - 1. Prime and seal substrate with release coat in accordance with wallcovering manufacturer's recommendations for substrate:
 - a. Assure compatibility with product of wall covering manufacturer.
 - b. Fill indentations in substrate and prime with opaque white primer before applying release coat.
 - c. Apply release coat in accordance with manufacturer's recommendations.
- Q. Barrier Coat: Provide barrier coats over incompatible primers or remove and reprime. Notify Owner in writing of anticipated problems using specified finish coat material over previously coated substrates.
- R. Material Preparation:
 - 1. Mix and prepare paint materials according to manufacturer's written instructions:
 - a. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 - b. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 - c. Do not use thinners for water based paints.
 - d. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat

where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.6 APPLICATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated:
1. The term *exposed surfaces* includes areas visible when permanent or built in fixtures, grilles, convector covers, covers for finned tube radiation, and similar components are in place. Extend coatings in these areas to maintain system integrity and provide desired protection.
 2. Use applicators and techniques suited for paint and substrate indicated.
 3. Provide finish coats compatible with primers.
 4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 5. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces:
 - a. Field painting of exposed surfaces include bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory applied final finish.
 - b. Areas visible when permanent or built in fixtures, grilles, convector covers, covers for finned tube radiation, and similar components are in place.
 - c. Extend coatings in areas, as required, to maintain system integrity and provide desired protection.
 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 7. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 8. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 9. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 10. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or surface imperfections. Cut in sharp lines and color breaks.
 11. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 12. Provide finish coats compatible with primers used.
 13. Sand lightly between each succeeding enamel or varnish coat.
- B. Items not to Receive Paint: Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
- C. Applicators:
1. Apply paints and coatings by brush, roller, spray, or applicators recommended by manufacturer:
 - a. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
 - b. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool recommended by manufacturer for material and texture required.

- c. Spray Equipment: Use airless spray equipment with orifice size recommended by manufacturer for material and texture required.
- D. Minimum Coating Thickness:
 - 1. Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer:
 - a. Measure film thickness on magnetic surfaces by use of Elcometer thickness gauge and on nonmagnetic surfaces by pit gauge or Tooke Gauge.
- E. Application:
 - 1. Apply first coat to surfaces that have been cleaned, pretreated, or prepared for painting as soon as practicable after preparation and before subsequent surface deterioration:
 - a. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
 - b. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished after removing rust and scale and priming or touching up surface sand if acceptable to topcoat manufacturers.
 - c. If undercoats, stains, or conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.
 - d. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried and cured to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- F. Mechanical and Electrical Work:
 - 1. Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces:
 - a. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
 - b. Prime and paint uninsulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, heat exchangers, tanks, ductwork, conduit, switchgear, and paintable insulation except where items are prefinished.
 - c. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
 - d. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
 - e. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.
 - f. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
 - g. Concealed Members: Wherever steel and metal parts to receive paint are built into and concealed by construction, paint as specified for exposed parts so finish painting is complete before members are concealed.
- G. Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Painting is limited to items exposed in equipment rooms and occupied spaces:

- a. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
 - b. Prime and paint uninsulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, heat exchangers, tanks, ductwork, conduit, switchgear, and paintable insulation except where items are prefinished.
 - c. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
 - d. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
 - e. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.
 - f. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
- H. Electrostatic Spray Painting:
1. Apply coating electrostatically to finished surfaces, free from runs, sags, visible overlaps, holidays, craters, pinholes and other defects detrimental to protective and decorative qualities of coating:
 - a. Thickness of Coatings: 1.5 to 2.0 mils dry film thickness. Measure dry film thickness with magnetic gauge.
 - b. Use application techniques, equipment, materials, and preparation procedures recommended by manufacturer.
- I. Block Fillers: Apply block fillers to concrete masonry block at rate to ensure complete coverage with pores filled.
- J. Prime Coats: Before applying finish coats, apply prime coat, recommended by manufacturer, to material required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or defects due to insufficient sealing.
- K. Finish Coats:
1. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance without bleed through:
 - a. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or surface imperfections is not acceptable.
 - b. Transparent (Clear) Finishes: Use multiple coats to produce glass smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats.
- L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.
- M. Touch Up:

1. Touch up marred, scraped, and blemished areas of surfaces which were factory primed or previously coated:
 - a. Prepare and touch up scratches, abrasions, and blemishes and remove foreign matter before proceeding with succeeding coats.
 - b. Touch up marred, scraped, and blemished areas of factory primed or previously coated surfaces.
 - c. Feather touch up coating overlapping minimum 2 inches onto adjacent unblemished areas producing smooth, uniform surface.
 - d. As soon after erection and installation as possible, touch up fasteners, welded surfaces and surroundings, field connections, and areas on which shop coat has been abraded or damaged with specified primer before corrosion and other damage occurs from exposure.

3.7 FIELD QUALITY CONTROL

- A. Dry Film Thickness (DFT) Testing:
 1. Tests for dry film thickness may be determined by using a Tooke Scale and microgroover, an electronic scanner, or the Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness:
 - a. Contractor shall touch up and restore painted surfaces damaged by testing.
 - b. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.8 CLEANING AND PROTECTION

- A. It is of the utmost importance to the AISD that the site remains in a safe, clean, and well maintained condition. At the end of each day, leave the site ready to use by staff and students. Protect staff and students and the learning environment throughout the work.
- B. Cleanup: At the end of each day, remove empty cans, rags, rubbish, and discarded paint materials from site. After completion of painting work, clean glass and paint spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. Provide *Wet Paint* signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work. After related work is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.
- E. At completion of painting activities, touch up and restore damaged or defaced painted surfaces.
- F. Waste Management: Legally dispose of unused paint and paint containers in accordance with manufacturer's recommendations and environmental regulations.

PART 4 SCHEDULES

- A. The following is a schedule of typical painted items and does not specifically include every

item that is to receive paint but should establish type and quality of finish for all items normally included in a complete paint job.

- B. Exterior Surfaces (Note: Exterior surfaces are divided into two (2) different categories, based upon color and level of graffiti resistance required. System 1 will be used when standard earthtone colors or neutral colors are specified, and System 2 will be used when bright colors (primary reds, yellows, and oranges) are specified and/or when a graffiti resistant coating is required.):
1. Galvanized Metal:
 - a. Surface Preparation: Acid etch galvanized surfaces that have not weathered at least six (6) months prior to beginning painting operations.
 - b. Primer: One (1) coat Pro-Cryl Pro Industrial Universal Primer (B66W310)
 - c. Finish: Two (2) coats Sher-Cryl HPA High Performance Acrylic (B66W300)
 2. Galvanized Metal - Chloramine environment:
 - a. Surface Preparation: Acid etch galvanized surfaces that have not weathered at least six (6) months prior to beginning painting operations.
 - b. Finish: One coat Macropoxy 646 (B58-600), two (2) coats HS Polyurethane.
 3. Un-galvanized Metal:
 - a. Primer: One (1) coat Pro-Cryl Pro Industrial Universal Primer (B66W310).
 - b. Finish: Two (2) coats Sher-Cryl HPA High Performance Acrylic (B66W300).
 4. Concrete and CMU:
 - a. Primer/Finish: (2) coats Loxon XP Exterior Waterproofing System, 14-18 mils wet, 6.4 – 8.3 mils dry per coat.
 5. All piping in mechanical rooms shall be painted in their entirety, in the following colors:
 - a. Gas lines: Orange
 - b. Domestic cold water: White
 - c. Domestic hot water: Pink
 - d. Heating hot water: Red
 - e. Condenser water: Green
 - f. Chilled water: Blue
- C. Interior Surfaces:
1. Galvanized Metal:
 - a. Primer: One (1) coat Pro-Cryl Pro Industrial Universal Primer (B66W310).
 - b. Finish: Two (2) coats Pro Industrial 0 VOC Acrylic Semi-Gloss.
 2. Shop-Primed Ferrous Metals (Use for metal doors and frames and miscellaneous metal items):
 - a. Shop coat by others.
 - b. One (1) coat over Steel and Aluminum, Pro Industrial Pro-Cryl Universal Primer (B66W610).
 - c. Two (2) coats Pro Industrial Acrylic Semi-Gloss, B66 Series.
 3. Gypsum Wallboard:
 - a. Primer: One (1) coat ProMar 200 Zero VOC Latex Primer (B28W2600).
 - b. Finish: Two (2) coats ProMar 200 Zero VOC Latex Eg-Shel (B20W2651 Series).
 - c. Alternate:
 - 1) Primer: One (1) coat ProMar 200 Zero VOC Latex Primer (B28W2600).
 - 2) Finish: Microbicidal Paint: Paint Shield (EPA# 64695-1).
 - a) Substitutions must meet EPA #64695-1.
 4. Gypsum Wallboard (Epoxy) – Kitchens, bathrooms, laboratories, etc.:
 - a. Primer: One (1) coat ProMar 200 Zero VOC Latex Primer (B28W2600).
 - b. Finish: Two (2) coats Pro Industrial Waterbased Epoxy, Eg-Shel (B73 Series).
OR
 - c. Finish - Two (2) coats Pro Industrial Pre-Catalyzed, Eg-Shel (K45 Series):
 - 1) Location: Corridors & Stairwells.
 5. Pipe and fittings, including but not limited to copper and brass, at kitchen areas (but

excluding aluminum, stainless steel, nickel and chrome plated pipe and fittings):

- a. Primer: One (1) coat; product recommended for the substrate by the finish coat manufacturer.
- b. Finish: Two (2) coats bright aluminum paint, S-W BondPlex Aluminum (B71S200).

END OF SECTION 09 90 00

SECTION 10 14 00 GRAPHICS AND SIGNAGE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Room identification signs.
 - 2. Restroom signs.
 - 3. Misc. identification signs.
 - 4. Informational signs (not identification signs).
 - 5. Accessories necessary for a complete installation.
- B. Related Sections:
 - 1. Section 06 10 00: Rough Carpentry.
 - 2. Section 09 21 16: Gypsum Board Assemblies.

1.3 SUBMITTALS

- A. Product Data: Technical data for each type of signage.
- B. Shop Drawings:
 - 1. Submit fabrication and installation details and attachments to other work:
 - a. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - b. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
 - c. Exterior applied signage on face of wall to include mounting brackets and support anchorage to fit condition.
- C. Samples: Submit one sample of each specified sign type, full-sized.

1.4 QUALITY ASSURANCE

- A. Field Inspections:
 - 1. All new tactile signage must be field inspected after installation per CBC 11B-703.1.1.2.
- B. Accessibility Requirements:
 - 1. Raised characters shall comply with CBC Section 11B-703.2.
 - a. Depth: It shall be 1/32 inch (0.8 mm) minimum above their background, shall be sans serif uppercase, and be duplicated in Braille.
 - b. Height: It shall be 5/8 inch (15.9 mm) minimum and 2 inches (51 mm) maximum based on the height of the uppercase letter "I." See CBC Section 11B-703.2.5.
 - c. Finish and Contrast: Characters and their background shall have a non-glare finish. Character shall contrast with their background with either light characters on a dark background or dark characters on a light background. See CBC Section 11B-703.5.1.
 - d. Proportions: It shall be selected from fonts where the width of the uppercase letter

“O” is 60% minimum and 110% maximum of the height of the uppercase letter “I.” Stroke thickness of the uppercase letter “I” shall be 15% maximum of the height of the character. See CBC Sections 11B-703.22.4 and 11B-703.2.8.

- e. Character Spacing: Spacing between individual raised characters shall comply with CBC Section 11B-703.2.7 and 11B-703.2.8.
- f. Format: Text shall be in a horizontal format. See CBC Section 11B-703.2.9.
- g. Braille: It shall be contracted (Grade 2) and shall comply with CBC Sections 11B-703.3 and 11B-703.4. Braille dots shall have a domed or rounded shape and shall comply with CBC Table and Figure 11B-703.3.1.
- h. Mounting Height: Tactile characters on signs shall be located 48 inches minimum to the baseline of the lowest Braille cells and 60 inches maximum to the baseline of the highest line of raised characters above the finish floor or ground surface. See CBC Section and Figure 11B-703.4.4.
- i. Mounting Location: A tactile sign shall be located per CBC Section and Figure 11B-703.4.2 as follows:
 - 1) Alongside a single door at the latch side.
 - 2) On the inactive leaf at double doors with one active leaf.
 - 3) To the right of the right hand door at double doors with two active leaves.
 - 4) On the nearest adjacent wall where there is no wall space at the latch side of a single door or at the right side of double doors with two active leaves.
 - 5) So that a clear floor space of 18 inches x 18 inches minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.
- j. Visual Characters: Shall comply with CBC Section 11B-703.5 and shall be 40 inches minimum above finish floor or ground.
- k. Pictograms: Shall comply with CBC Section 11B-703.6.
- l. Symbols of Accessibility: Shall comply with CBC Section 11B-703.7.
- m. Variable Message Signs: Shall comply with CBC Section 11B-703.8.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturers:
 - 1. Subject to compliance with requirements, provide products by one of the following:
 - a. Apco Signs
 - b. ASI Modulex, Inc.
 - c. Best Sign Systems, Inc.
 - d. InPro Corporation (IPC).
 - e. Mohawk Sign Systems.
 - f. Nelson-Harkins Industries.
 - g. Seton Identification Products.
 - h. Stamprite Supersine; a division of Stamp Rite Inc.
 - i. Vomar Products, Inc.
- B. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated. Refer to drawings for location.
- C. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated. Refer to drawings for location.
- D. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

- E. Acrylic Sheet: ASTM D 4802, category standard with manufacturer for each sign, Type UVF (UV filtering).
- F. Plastic Laminate Sheet: NEMA LD 3, general purpose HGS grade, 0.048-inch (1.2-mm) nominal thickness.
- G. Vinyl Film: UV resistant vinyl film of nominal thickness indicated, with pressure sensitive, permanent adhesive on back; die cut to form characters or images indicated and suitable for exterior applications.
- H. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.
- I. Accessories:
 - 1. Fasteners and Anchors:
 - a. As necessary for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - 1) Use concealed fasteners and anchors unless indicated to be exposed.
 - 2) Exposed Metal Fastener Components: Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - 2. Sign Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
 - 3. Adhesive: Recommended by sign manufacturer.
 - 4. Two Face Tape: High bond, foam core tape, 0.045 inch (1.14 mm) thick, with adhesive on both sides.
 - 5. Bituminous Paint: Cold applied asphalt emulsion complying with ASTM D 1187.

2.2 SIGNAGE

- A. Solid Plastic Tactile Room, Restroom and Miscellaneous Identification Signs:
 - 1. 1/4-inch thick, Graphic Process Sand Carved with pre-drilled holes for mounting screws:
 - a. Sign Panel Perimeter:
 - 1) Edge Condition: Square cut.
 - 2) Corner Condition in Elevation: 3/8" radius.
 - b. Mounting at Walls: Stainless steel vandal-proof pin-in-head torx screws
 - c. Mounting at Glazing: Clear silicone adhesive
 - d. Text and Typeface:
 - 3) Accessible raised characters and Braille. Finish raised characters to contrast with background color, and finish Braille to match background color:
 - a) Raised Characters: Refer to drawings
 - b) California Contracted Grade 2 Braille: Refer to drawings
 - c) Pictograms: Field height of minimum 6 inches; no characters or braille in pictogram field; nonglare, field contrast to pictogram, text descriptors below pictogram field
 - d) Accessibility Symbols: Where used, symbols shall comply with CBC 11B-703.7.
 - e. Color: As selected by Architect from manufacture's full range of standard colors.
 - f. For exterior uses, fabricate signs from exterior grade materials with UV inhibitor.

2.3 FABRICATION

- A. Provide sign assemblies according to requirements indicated:
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible.

Disassemble signs and assemblies as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.4 FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.
- E. Aluminum Finishes:
 1. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage devices and electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

3.2 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of signage work. Verify sign support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.3 INSTALLATION

- A. Install signs using mounting methods indicated and according to manufacturer's written

instructions:

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 3. Interior Wall Signs:
 - a. Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door:
 - 1) See drawings for the mounting height and location of each sign.
 4. Before installation, verify sign surfaces are clean and free of materials or debris that impair installation.
 5. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Height:
1. Tactile characters on signs shall be located 48 inches minimum to the baseline of the lowest Braille cells and 60 inches maximum to the baseline of the highest line of raised characters above the finish floor or ground surface, pursuant to CBC Section and Figure 11B-703.4.1.
- C. Mounting Location:
1. A tactile sign shall be located as follows, pursuant to CBC Section and Figure 11B-703.4.2:
 - a. Alongside a single door at the latch side.
 - b. On the inactive leaf at double doors with one active leaf.
 - c. To the right of the right hand door at double doors with two active leaves.
 - d. On the nearest adjacent wall where there is no wall space at the latch side of a single door or at the right side of double doors with two active leaves.
 - e. So that a clear floor space of 18 inches by 18 inches minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.
- D. Mounting Methods:
1. Exposed Fastener: Install vandal-resistant fastener; set screw head flush with sign face.
 2. Concealed Studs:
 - a. Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface:
 - 1) Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - 2) Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
 3. Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.
 4. Shim Plate Mounting: Provide 1/8 inch (3 mm) thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other direct mounting methods are impractical. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach signs to plate using method specified above.
- E. Visual Characters shall comply with CBC Section 11B-703.5 and shall be 40 inches minimum above finish floor or ground.

- F. Field Applied, Vinyl Character Signs: Clean and dry substrate. Align sign characters in final position before removing release liner. Remove release liner in stages, and apply and firmly press characters into final position. Press from the middle outward to obtain good bond without blisters or fishmouths. Remove carrier film without disturbing applied vinyl film.
- G. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.
- H. DSA Inspections: Signs and identifications or other information shall be field inspected after installation and approved by Division of the State Architect prior to the issuance of a final certificate of occupancy, or final approval where no certificate of occupancy is issued. The inspection shall include, but not limited to, verification that Braille dots and cells are properly spaced and the size, proportion and type of raised characters are in compliance with CBC, Section 11B-703.1.1.2.

3.4 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 00

SECTION 10 21 13 TOILET COMPARTMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Toilet partitions.
 - 2. Urinal screens.
 - 3. Entrance screens.
 - 4. Accessories necessary for a complete installation.
- B. Related Sections:
 - 1. Section 05 50 00: Metal Fabrications.
 - 2. Section 06 10 00: Rough Carpentry.

1.3 SUBMITTALS

- A. Product Data: Technical data for each type of product including construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings - Submit plans, elevations, sections, details, and attachments to other work:
 - 1. Show locations of cutouts for compartment-mounted toilet accessories.
 - 2. Show locations of reinforcements for compartment-mounted grab bars.
 - 3. Show locations of centerlines of toilet fixtures.
 - 4. Show ceiling grid and overhead support or bracing locations.
- C. Samples: Submit for each type of unit with samples of hardware and accessories involving material and color selection.
- D. Maintenance Data: Submit data to include in maintenance manuals.

1.4 PERFORMANCE REQUIREMENTS

- A. Accessible Toilet Compartments:
 - 1. Wheelchair accessible compartment shall comply with CBC Section 11B-604.8.1.
 - 2. Toe clearance for at least one side partition of a wheelchair accessible compartment shall comply with CBC Section and Figure 11B-604.8.1.4. It shall be a minimum of 9 inches high above the finish floor, and a minimum of 6 inches deep beyond the compartment side face of the partition, exclusive of partition support members. It shall be a minimum of 12 inches high above the finish floor for children's use. Partition components at toe clearances shall be smoother without shop edges or abrasive surfaces. Toe clearance at the side partition is not required in a compartment greater than 66 inches wide.
 - 3. Ambulatory accessible compartments shall be provided where there are six or more toilet compartments, or where the combination of urinals and water closets total six or more fixtures. Such compartments shall be provided in the same quantity as wheelchair accessible compartments per CBC Section 11B-213.3.1 and shall comply with CBC Section 11B-604.8.2.

4. Door and door hardware for accessible compartments shall be self-closing and shall comply with CBC Section 11B-404 except that if the approach is to the latch side of an ambulatory compartment door, clearance between the door side of the compartment and any obstruction shall be 44 inches minimum. See CBC Figure 11B-604.8.2.
5. A door pull complying with CBC Section 11B-404.2.7 shall be placed on both sides of the accessible compartment door near the latch.
6. Ambulatory Accessible Toilet Compartment doors shall not swing into the clear floor space or clearance required for any fixture or into the minimum required compartment area. See CBC Section 11B-604.8.2.2.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 1. Accessibility Requirements - Comply with applicable requirements:
 - a. Americans with Disabilities Act of 1990, as amended:
 - 1) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design.
 - b. CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
 - 1) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
 2. Surface Burning Characteristics - Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency:
 - a. Flame Spread Index: 25 or less.
 - b. Smoke Developed Index: 450 or less.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 1. Solid Plastic (HDPE):
 - a. Accurate Partitions Corp.; ASI Group.
 - b. Ampco Products, LLC.
 - c. General Partitions Mfg. Corp.
 - d. Global Partitions; ASI Group.
 - e. Metpar Corp./Sanymetal
 - f. Scranton Products; Capitol Partitions, Comtec Industries.
- B. Aluminum Castings: ASTM B26/B26M.
- C. Aluminum Extrusions: ASTM B221.
- D. Stainless Steel Sheet: ASTM A666, Type 304, stretcher leveled standard of flatness.
- E. Stainless Steel Castings: ASTM A743/A743M.

2.2 PARTITION COMPONENTS

- A. Solid Plastic Partitions:
 1. Style:
 - a. Toilet Partition: Floor anchored and overhead braced.
- B. Door, Panel, Screen, and Pilaster Construction - Solid, high density polyethylene (HDPE) panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges, no sightline

system, and with homogenous color and pattern throughout thickness of material:

1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
 2. Heat Sink Strip: Continuous, stainless steel strip fastened to exposed bottom edges of solid plastic components to hinder malicious combustion.
 3. Color and Pattern: Selected by Architect.
 4. Pilaster Shoes and Sleeves (Caps) - Stainless steel:
 - a. Pilaster shall be attached to the floor by means of an 11 gauge stainless steel footer, with provisions for leveling, attached to two (2) 3/8 inch diameter stainless steel studs set into expansion shields. The floor connections are to be covered by a four (4) inch high stainless steel shoe, #4 finish.
 - b. Option Panels: 1/2 inch thick solid phenolic core with high pressure color surface on faces. Edges shall be burnished and slightly rounded.
- C. Brackets (Fittings):
1. Stirrup Type: Ear or U-brackets, stainless steel.
 2. Full Height (Continuous) Type: Stainless steel.

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories - Heavy duty operating hardware and accessories:
1. Hinges: Minimum 0.062 inch (1.59 mm) thick, full door length, stainless steel continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door. Mount with through bolts.
 2. Latch and Keeper: Heavy duty surface mounted cast stainless steel latch unit designed to resist damage due to slamming, with combination rubber faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through bolts.
 3. Coat Hook: Heavy duty combination cast stainless steel hook and rubber tipped bumper, sized to prevent in swinging door from hitting compartment mounted accessories. Mount with through bolts.
 4. Door Bumper: Heavy duty rubber tipped cast stainless steel bumper at out swinging doors and entrance screen doors. Mount with through bolts.
 5. Door Pull: Heavy duty cast stainless steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through bolts.
- B. Overhead Bracing: Continuous, extruded aluminum head rail with antigrip profile and in standard finish.
- C. Anchorages and Fasteners: Exposed fasteners of stainless steel, finished to match the being secured, with theft resistant type heads. Provide sex type bolts for through bolt applications. For concealed anchors, use stainless steel, hot dip galvanized steel, or rust resistant, protective coated steel compatible with related materials.

2.4 FABRICATION

- A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead Braced Units: Provide corrosion resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

- C. Door Size and Swings: Unless otherwise indicated, provide 24 inch (610 mm) wide, in swinging doors for standard toilet compartments and 36 inch (914 mm) wide, out swinging doors with a minimum 32 inch (813 mm) wide, clear opening for compartments designated as accessible.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the work. Confirm location and adequacy of blocking and supports required for installation. Proceed with installation after correcting unsatisfactory conditions.

3.3 INSTALLATION

- A. Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices:
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch (13 mm).
 - b. Panels and Walls: 1 inch (25 mm).
 - 2. Stirrup Brackets - Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel:
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
 - 3. Full Height (Continuous) Brackets - Secure panels to walls and to pilasters with full height brackets:
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Overhead Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position. Attach wall brackets into solid backing/blocking and/or wall studs. No drywall anchors allowed.

3.4 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out swinging doors to return doors to fully closed position.

3.5 MAINTENANCE MATERIAL

- A. Furnish extra materials that match products installed and packaged with protective covering for storage and identified with labels describing contents and source:

1. Door Hinges: One hinge(s) with associated fasteners.
2. Latch and Keeper: One latch and keeper(s) with associated fasteners.
3. Door Bumper: One bumper(s) with associated fasteners.
4. Door Pull: One door pull(s) with associated fasteners.
5. Fasteners: Ten fasteners of each size and type.

END OF SECTION 10 21 13

SECTION 10 22 39 FOLDING PANEL PARTITIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Related Sections:
 - 1. Section 03 30 00: Cast-In-Place Concrete.
 - 2. Section 05 50 00: Metal Fabrications.
 - 3. Section 06 10 00: Rough Carpentry.
 - 4. Section 09 21 16: Gypsum Board Assemblies.
 - 5. Section 09 51 10: Acoustical Ceilings Tile.
- B. Reference Standards:
 - 1. ASTM E90 (UL 723): Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - 2. ASTM E413: Classification for Rating Sound Insulation.
 - 3. ASTM E557: Standard Guide for Architectural Design and Installation Practices for Sound Isolation Between Spaces Separated by Operable Partitions.
 - 4. ASCE 7: Minimum Design Loads for Buildings and Other Structures.
 - 5. NFPA 70: National Electrical Code.
 - 6. UL 508: Standard for Industrial Control Panels.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00: Submittal Procedures.
- B. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.
- C. Shop Drawings: Show location and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.
- D. Setting Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.
- E. Samples: Color samples demonstrating full range of finishes available. Verification samples shall be available in same thickness and material indicated for the work.
- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- G. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic checking and maintenance of all components.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Experienced installer, certified by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.
- B. Acoustical Performance: Test operable partitions in accordance with ASTM E90 test procedure to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.
- C. Preparation of Opening: Conform to ASTM E557.
- D. Panel finishes shall be Class A per CBC 2019 Section 803:
 - 1. Flame spread index 0-25,
 - 2. Smoke-developed index 0-450

1.5 WARRANTY

- A. Provide operable partition manufacturer's written warranty agreeing to repair or replace components with manufacturing defects for a period of two years.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Clearly mark packages and panels with numbering systems used on Shop Drawings. Do not use permanent markings on panels.
- B. Protect panels during delivery, storage, and handling to comply with manufacturer's instructions and as required to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Modernfold, Inc., which is located at: 215 W. New Rd.; Greenfield, IN 46140; Toll Free Tel: 800-869-9685; Tel: 317-468-6700; Fax: 866-410-5016; Email: request info (info@modernfold.com); Web: www.modernfold.com
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00: Product Requirements.

2.2 OPERATION

- A. Acousti-Seal Encore™ – Paired Panel: Series of paired flat panels hinged together in pairs, manually operated, top supported with operable floor seals and automatic top seals.
- B. Final Closure:
 - 1. Horizontally expanding panel edge with removable crank

2.3 PANEL CONSTRUCTION

- A. A. Nominal 4-1/4-inch (108 mm) thick panels in manufacturer's standard 51-inch (1295 mm) widths. All panel horizontal and vertical framing members fabricated from minimum 16-gage

formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.

- B. B. Panel Skin Options:
 - 1. Roll-formed steel wrapping around panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction. Acoustical ratings of panels with this construction:
 - a. 56 STC - 16-gage steel
- C. Hinges for Panels, Pass Doors, and Pocket Doors shall be:
 - 1. Full leaf butt hinges, attached directly to panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.
- D. Panel Trim: No vertical or horizontal trim required or allowed on edges of panels; minimal groove appearance at panel joints.
- E. E. Panel Weight:
Steel Skin
 - 1. 3. 56 STC – 11.9 lbs./square foot

2.4 PANEL FINISHES

- A. Panel face finish shall be:
 - 1. Reinforced heavy-duty vinyl with woven backing weighing not less than 30 ounces per lineal yard.
- B. Panel Trim: No exposed panel trim required or allowed, hardware to be of one consistent color:
 - 1. Natural Choice

2.5 SOUND SEALS

- C. Vertical Interlocking Sound Seals between panels: Roll-formed steel astragals, with tongue and groove configuration in each panel edge. Rigid plastic or aluminum astragals are not acceptable.
- D. Horizontal Top Seals shall be Modernfold SureSet™ automatic operable top seals, manually operated operable top seals not required or permitted.
- E. Horizontal Bottom Seals shall be Modernfold SureSet™ bottom seal (select one):
 - 1. SA2 - Automatic bottom seals providing nominal 2-inch (51 mm) operating clearance with an operating range of +1/2-inch (13 mm) to -1-1/2-inch (38 mm) which automatically drop as panels are positioned, without the need for tools or cranks. Extended seal shall exert nominal 120 pounds (265 kg) downward force to the floor throughout operating range.

PART 3 2.6 SUSPENSION SYSTEM

A. #17 Suspension System

1. Suspension Tracks: Minimum 11-gage, 0.12-inch (3.04mm) roll-formed steel track, supported by adjustable steel hangar brackets. Supporting the load bearing surface of the track, to structural support pairs of 3/8-inch (9.5 mm) diameter threaded rods. Brackets must support the load bearing surface of the track.

a. Exposed track soffit: Steel, removable for service and maintenance, attached to track bracket without exposed fasteners, and pre-painted off-white.

2. Carriers: One all-steel trolley with steel-tired ball bearing wheels per panel (except hinged panels). Non-steel tires are not acceptable.

PART 4

PART 5 2.7 OPTIONS

A. A. Single Pass Doors:

1. Matching pass door same thickness and appearance as panels. ADA compliant pass door to be trimless and equipped with friction latch and flush pulls for panic operation. No threshold will be permitted.

2. Hardware:

a. Lever handles both sides of door

b. Automatic door closer.

PART 6 EXECUTION

6.1 EXAMINATION

A. Do not begin installation until supports and substrates have been properly prepared.

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

6.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

6.3 INSTALLATION

A. Install in accordance with manufacturer's instructions and ASTM E557 installation procedures. Test for proper operation and make necessary adjustments until satisfactory results are obtained.

6.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 10 22 39

SECTION 10 28 13 TOILET ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Public use washroom accessories.
 - 2. Accessories necessary for a complete installation.

1.3 PERFORMANCE REQUIREMENTS

- A. Sanitary Facility Elements:
 - 1. Elements of sanitary facilities shall be mounted at locations in compliance with CBC Sections 11B-602 through 11B-612.
 - 2. Grab bars in toilet facilities and bathing facilities shall comply with CBC Section 11B-609.
 - 3. Grab bars and any wall or other surfaces adjacent to grab bars shall be free of sharp or abrasive elements and shall have rounded edges. The space around the grab bars shall be as follows:
 - a. 1 ½ inches between the grab bar and the wall.
 - b. 1 ½ inches minimum between the grab bar and projecting objects below and at the ends.
 - c. 12 inches minimum between the grab bar and projecting objects above.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Technical Data including construction details, material descriptions, dimensions of individual components and profiles, and finishes:
 - a. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - b. Include electrical characteristics.
- B. Samples:
 - 1. Full size, for each exposed product and for each finish specified:
 - a. Approved full size Samples will be returned and may be used in the Work.
- C. Product Schedule: Show types, quantities, sizes, and installation locations by room of each accessory required. Identify locations using room designations indicated.
- D. Maintenance Data: Submit for inclusion in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Accessibility Requirements:
 - 1. Comply with applicable requirements:
 - a. Americans with Disabilities Act of 1990, as amended:
 - 1) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design

- b. CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
 - 1) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.

B. Source Limitations: Obtain products from single source from single manufacturer.

1.6 WARRANTY

- A. Written warranty signed by manufacturer in which manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period:
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Basis of Design: Bobrick Washroom Equipment, Inc; All items are to be contractor supplied and installed unless noted otherwise
- B. Manufacturers
 - 1. Toilet accessories schedule is based on Bobrick Washroom Equipment. Subject to compliance with requirements, provide products by one of the following:
 - a. American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. Bradley Corporation.
 - d. Georgia-Pacific Professional
- C. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.
- D. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- E. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.
- F. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot dip zinc coating.
- G. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot dip galvanized after fabrication.
- H. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- I. Mirrors: Annealed float glass nominal 6.0 mm thick, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- J. Keys: Provide 2 keys for each accessory to Owner; master key lockable accessories.

2.2 COMPONENTS

2.3 FABRICATION

- A. Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 EXECUTION

3.1 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

3.2 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.3 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items. Remove temporary labels and protective coatings. Clean and polish exposed surfaces according to manufacturer's written recommendations.

PART 4 SCHEDULE

4.1 ACCESSORY SCHEDULE

- A. Combination Toilet Paper Dispenser, Seat Cover Dispenser, Sanitary Napkin Disposal: Double roll, recessed, stainless steel unit with pivot hinge, tumbler lock.
 - 1. Product: B-35745 manufactured by Bobrick. (recessed)
 - 2. Product: B-3579 manufactured by Bobrick. (surface mounted)
- B. Combination Towel Dispenser/Waste Receptacle: Recessed flush with wall (so as to allow required clearance of 1-1/2 inches at grab bars), stainless steel; seamless wall flanges, continuous piano hinges, tumbler locks on upper and lower doors.
 - 1. Waste receptacle liner: Reusable, heavy-duty vinyl.
 - 2. Waste receptacle capacity: 12 gallons.
 - 3. Product: B-3944 manufactured by Bobrick.

- C. Grab Bars: Stainless steel, nonslip grasping surface finish.
 - 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force, minimum.
 - b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
 - c. Length and Configuration: As indicated on drawings.
 - d. Finishing: Grab bars and any wall or other surfaces adjacent to grab bars shall be free of sharp or abrasive elements and shall have rounded edges.
 - e. Products:
 - i. B-6806.

END OF SECTION 10 28 13

SECTION 10 44 00 FIRE EXTINGUISHER AND CABINETS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Fire Extinguisher Cabinets.
 - 2. Fire Extinguishers
- B. Related Sections:
 - 1. Section 06 10 00: Rough Carpentry.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's specifications and technical data to indicate specification compliance.
 - 2. Manufacturer's installation instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Specifications are based on the products of named manufacturers. Other listed manufacturers who produce products equivalent to those specified are approved for use on the Project. Other manufacturers must have a minimum of five (5) years' experience manufacturing equivalent to those specified and comply with Division 1 requirements regarding substitutions to be considered:
 - 1. Larsen's Manufacturing Co.
 - 2. The Williams Bros. Corporation of America.
 - 3. J. L. Industries, Inc.
 - 4. Potter-Roemer.

2.2 MATERIALS

- A. Fire Extinguishers and Cabinets must comply with CBC Sections 11B-307, 11B-308, 11B-309, and 11B-403.
- B. Fire Extinguisher Cabinets (FEC):
 - 1. Size: 24 inches x 9-1/2 inches x 6 inches inside tub dimension.
 - 2. Type: Semi-recessed with 2-1/2 inch return trim rolled edge; ADA compliant.
 - 3. Tub Construction: 22 gauge min. steel with standard baked acrylic enamel interior finish.
 - 4. Door and Frame: 18 gauge min. 304 stainless steel door and frame with vertical decal lettering "FIRE EXTINGUISHER" in red color, unless directed otherwise by Architect.
 - 5. Glazing: clear acrylic "Duo" vertical glazing panel
 - 6. Hardware: Continuous concealed piano hinge constructed of material which matches door and trim material. Satin finish pull handle with cam cylinder lock with safety pull designed to release upon firm pull on handle (Larsen's "Larsen-Loc"™, J.L. Industries

“Saf-T-Lok”™; or equivalent).

7. Bracket: Hook type; Larsen's #1007, or equal.
8. Finish of Exterior: #4 Stainless steel.
9. Fire rating: as occurs, provide fire rated cabinet, for one or two hour rated conditions as indicated or required by specific location. Cabinet shall be tested and approved by Warnock Hersey to ASTM E-814, and shall bear the Warnock Hersey label.

C. Fire Extinguishers (F.E):

1. Models/Types:
 - a. Multipurpose dry chemical with 10 lbs. capacity and UL 4A-80B: C rating conforming to MP10 Series.
2. Mounting: Provide eye brackets for direct wall mounting to hook and for mounting in Fire Extinguisher cabinets. Refer to drawings for location and quantity.
3. Provide initial inspection tag for each extinguisher.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install fire extinguishers and cabinets in openings in accordance with manufacturer's printed instructions.
- B. Install fire extinguishers and cabinets where indicated on the drawings, or if not indicated, in locations required by governing code and as directed by Owner.

END OF SECTION 10 44 00

SECTION 12 21 13 WINDOW BLINDS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Horizontal Shade Devices.
 - 2. Accessories necessary for a complete installation.

1.3 SUBMITTALS

- A. Product Data: Technical data for each type of product.
- B. Shop Drawings - Submit fabrication and installation details:
- C. Samples - For each exposed product and for each color and texture specified, 12 inches (300 mm) long:
 - 1. Slat: Not less than 12 inches (300 mm) long.
 - 2. Tapes: Full width, not less than 6 inches (150 mm) long.
 - 3. Horizontal Louver Blind: Full size unit, not less than 16 inches (400 mm) wide by 24 inches (600 mm) long.
 - 4. Valance: Full-size unit, not less than 12 inches (300 mm) wide.
- D. Product Test Reports: For horizontal louver blinds with polymer slats that have been tested for compliance with NFPA 701, for tests performed by.
- E. Maintenance Data: Submit data to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain horizontal louver blinds from single source from single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver horizontal louver blinds in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturers:
 - 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. MechoShade Systems <http://www.mechoshade.com>.
 - b. Skyco <http://www.skycoshade.com>.
 - c. Draper <http://draperinc.com/WindowShades/index.asp>.

- d. Approved equal.
- B. Product:
 - 1. Roller shades to comply with WCMA A 100.1.
 - 2. Flame Resistance Rating: Pass NFPA 701.
 - 3. Black-out Shade Material:
 - a. Room darkening (PVCFree) Shadecloth with opaque acrylic backing MechoShade System, Inc. 008 inches thick (19mm) blackout material and weighing 94 lbs. per square yard comprising of 53 percent fiberglass, 45 percent acrylic, 2 percent poly finish.
 - b. Color: Architect to select from manufacturers standard colors
 - 4. Rollers and Housing:
 - c. Electro-galvanized or epoxy primed steel or extruded aluminum tube and wall thickness of appropriate diameter and gauge to not sag over required spans.
 - d. No plastic hardware allowed.
 - e. Assembly must be easy to remove for replacement of material.
 - 5. Brackets:
 - a. Galvanized or zinc plated steel.
 - 6. Operations:
 - a. Manual: Stainless steel chain pulls.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

- A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet-work and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

3.2 EXTRA MATERIALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents:
 - 1. Operable rolling shade device: Full size units equal to 5 percent of quantity installed for each size, color, texture, pattern, and gloss indicated, but no fewer than two units.

3.3 INSTALLATION

- A. Install shades at locations scheduled, noted on the drawings, or as directed by the Architect in accordance with manufacturer's installation procedures, except as otherwise specified herein.
- B. Install intermediate support and extension brackets as needed to prevent deflection in headrail.
- C. Install shades with adequate clearance to permit smooth operation with minimum clearance

of 1/4 inch from each side of window opening on inside mount, unless other clearance is indicated or suggested by manufacturer.

3.4 CLEANING AND DEMONSTRATION

- A. Clean in accordance with manufacturer's instructions.
- B. Provide final protection and maintain conditions that ensures shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems.

END OF SECTION 12 21 13

SECTION 21 00 00 FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

- A. Wet-Pipe Fire Sprinkler System.
- B. System Design, Installation and Certification.

1.02 RELATED REQUIREMENTS:

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 01 - General Requirements apply to this section.
- B. Section 28 31 00 – Fire Detection and Alarm.
- C. Section 21 00 01 - Common Work Results for Fire Suppression: Pipe, fittings, and valves.
- D. Section 21 00 02 - Identification for Fire Suppression Piping and Equipment: Piping Identification.
- E. Division 22/ 23 – Plumbing/ Mechanical.
- F. Division 26 – Electrical.
- G. Division 28 – Technology.

1.03 REFERENCE STANDARDS:

- A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association 2016.
- C. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.
- D. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- E. ASTM B75 - Seamless Copper Tube.
- F. ASTM B88 - Seamless Copper Water Tube.
- G. ASTM B251 - General Requirements for Wrought Seamless Copper and Copper Alloy Tube.
- H. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for

Piping and Tubing.

1.04 SUBMITTALS:

- A. See Division 01 for Administrative Requirements, for Submittal Procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Shop Drawings: Fire sprinkler system design is not a deferred submittal. The overall system design is approved by DSA. The overall system design is a directive for the installation of the system.
 - 1. Examine Contract Documents prior to bidding of Work and report discrepancies in writing to LP Engineers, Inc.
 - 2. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The fire protection Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.
 - 3. Architectural and structural Drawings are part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over fire protection Drawings.
 - 4. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in locations shown. Obtain LP Engineers' approval prior to relocation of equipment and materials.
 - 5. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
 - 6. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, seismic details and calculations, components and accessories. Indicate system controls.
 - 7. Submit shop drawings to LP Engineers, Inc. for approval prior to fabrication or installation.
 - 8. Installation is to conform to the DSA approved fire sprinkler plans.
 - 9. Approved documents do not relieve the contractor of field coordination. It is the fire sprinkler contractors' responsibility to coordinate piping locations with the work of other trades.
 - 10. Preparation of installation and fabrication drawings is the responsibility of the fire sprinkler contractor.
- D. Material Data: DSA Approved material data is a guideline. The fire sprinkler system design parameters must be strictly adhered to. Alternate manufacturers may be submitted to LP Engineers, Inc. for review of project compliance. DSA approval must be obtained prior to installation. A copy of the approved material data must be on the project site for the Project Inspector prior to the commencement of installation.

E. SUBSTITUTIONS

1. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project.
2. Substitutions will be interpreted to be manufacturers other than those specifically listed in Contract Documents by brand name, model, or catalog number.
3. Only one request for substitution will be considered for each item of equipment or material.
4. Substitution requests shall include the following:
 - a. Reason for substitution request.
 - b. Complete submittal information

E. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

F. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

G. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

H. Maintenance Materials: Furnish the following for the Dublin Unified School District use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
3. Sprinkler Wrenches: For each sprinkler type.

I. Section 01 91 13 - General Commissioning Requirements.

1.05 QUALITY ASSURANCE:

- A. Maintain one copy of referenced design and installation standard on site.
- B. Conform to UL and FM requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- D. Fabrication shop must provide welding certifications and copy of weld stamp. Weld stamp to be provided on all pipe at welds.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum five year's experience. Installing company must have a valid State of California contractors' license with a C-16 classification.
- F. Equipment and Components: Provide products that bear UL and FM label or marking.

- G. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS:

- A. Fire protection systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.
- B. Contractor shall design seismic bracing for all fire protection equipment and systems to comply with the 2019 California Building Code (CBC) and the latest edition of the Mason Industries "Seismic Restraint Guidelines".
 - 1. Contractor shall submit details and calculations prepared and signed by a licensed professional structural engineer registered in the state in which the Work is performed demonstrating compliance with the above and all applicable codes.
 - 2. Drawings, details and calculations shall be submitted to the Architect for review. Compliance documents shall be approved by the Architect prior to installation.
- C. Fire protection systems and equipment shall include, but are not limited to, all piping, valve assemblies, fire pumps, electrical and control panels, conduits and other components.
- D. Supports, anchorage and restraints, including attachments to building structure, for all piping for standard installation details that comply details shown on the fire sprinkler plans and structural plans.

1.07 DELIVERY, STORAGE AND HANDLING:

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 - PRODUCTS - ALL PRODUCTS SHALL CONFORM TO CONTRACT DOCUMENTS INCLUDING APPROVED MATERIAL DATA.

2.01 SPRINKLER SYSTEM:

- A. Sprinkler System: Provide coverage for building areas noted on Drawings, including all areas, rooms, spaces above and below ceilings, entry ways, overhangs (if applicable), etc. and all other areas requiring sprinklers in accordance with NFPA 13.
- B. Occupancy: Light Hazard, Kitchen: Ordinary Hazard, Group 1. Comply with NFPA 13, 2016. All storage rooms to have sprinklers spaced for ordinary hazard.
- C. Interface system with building fire and smoke alarm system.
- D. Provide fire department connections - existing
- E. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to fire sprinkler riser. Supply no less than two (2) spare sprinklers of each type and temperature rating used on project. Storage cabinet to include a wrench(s) applicable to sprinkler types.

2.02 SPRINKLERS:

- A. Exposed Area Type: Upright.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Brass.
 - 4. Fusible Link: Glass bulb type temperature rated for specific area hazard.
 - 5. Application: Areas with exposed construction and all spaces above ceiling.

- B. Finished Gypsum Board Ceilings and Suspended Ceilings: Semi-Recessed Pendant
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard
 - 3. Finish: Chrome sprinkler with White escutcheon
 - 4. Fusible Link: Glass bulb type temperature rated for specific area hazard.

2.03 PIPING SPECIALTIES:

- A. Zone Control Valves:
 - 1. Outside screw and yoke or butterfly, U.L. listed.
 - 2. Valves shall be sealed open using approved seal.
 - 3. Provide weatherproof actuator housing with two single pole double throw switches.

- B. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.

- C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

- D. Tamper switch: PCVS Control Valve Supervisory Switch, with two contacts

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install in accordance with referenced NFPA design and installation standards, DSA requirements and DSA approved plans.

- B. Approved documents do not relieve the fire sprinkler contractor of field coordination. It is the fire sprinkler contractors' responsibility to coordinate piping locations with the work of other disciplines.

- C. Strict adherence to the contract design documents is required. Any deviation from the contract documents requiring additional plan review, hydraulic calculations, structural review or calculations, or seismic calculations, shall be submitted to LP Engineers, Inc. for review prior to making changes.

- D. Install equipment in accordance with manufacturer's instructions.

- E. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.
- F. Preparation of installation and fabrication drawings is the responsibility of the fire sprinkler contractor.
- G. Locate outside alarm gong on building wall as indicated on Fire Sprinkler Shop Drawings.
- H. Place pipe runs to minimize obstruction to other work.
- I. Place piping in concealed spaces above finished ceilings.
- J. Center sprinklers in two directions in ceiling tile and provide piping offsets as required. Flex drops are not permitted.
- K. All pendent or horizontal sidewall sprinklers are to be installed on return bends
- L. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- M. Flush entire piping system of foreign matter.
- N. Install guards on sprinklers where subject to damage as in attic space where mechanical equipment is located and in mechanical room.
- O. Hydrostatically test entire system.
- P. Required test to be witnessed by IOR.
- Q. Verification of weld inspection required prior to installation of fire sprinkler system.

3.02 INTERFACE WITH OTHER PRODUCTS:

- A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION

SECTION 21 00 01 COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.01 SECTION INCLUDES:

- A. Pipe, fittings, valves, and connections for sprinkler systems.

1.02 RELATED REQUIREMENTS:

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 01 - General Requirements apply to this section.
- B. Section 21 00 00 – Fire Suppression Sprinkler Systems: Sprinkler systems design.
- C. Section 21 00 02 - Identification for Fire Suppression Piping and Equipment: Piping Identification.
- D. Division 22/ 23 – Plumbing/ Mechanical.
- E. Division 26 – Electrical.
- F. Division 28 – Technology.

1.03 REFERENCE STANDARDS:

- A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers.
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; The American Society of Mechanical Engineers.
- C. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers.
- D. ASME B16.4 - Gray Iron Threaded Fittings; The American Society of Mechanical Engineers.
- E. ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings; The American Society of Mechanical Engineers.
- F. ASTM A 47/A 47M - Standard Specification for Ferritic Malleable Iron Castings.
- G. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- H. ASTM A 795/A 795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
- I. AWWA C110/A21.10 - American National Standard for Ductile-Iron and Gray-Iron

Fittings, 3 In. Through 48 In. (75 mm Through 1200 mm), for Water and Other Liquids; American Water Works Association.

- J. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association (ANSI/AWWA C111/A21.11).
- K. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association (ANSI/AWWA C151/A21.51).
- L. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2016.
- M. NFPA 14 - Standpipe and Hose Systems.
- N. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.
- O. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.
- P. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS:

- A. See Division 01 for Submittal Procedures.
- B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.
- C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, seismic restraints and calculations, and piping connections.
 - 1. Examine Contract Documents prior to bidding of Work and report discrepancies in writing to Architect.
 - 2. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The fire protection Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.
 - 3. Architectural and structural Drawings are part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over fire protection Drawings.
 - 4. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in locations shown. Obtain Architects' approval prior to relocation of equipment and materials.
 - 5. Relocate equipment and materials installed without prior approval of Architect. Remove and relocate equipment and materials at Contractors' expense upon Architects' direction.

6. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work or work directly connected to same are installed and providing no additional material is required.

D. Project Record Documents: Record actual locations of components and tag numbering.

E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

F. Section 01 91 13 - General Commissioning Requirements.

1.05 QUALITY ASSURANCE:

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Fabrication shop must provide welding certifications and copy of weld stamp. Weld stamp to be provided on all pipe at welds.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

D. Conform to UL and FM requirements.

E. Valves: Bear UL and FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

F. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 – PRODUCTS

2.01 FIRE PROTECTION SYSTEMS:

A. Sprinkler Systems: Conform work to NFPA 13 and DSA requirements.

B. Welding Materials and Procedures: Conform to ASME Code.

2.02 BURIED PIPING: PIPING TO 5'-0" OUTSIDE BUILDING FACE

- A. Ames ES.A - Series IBR - In Building Riser.
- B. Thrust Blocks -Suitable anchorage/thrust blocking or joint restraint shall be provided at all of the following main locations: dead ends, plugs, caps, tees, crosses, valves, and bends, in accordance with the Standard Drawings DD-839 Series. All mechanical (joint) restraints shall be bidirectional. Anchor blocks shall be constructed solidly behind the fitting and symmetrical with the axis of resultant thrust, except where this is not possible as in the case of gravity anchorage for vertical bends. Special ties and anchor fittings may be utilized in conjunction with blocking when shown in the contract documents or as directed by the Engineer. All thrust blocking shall be a minimum of 3,000 psi concrete placed between solid ground and the fitting except as otherwise shown in the contract documents. The area of bearing in contact with solid ground shall be that shown in the contract documents or as directed by the Engineer. All thrust blocking placed in conjunction with mains and appurtenances constructed in Pressure Zones 9 through 16 shall be in accordance with Standard Drawings DD-839 Series. In all cases, the design of thrust blocking shall be of sufficient size to withstand an assumed soil lateral load bearing capacity of 3,000 psf, unless specified otherwise in the contract documents. When specifically requested by the Contractor and approved by the Engineer, the maximum soil lateral load bearing capacity that will be allowed for the design of thrust blocking shall be 5,000 psf. When soil lateral load bearing capacities of 4,000 psf or 5,000 psf are recorded for design of thrust blocks, copies of soil tests made for determining the lateral load bearing capacity of the subject soil shall be submitted to the Engineer for approval. The blocking shall be placed so that pipe and fitting joints will be accessible.

2.03 ABOVE GROUND PIPING:

- A. Steel Pipe: ASTM A 795 Schedule 10 or ASTM A 53 Schedule 40, black, or as approved by DSA:
 - 1. Steel Fittings: ASME B16.9, wrought steel, buttwelded.
 - a. Schedule 10 Pipe: Shall be U.L. approved with U.L. approved grooved fittings and couplings for pipe sizes 2-1/2" and larger only. Schedule 10 pipe shall not be used for pipe sizes less than 2-1/2". Threaded fittings shall not be used for any Schedule 10 pipe.
 - 2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
 - 3. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A 47/A 47M.
 - 4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
 - 5. Mechanical formed fittings, including, but not limited to, tees, saddle fittings, bushings and mechanical sprinkler head fittings shall not be used.
- B. Cast Iron Pipe: AWWA C151/A21.51.
 - 1. Fittings: AWWA C110/A21.10, standard thickness.
 - 2. Joints: AWWA C111, rubber gasket.
 - 3. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped composition sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

2.04 PIPE HANGERS AND SUPPORTS:

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, split ring.
- C. Vertical Support: Steel riser clamp.
- D. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.05 GATE VALVES:

- A. Up to and including 2 inches:
 - 1. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.
- B. Over 2 inches:
 - 1. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid bronze or cast iron wedge, flanged ends.
- C. Over 4 inches:
 - 1. Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

2.06 GLOBE OR ANGLE VALVES:

- A. Up to and including 2 inches:
 - 1. Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with backseating capacity repackageable under pressure.

2.07 CHECK VALVES:

- A. Up to and including 2 inches:
 - 1. Bronze body and swing disc, rubber seat, threaded ends.
- B. Over 2 inches and less than 4 inches:
 - 1. Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.
- C. 4 inches and Over:
 - 1. Iron body, bronze disc, stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

PART 3 – EXECUTION

3.01 PREPARATION:

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.

- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION:

- A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Sleeve pipes passing through partitions, walls, and floors.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Pipe Hangers and Supports:
 - 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 2. Place hangers within 12 inches of each horizontal elbow.
 - 3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
- H. Slope piping and arrange systems to drain at low points.
- I. Prepare pipe, fittings, supports, and accessories for finish painting.
- J. Do not penetrate building structural members unless indicated.
- K. Provide sleeves when penetrating footings, floors, and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- L. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- M. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.
- N. Provide gate valves for shut-off or isolating service.
- O. Provide drain valves at main shut-off valves, low points of piping and apparatus.

END OF SECTION

SECTION 21 00 02 IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe Markers.

1.02 RELATED REQUIREMENTS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. Section 09 90 00 – Painting.

1.03 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittals, for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- E. Project Record Documents: Record actual locations of tagged valves.
- F. Section 019113 General Commissioning Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Brady Corporation: www.bradycorp.com.
- B. Champion America, Inc: www.Champion-America.com.
- C. Seton Identification Products: www.seton.com/aec.

2.02 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: Equipment, control panels 1 inch.
 - 3. Letter Height: Controls and small components, 1/4 inch.
 - 4. Background Color: Black.

2.03 TAGS

- A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.04 PIPE MARKERS

- A. Color: Conform to ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Secure to pipe using two (2) bands of adhesive tape with flow arrows supplied by the manufacturer. Install securing bands completely around pipe and overlapped.
- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Identify valves in main and branch piping with tags.
- G. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 22 00 00

GENERAL PLUMBING PROVISIONS

PART 1 - GENERAL

1.01 GENERAL CONDITIONS:

- A. The foregoing General and Special Conditions shall form a part of this Division with the same force and effect as though repeated herein. The provisions of this Section shall apply to all the Sections of Division 22.

1.02 CODES AND REGULATIONS:

- A. All work and materials shall be in full accordance with current rules and regulations of applicable codes. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the drawings or specifications call for material or methods of construction of a higher quality or standard than required by these codes, the specifications shall govern. Applicable codes and regulations are:

1. California Code of Regulations – CCR:
 - a. Title 8, Industrial Relations.
 - b. Title 24, Building Standards.
2. California Building Code – CBC.
3. California Mechanical Code – CMC.
4. California Plumbing Code – CPC.
5. California Green Building Code.
6. American Gas Association – AGA.
7. American National Standards Institute – ANSI.
8. American Society of Heating, Refrigerating and Air Conditioning Engineers – ASHRAE.
9. American Society of Mechanical Engineers – ASME.
10. American Society for Testing and Materials – ASTM.
11. American Water Works Association – AWWA.
12. Cast Iron Soil Pipe Institute – CISPI.
13. California Electrical Code – CEC.
14. National Electrical Manufacturers Association – NEMA.
15. National Fire Protection Association – NFPA.
16. National Sanitation Foundation – NSF.
17. Plumbing and Drainage Institute – PDI.
18. Sheet Metal and Air Conditioning Contractors National Association – SMACNA.
19. Underwriters' Laboratory – UL.
20. Occupational Safety and Health Act - OSHA.
21. California Assembly Bill 1953 (AB1953).

1.03 PERMITS AND FEES:

- A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required by local ordinances. All charges are to be included in the work. Permits for equipment connected to a particular system are to be considered as a part of the work included under each system; for example, permits for electric motor connection are part of electrical work, permits for domestic water or gas connections are part of plumbing work. All charges for service connections, meters, etc. by utility companies or districts shall be included in the work.

1.04 COORDINATION OF WORK:

- A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. The actual locations of all materials, piping, fixtures, equipment, supports, etc.

shall be carefully planned, prior to installation of any work, to avoid all interference's with each other, or with structural, electrical or architectural elements. Verify the proper voltage and phase of all equipment with the electrical plans. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment.

1.05 GUARANTEE:

- A. Guarantee shall be in accordance with the General Conditions. These specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the Certificate of Guarantee shall be furnished to the Owner through the Engineer.

1.06 EXAMINATION OF SITE:

- A. The Contractor shall examine the site, compare it with plans and specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.07 SUBMITTALS:

- A. Submit shop drawings in accordance with Division 01.
- B. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material and equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution. All shop drawings must comply with the following:
 - 1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory.
 - 2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer and Contractor; Table of Contents; and indexed tabs dividing each group of materials or item of equipment. All items shall be marked with the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on the drawings.
 - 3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be highlighted, circled or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled, or detailed.
- C. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and the features desired. Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items.
- D. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the

Contractor to provide all materials, equipment and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept; that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed.

1.08 OPERATION AND MAINTENANCE INSTRUCTIONS:

- A. Submit one electronic pdf copy for review and after approved submit three hard copies of the Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts lists for all equipment, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. WH-1). All wiring diagrams shall agree with revised shop drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Water Heaters, Pumps, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included. **(These submittals shall be submitted with regular submittals at start of job so Commissioning Contractor can start on the commissioning check list for LEED Certification or Title 24 Requirements)**
- B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instruction that applies to the control system. The Engineer's office shall be notified 96 hours prior to this meeting.
- C. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed, verbal and posted) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.09 RECORD DRAWINGS:

- A. The Contractor shall maintain a set of prints for the project as a record of all construction changes made. As the Work progresses, the Contractor shall maintain a record of all deviations in the Work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. buildings, curbs and walks. In addition, the water, gas, sewer, etc. within the building shall be recorded by offset distances from building walls. The original drawings will be made available to the Contractor from which he shall have a set of reproducible drawings made. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up prints and reproducibles) shall be submitted to the Engineer for review (as an alternative, the marked-up prints may be photocopied full size on reproducible stock).

PART 2 - PRODUCTS

2.01 PROTECTIVE COATING FOR UNDERGROUND PIPING:

- A. All ferrous pipe below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness, X-Tru Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Manville Corporation. Protective coating shall be extended 6" above surrounding grade.

2.02 CONCRETE ANCHORS:

- A. Concrete Anchors shall comply with CBC 1901A.3. Steel stud with expansion anchor requiring a drilled hole; powder driven anchors are not acceptable. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 10 diameters center-to-center and 5 diameters from center to edge of concrete. Maximum allowable stresses for tension and shear shall be 80% of the test report values "with special inspection". Anchors shall be Hilti, Philips - or Approved equal.

2.03 SEISMIC RESTRAINTS:

- A. All plumbing systems (all equipment, piping, etc.) shall be provided with seismic restraints in accordance with "Guidelines for Seismic Restraint of Mechanical Systems" dated 2006 by SMACNA.

2.04 SYSTEM IDENTIFICATION:

- A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by preprinted markers or stenciled marking, and include arrows to show the direction of flow. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floor, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portion of lines. Marking of short branches and repetitive branches for equipment connections is not required.
- B. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. WH-1). Provide 1/2" high lettering, white on black background. Nameplates shall be permanently secured to the unit.
- C. Valves: Provide valve tags on all valves of each piping system, excluding check valves, valves within equipment, faucets, stops and shut-off valves at fixtures and other repetitive terminal units. Provide brass tags or plastic laminate tags. Prepare and submit a tagged valve schedule, listing each valve by tag number, location and piping service. Mount in glazed frame where directed.

2.05 EQUIPMENT SUPPORT FRAMES:

- A. Unless specifically noted otherwise, it shall be the responsibility of Plumbing Contractor to furnish and install all support frames for its equipment.

PART 3 - EXECUTION

3.01 SCHEDULING OF WORK:

- A. All work shall be scheduled subject to the approval of the Engineer and Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site.

3.02 CONDUCT OF WORK:

- A. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work, and shall cause no delay to other Divisions engaged upon this project or to the Owner.
- B. Plumbing Contractor shall arrange for all cutting necessary for the proper installation of its work, providing all sleeves and chases necessary. Cutting shall not be done in such a manner to impair the strength of the structure. Any damage resulting from work shall be repaired by the Contractor at his expense to the satisfaction of the Engineer.
- C. Progressively, daily at the completion of each day's work, and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.
- D. **IAQ Management plan will be in effect for LEED Certification. Adhesives and mastic must comply with low VOC requirements and documentation (MSDS, etc.) shall be provided with submittals.**

3.03 EXCAVATION AND BACKFILL:

- A. Excavation: Trenches are to be excavated to grade and depth established by drawings. Unless otherwise noted, minimum earth cover above top of pipe shall be 24", not including base and paving in paved areas. Width of trenches at top of pipe shall be a minimum of 16" plus the outside diameter of the pipe. Provide all shoring required by site conditions. Barrel of pipe shall have uniform support on trench bottom, hand excavate additional depth at bells, hubs and fittings. Where over-excavation occurs, provide compacted selected backfill to pipe bottom. Where ground water is encountered, remove to keep excavation dry, using well points and pumps as required.
- B. Backfill:
 - 1. Around Pipe and to One Foot Above Pipe: Material shall be river run sand or native granular free flowing material, free of clay lumps, silt or vegetable matter and shall have 100% passing through the No. 4 sieve and a maximum of 3% passing through the No. 200 sieve. Place carefully around and on top of pipe, taking care not to disturb piping. Consolidate with vibrator.
 - 2. One Foot Above Pipe to Grade: Material to be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed, to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to approval by the Engineer.
 - 3. Remove all water sensitive settlement from trench backfill regardless of location and compaction requirements.
- C. Compaction: Compact to a density of 95% within building and 90% outside building. Demonstrate proper compaction by testing at one-half of the trench depth. Perform three tests per 100' of trench.

3.04 OPENINGS, CUTTING AND PATCHING:

- A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. The actual openings and the required cutting and patching shall be provided. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall also be provided. Cutting and coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

3.05 MANUFACTURER'S RECOMMENDATIONS:

- A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of a particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

3.06 QUIETNESS:

- A. Piping and equipment shall be arranged and supported so that vibration is a minimum and is not carried to the building structure or spaces.

3.07 DAMAGES BY LEAKS:

- A. The Contractor shall be responsible for damages to other work caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages to other work caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

3.08 CLEANING:

- A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

*** END OF SECTION ***

SECTION 22 00 01

PLUMBING

PART 1 - GENERAL

1.01 GENERAL CONDITIONS:

- A. The foregoing Section 22 00 00, General Plumbing Provisions shall form a part of this specification.

1.02 SCOPE:

- A. Included: Perform all work necessary and required to complete construction as indicated. Such work includes the furnishings of all labor, materials and services necessary for a complete, lawful and operating plumbing system with all equipment as shown or noted on the drawings or as specified herein. The work includes, but is not necessarily limited to, the following:
 - 1. Sanitary sewer system.
 - 2. Domestic water system.
 - 3. Plumbing fixtures.
 - 4. Plumbing equipment.
 - 5. Condensate drains.
 - 6. Storm drain system.
 - 7. Gas piping.
- B. Work Specified Elsewhere:
 - 1. Line voltage power wiring (60 volts or greater), motor starters in motor control centers, and disconnect switches are included in the Electrical Division, unless otherwise noted.
 - 2. Access doors.
 - 3. Concrete and reinforcing steel.
 - 4. 23 00 01, Heating, Ventilating and Air Conditioning.

1.03 CODES AND STANDARDS:

- A. All pipe, pipe or plumbing fittings or fixture, solder, or flux shall be lead free that provides water for human consumption per California Assembly Bill 1953 (AB1953).
- B. See Section 22 00 00 for additional requirements.

1.04 SUBMITTALS:

- A. Provide product data for all materials per Division 01.

PART 2 - MATERIALS

2.01 PIPING MATERIALS:

- A. Sanitary Sewer:
 - 1. Soil, Waste and Vent Piping:
 - a. Inside Building and Within Five Feet of Building Walls: Standard weight coated cast iron pipe and fittings. Plain end with neoprene gasket and stainless steel retaining sleeve, CISPI 301, ASTM A888 hubless cast-iron, or hub end with rubber gasket, ASTM A74, ASTM C564. Size 2" and smaller above grade may be standard weight galvanized steel, ASTM A53, with coated cast iron recessed drainage fittings, ANSI

B16.12. All cast iron pipe and couplings shall be American made and tested, no imported pipe or coupling is acceptable. Use heavy-duty (4-Band) couplings for all soil and waste piping. Use standard (2-Band) couplings for all vent piping. Tyler Pipe, AB & I Foundry or Charlotte Pipe. Couplings shall be Tyler, Anaco or Husky.

OR

- a. Inside Building and Within Five Feet of Building Walls: PVC-DWV sewer pipe with solvent weld, ASTM D2665. Schedule 40 wall thickness. Traps, sink outlets, cleanouts, etc., shall be same material. Traps shall have union connections.
 - i. Piping over food prep centers, food serving facilities, food storage areas and other critical areas shall be kept to a minimum and shall not be exposed.
- b. Outside Building:
FOR STATE JOBS, DELETE PLASTIC PIPE FROM DRAINAGE SECTION PER AMENDMENT TO UPC, 701.1.
 - i. For domestic waste only: Polyvinyl chloride gravity sewer pipe with bell and rubber Z-gasket, ASTM D3034, SDR 35. Carlon, J.M.
 - ii. PVC-DWV sewer pipe with solvent weld, ASTM D2665. Schedule 40 wall thickness. Traps, sink outlets, cleanouts, etc., shall be same material. Traps shall have union connections.
 - iii. Where cover is less than 15", pipe shall be cast iron, same as for inside of building.

B. Water, and Gas:

1. Cold Water, Piping:
 - a. Inside Building: Schedule 40 galvanized steel pipe, ASTM A120. 150 psi galvanized malleable iron screwed fittings, ANSI B16.3 or Type L hard temper seamless copper, ASTM B88. Wrought copper fittings ANSI B16.22. Vacuum pipe shall have long sweeping elbow fittings. 95/5 tin-silver soldered joints. Brazesafe, Silcan or equal brazing material.
 - b. Outside Building Below Grade: Same as Inside Building with protective coating on ferrous pipe or Schedule 40 PVC pipe thru 2", Class 315 2" thru 4".
2. Gas Piping:
 - a. Above Grade: Schedule 40 black steel pipe, ASTM A120. 150 psi black malleable iron screwed fittings, ANSI B16.3, ANSI B31.8. Galvanized pipe and fittings will not be allowed. Flexible connections shall be convoluted brass with dielectric couplings, AGA approved. Outside building flexible connections shall be convoluted stainless steel with dielectric couplings, AGA approved. Prime and paint all piping.
 - b. Outside Building – Below Grade: Same as Inside Building – Above Grade, with protective coating of ferrous pipe or medium density polyethylene (MDPE) PE2708 or PE2406 pipe manufactured in accordance with ASTM D2513 and IAPMO Standards.

C. Condensate Drain Piping: Same as cold water piping.

D. Valves and Specialties:

1. Valves:
 - a. General: Manufacturer's model numbers are listed to complete description. Milwaukee, Kitz, Apollo, Nibco, Stockham or equal. All valves shall be full size of upstream piping. **Ball valves shall be substituted for gate valves 2" and smaller. Butterfly valves shall be substituted for gate valves 2-1/2" and larger. C_v factors for ball valves shall not be less than equal size gate valves.**
 - b. Gate Valve: 2" and smaller: All bronze, rising stem, union bonnet, wedge disk, 200 psi WOG. Milwaukee No. 1152. The material of the valve stem shall be limited to a maximum of six (6) percent zinc content. 2-1/2" and larger: Iron body, bronze mounted. Non-rising stem. Wedge disk. 200 psi WOG. Flanged or AWWA hub as

- applicable. Open/ closed indicator. Milwaukee No. F2882. Underground valves shall have square operating nut.
- c. Check Valve: 2" and smaller: All bronze swing check, regrinding. 200 psi WOG. Milwaukee No. 509, 1509 or equal. 2-1/2" and larger: Non-slam type, 125 psi iron body wafer type with renewable seats and stainless steel spring. Milwaukee 1400 series or equal.
 - d. Plug Valve: Eccentric bronze plug. Nickel chromium alloy iron body. Bronze bushings. Buna-N O-rings. UL approved for gas distribution. 175 psi WOG. DeZurick Series 400 or equal.
 - e. Ball Valves: Two or three piece construction, forged bronze body, chrome plated brass ball, threaded ends, teflon seats, PTFE or reinforced teflon stem seals, lever handle. Underground valves shall have "T" handle. Provide one operating "T" extension handle for all underground valves. Milwaukee BA100/150, BA300/350, Nibco or equal.
 - f. Gas Valves: 2" and smaller, Milwaukee BB2-100; 2-1/2" and larger, Rockwell #142 or equal.
 - g. Valve Box: Precast reinforced concrete. Cast iron lid marked for service. Christy or equal; F22 in foot traffic areas: G5 in roadways.
 - h. Butterfly Valve: Iron Body, Aluminum bronze disk (connection to shaft shall not be by pins, screws or bolts). Ductile body PPS coated with EPPM coated ductile disc. O-ring seals. Resilient removable seat. 416 stainless steel two piece shaft. 6" and smaller valves shall have multi-position lever handle. Underground valves shall have square operating nut. Provide one operating "T" handle for underground valves. Provide 2" extension neck at insulated pipes. Milwaukee "C" series, Kitz or equal.
2. Miscellaneous Specialties:
- a. Temperature and Pressure Relief Valve: ASME rated fully automatic, reseating combination temperature and pressure relief valve sized in accordance with energy input. Sensing element immersed within upper 6" of tank. Watts.
 - b. Union: 2" and Smaller: AAR malleable iron, bronze to iron ground seat. 300 psi.
 - c. Dielectric Coupling: Insulating coupling rated for 250 psig. EPCO or equal.
 - d. Shock Absorbers: Sioux Chief "Hydra-Rester", Zurn "Shoktrol", PPP "SC Series" or equal.
- E. Flue Piping:
1. Gas Flue Piping: Flue pipe shall be type as recommended by equipment manufacturer for which the pipe is connected to. UL listed. Metalbestos, Amerivent or equal.
 2. Flue Cap: Designed to properly ventilate flue regardless of wind direction. Storm proof, bird proof. Metalbestos, Amerivent or equal.
- F. Miscellaneous Piping Items:
1. Pipe Support:
 - a. Pipe Hanger: Adjustable split ring, swivel hanger and rod. Black malleable iron. Size and maximum load per manufacturer's recommendation. Felt lined, B-Line B3690F, Unistrut or equal.
 - b. Construction Channel: 12 gage 1-5/8" x 1-5/8" steel channel. Single or multiple section. Self-locking nuts and fittings. B-Line, Unistrut, Superstrut or equal.
 2. Pipe Sleeves: 24 gage galvanized steel. Adjus-to-Crete #10 with #99 thimble for floors. #100 for walls.
 3. Flashing: Vent flashing and flashing for piping through roof shall be prefabricated 24 gauge galvanized steel roof jacks with 8" square flange around pipe. For tile or other roofing systems where pliable flashing is required, flashing shall be lead. Seal with weatherproofing mastic.

2.02 PIPING INSULATION MATERIALS:

- A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.
- B. Pipe Insulation: Elastomeric type, ASTM C534, with a thermal conductivity of 0.27 at 75°F when measured in accordance with ASTM C177 or ASTM C518.
 - 1. Wall thickness: 3/4 in.
 - 2. Adhesive: Conform to Manufacturer's recommendations.
- C. Pre-molded Fiberglass: Heavy density sectional pre-molded fiberglass with vapor barrier laminated all-service jacket and pressure sealing vapor barrier lap. Thermal conductivity shall not exceed 0.25 Btu-in/hr-sq. ft-degrees F, at a mean temperature of 50 degrees F. Perm rating 0.02, ASTM E96. Puncture rating 50 Beach units, ASTM D781. Provide 3" (min.) wide tape of same material as lap for butt joints. For hot water piping, thickness shall be 1" for pipe sizes less than 2", 1-1/2" thickness for pipe sizes 2" and larger. CSG Insulation Corp., Manville, Owens-Corning or equal.
- D. Fiberglass Blanket: Unfaced. Thermal conductivity shall not exceed 0.25 Btu-in/hr sq. ft-degrees F, at a mean temperature of 50 degrees F. 1-1/2" thickness. Manville, Owens-Corning or equal.
- E. PVC Jacket (for exposed pipes and fittings): Pre-molded polyvinyl chloride (PVC) jackets. Size to match application. Provide PVC vapor barrier, pressure-sealing tape by same manufacturer. Zeston or equal.

2.03 FIXTURES:

- A. General: This Division shall rough-in for and install all plumbing fixtures shown on drawings. All trim not concealed shall be brass with polished chromium plate finish unless otherwise noted. All enameled fixtures shall be acid resisting. Standard color is white unless otherwise noted.
- B. Schedule: Refer to Plumbing Fixture Schedule on the drawings for list of fixtures. Manufacturer's model numbers are listed to complete description. Water consumption quantities listed on schedule are maximum. Equivalent models of American Standard, Crane, Haws, Kohler, Eljer, Zurn or equal. For drainage fixtures, equivalent models of Josam, Smith, Wade, Zurn or equal.
- C. Stops and P-traps: All fixtures shall be provided with stops and p-traps as applicable.
 - 1. Stops: All hot and cold water supplies shall be 1/2" angle stops with IPS inlets and compression outlets, stuffing box, screw driver lock shield, and 1/2" flexible brass tubing riser. Speedway. Wall mounted trim shall have concealed loose key wall stop. Chicago 1771 or equal.
 - 2. P-traps: Brass, ground joint. 17 gage. American Standard, California Tubuler or equal.
 - a. Trap primers shall be provided with ball valve and cylinder key-lock access panel for all floor drains and floor sinks. PPP, Inc. or equal.

2.04 EQUIPMENT:

- A. General Requirements:
 - 1. General: These equipment specifications are to supplement the drawings. Refer to schedules on drawings for the specific equipment to be provided. Capacities shall be in accordance with the schedules shown on the drawings. Capacities are to be considered minimum.

2. Dimensions: Equipment must conform to space requirements and limitations as indicated on the drawings and as required for operation and maintenance. Equipment will not be accepted that does not readily conform to space conditions.
3. Ratings: Electrical equipment shall be in accordance with NEMA Standards and UL listed where applicable standards have been established.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION:

A. General:

1. Piping Layout: Piping shall be concealed in walls, above ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by Owner's Representative. No structural member shall be cut, notched, bored or otherwise altered unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Expansion joints shall be installed as required. Vertical lines shall be installed to allow for building settlement without damage to piping. All exposed piping to be primed and painted, see painting section.
2. Joints:
 - a. Threaded: Pipe shall be cut square, and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.
 - b. Welded or Brazed: Filler rod shall be of the same suitable alloy as pipe. Welding or brazing shall be performed in accordance with requirements of recognized published standards of practice and by licensed or otherwise certified contractors. Welder or Brazer shall be a person who specialized in welding or brazing of pipes and holds a recognized certificate of competency from a recognized testing laboratory, based on the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.
 - c. Other: Joints other than threaded or welded shall be installed in accordance with manufacturer's recommendations.
 - d. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.
 - e. Electrical Equipment: Joints shall be avoided, where possible, over electrical equipment.
 - f. Copper pipe 1-1/2" or less may be soldered. Above 1-1/2" and all below grade shall be brazed.
3. Fittings:
 - a. Standard Fittings: All joints and changes in direction shall be made with standard fittings. Close nipples shall not be used.
 - b. Reducers: Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.
 - c. Unions: A union shall be installed on the leaving side of each valve, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.
 - d. Valves: All valves shall be full line size. At equipment connections, valves shall be full size of upstream piping.
4. Pipe Support:
 - a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below. Actual spacing requirements will depend on structural system. Refer to drawings for additional requirements and attachment to structure. Vertical piping shall be supported at floor and ceiling. Support pipe within 12" of all changes in direction. Support individual

pipes with pipe hanger. All pressure piping, drainage piping above grade and metallic piping of dissimilar metal from hangers shall have isolating shield, or felted hangers.

i. Screwed Pipe:

| Pipe Size Between Supports* | Max. Spacing |
|-----------------------------|--------------|
| (in) | (ft) |
| 1/2 | 6 |
| 3/4 | 8 |
| 1 | 8 |
| 1-1/4 & larger | 10 |

* Based on straight lengths of pipe with couplings only. Provide additional supports for equipment, valves or other fittings.

ii. Copper Tubing: Copper tubing shall be supported at approximately six (6) foot intervals for piping one and one-half (1-1/2) inches and smaller in diameter and ten (10) foot intervals for piping two (2) inches and larger in diameter.

iii. Gravity Drain Pipe: Piping shall be supported at each length of pipe or fitting, but in no case at greater spacing than indicated above for pressure pipe.

b. Trapeze: Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for approval.

5. Excavation and Backfill: Minimum cover on all piping shall be as follows unless otherwise noted:

- a. Up to 2-1/2" pipe - 24" cover.
- b. 3" and larger pipe - 30".

6. Miscellaneous:

- a. Escutcheons: Provide chromium plated escutcheons where piping penetrates walls, ceilings or floors in finished areas.
- b. Pipe Sleeves: All piping passing through concrete shall be provided with pipe sleeves. Allow 1" clearance between sleeve and pipe or pipe insulation.
- c. Dielectric Couplings: Dielectric couplings shall be installed wherever piping of dissimilar metals are joined.
- d. Shock Absorbers: Install per manufacturers recommendations.

B. Sanitary Sewer Piping:

- 1. General: Where inverts are not indicated, sanitary sewer piping shall be installed at 1/4" per foot pitch. Piping 4" and larger may be installed at 1/8" per foot pitch where structural or other limitations prevent installation at a greater pitch.
- 2. Cleanouts: Install cleanouts at ends of lines, at changes of direction greater than 45 degrees, and at not greater than 100 foot intervals. Locate interior cleanouts in accessible locations and bring flush to finished surface. Cleanouts at urinals shall be installed above urinal.
- 3. Vents: Vents shall terminate not less than 6" above the roof nor less than 12" from any vertical surface nor within 10 feet of any outside air intake. Install horizontal vent lines at 1/4" per foot pitch. Offset vents 2 feet minimum from gutters, parapets, ridges and roof flashing.

C. Water Piping: Connections to branches and risers shall be made from the side of the main. Supply header in fixture battery shall be full size to last fixture, reducing in size only on individual connections to each fixture in battery. Provide ball valve shutoff for each building and at each connection to equipment and trap primers. Shock absorbers shall be installed in a vertical position at end of branch runs as specified in this section whether specifically shown or not on drawings. Connections to equipment shall be made with flexible connectors. Non-metallic pipe shall have 18 AWG copper tracer wire laid on top of pipe and taped in place at 15-foot spacing, terminate 4" above grade at ends of pipe runs.

D. Gas Piping: Shall be pitched to drain to drip legs at each piece of equipment. No unions shall be installed except at connections to equipment. Provide shutoff at each equipment

connection. Connections to equipment shall be made with flexible connectors. Under floor piping shall be sleeved, sealed and vented. Polyethylene or polyvinyl chloride pipe and fittings shall be joined in accordance with manufacturer's recommendation. Metal-to-plastic transition fittings shall be installed at all transitions. Non-metallic pipe shall have 18 AWG copper tracer wire laid on top of pipe and taped in place at 15-foot spacing, terminate 4" above grade at ends of pipe runs. All gas below grade shall have continuous caution tape installed 12" above gas line. All exposed gas piping shall be primed and painted, see painting section.

- E. Condensate Drain Piping: Install with constant pitch to receptacle, 1/4" per foot where possible, otherwise 1/8" per foot minimum. Provide trap at each air handling unit to prevent air leakage. Connections to equipment shall be made with flexible connection unless connection is internally isolated.
- F. Storm Drain Piping: Install at 1/4" per foot pitch.
- G. Flue Piping: Flue piping shall be installed in accordance with its UL listing and manufacturer's instructions.

3.02 PIPING INSULATION INSTALLATION:

A. ADA Compliant Fixtures:

- 1. At sinks/ lavatories which are to be ADA Compliant, the p-trap and angle stop assemblies shall be insulated with Trap Wrap Protective Kit 500R by Brocar, Truebro Handi Lav-Guard #102W or #105W or equal. Abrasion resistant exterior cover shall be smooth and have 1/8" wall minimum over cushioned foam insert. Fasteners shall remain substantially out of sight.

OR

B. ADA Compliant Fixtures:

- 1. At lavatories which are to be ADA Compliant the P-Trap and angle stop assemblies & water heater shall be covered with Truebro Lav-Shield, or equivalent. Abrasion resistant exterior cover shall be smooth. Fasteners shall be tamper resistant.

3.03 FIXTURE INSTALLATION:

- A. Fixture Height: Shall be standard height except those specified as ADA Compliant. Such fixtures shall be mounted in accordance with CBC, Section 11B, Division 6 and drawing details.
- B. Wall Hung Fixtures: Shall be provided with proper backing and hanger plates secured to wall. Fixtures mounted on carriers shall bear against stop nuts, clear of wall surface. Caulk fixtures against walls with white G.E. "Sanitary SCS1700" silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).
- C. Floor Drains or Floor Sinks: Shall be placed parallel to room surfaces, set level, flush with floor and adjusted at proper height to drain and easily accessible for inspection and cleaning. Cover openings during construction to keep all foreign matter out of drain line.
- D. Other Connections: Rough-in and connection for trim or fixtures supplied by others shall be included in this specification section.

- E. Floor Mounted Fixtures: Shall be provided with proper support plates. Caulk fixtures against floors with white G.E. "Sanitary SCS1700" silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).

3.04 EQUIPMENT INSTALLATION:

- A. General: It shall be the responsibility of the equipment installer to insure that no work done under other specification sections shall in any way block, or otherwise hinder the equipment.
- B. Connections to Equipment: Where size reductions are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet.

3.05 TESTS AND ADJUSTMENTS:

- A. General: Unless otherwise directed, tests shall be witnessed by the Owner's Representative. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair his work, and that of other contractors, to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections. However, all connections between sections previously tested and new section shall be included in the new test. New sections shall be isolated from existing sections for testing purposes. There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made. Test the new sections or branches of piping only.
- B. Gravity System:
 - 1. Sanitary Sewer: All ends of the new sections of sewer system shall be capped and lines filled with water to the top of the highest vent, 10 feet above grade minimum. This test shall be made before any fixtures are installed. Test shall be maintained until all joints have been inspected, but no less than 2 hours.
 - 2. Condensate Piping: Maintain 15 psig water pressure for a duration of 4 hours.
- C. Pressure Systems:
 - 1. General: There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made. Test the new sections or branches of piping only.
 - 2. Domestic Tempered, Cold & DI Water Piping: Maintain 60 psig water pressure for a minimum duration of 2 hours.
 - 3. Gas, Vacuum and Air Piping: Maintain 60 psig air pressure for a minimum duration of 2 hours.
- D. Accessible Lavatories:
 - 1. Faucet controls and operating mechanisms shall be installed and tested to comply per CBC Section 11B-606.4.

3.06 DISINFECTION:

- A. Disinfect all domestic hot and cold water piping systems in accordance with California Plumbing Code Sections 609.9.1 through 609.9.4. The method to be followed shall be that prescribed by the Health Authority or, in case no method is prescribed by it, the following:
 - 1. The pipe system shall be flushed with clean, potable water until potable water appears at the points of outlet.

2. The system or parts thereof shall be filled with a water-chlorine solution containing not less than 50 parts per million of chlorine, and the system or part thereof shall be valved-off and allowed to stand for 24 hours; or, the system or part thereof shall be filled with a water-chlorine solution containing not less than 200 parts per million of chlorine and allowed to stand for 3 hours.
 3. Following the allowed standing time, the system shall be flushed with clean, potable water until the chlorine residual in the water coming from the system does not exceed the chlorine residual in the flushing water.
 4. The procedure shall be repeated where it is shown by bacteriological examination made by an approved agency that contamination persists in the system.
- B. Disinfection process shall be performed by certified testing agency or in cooperation with health department having jurisdiction and witnessed by a representative of the Architect. During procedure, signs shall be posted at each water outlet stating, "Chlorination - Do Not Drink". After disinfection, water samples shall be collected by certified testing agency or by health department for bacteriological analysis. Certificate of Bacteriological Purity shall be obtained and delivered to the Owner through the Owner's Representative.

*** END OF SECTION ***

SECTION 23 00 00

GENERAL MECHANICAL PROVISIONS

PART 1 - GENERAL

1.01 GENERAL CONDITIONS:

- A. The foregoing General and Special Conditions shall form a part of this Division with the same force and effect as though repeated herein. The provisions of this Section shall apply to all the Sections of Division 23.

1.02 CODES AND REGULATIONS:

- A. All work and materials shall be in full accordance with current rules and regulations of applicable codes. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the drawings or specifications call for material or methods of construction of a higher quality or standard than required by these codes, the specifications shall govern. Applicable codes and regulations are:

1. California Code of Regulations – CCR:
 - a. Title 8, Industrial Relations.
 - b. Title 24, Building Standards.
2. California Building Code – CBC.
3. California Mechanical Code – CMC.
4. California Plumbing Code – CPC.
5. California Green Building Code.
6. Air Diffusion Council – ADC.
7. American Gas Association – AGA.
8. Air Moving and Conditioning Association – AMCA.
9. American National Standards Institute – ANSI.
10. Air Conditioning and Refrigeration Institute – ARI.
11. American Society of Heating, Refrigerating and Air Conditioning Engineers – ASHRAE.
12. American Society of Mechanical Engineers – ASME.
13. American Society for Testing and Materials – ASTM.
14. American Water Works Association – AWWA.
15. California Electrical Code – CEC.
16. National Electrical Manufacturers Association – NEMA.
17. National Fire Protection Association – NFPA.
18. Sheet Metal and Air Conditioning Contractors National Association – SMACNA.
19. Underwriters' Laboratory – UL.
20. Occupational Safety and Health Act - OSHA.

1.03 PERMITS AND FEES:

- A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required by local ordinances. All charges are to be included in the work. Permits for equipment connected to a particular system are to be considered as a part of the work included under each system; for example, permits for electric motor connection are part of electrical work, permits for domestic water or gas connections are part of plumbing work. All charges for service connections, meters, etc. by utility companies or districts shall be included in the work.

1.04 COORDINATION OF WORK:

- A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. The actual locations of all materials, piping, ductwork, equipment, supports, etc.

shall be carefully planned, prior to installation of any work, to avoid all interference's with each other, or with structural, electrical or architectural elements. Verify the proper voltage and phase of all equipment with the electrical plans. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment.

1.05 GUARANTEE:

- A. Guarantee shall be in accordance with the General Conditions. These specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the Certificate of Guarantee shall be furnished to the Owner through the Engineer.

1.06 EXAMINATION OF SITE:

- A. The Contractor shall examine the site, compare it with plans and specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.07 SUBMITTALS:

- A. Submit shop drawings in accordance with Division 01.
- B. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material and equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution. All shop drawings must comply with the following:
 - 1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory.
 - 2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer, and Contractor; Table of Contents; and indexed tabs dividing each group of materials or item of equipment. All items shall be marked with the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on the drawings.
 - 3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be highlighted, circled or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled, or detailed.
- C. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and the features desired. Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items.
- D. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment and installation in accordance with the drawings

and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept; that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed.

1.08 OPERATION AND MAINTENANCE INSTRUCTIONS:

- A. Submit one electronic pdf copy for review and after approved submit three hard copies of the Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts lists for all equipment, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. AC-1). All wiring diagrams shall agree with revised shop drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Fans, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included. **(These submittals shall be submitted with regular submittals at start of job so Commissioning Contractor can start on the commissioning check list for LEED Certification or Title 24 Requirements)**
- B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instruction that applies to the control system. The Engineer's office shall be notified 96 hours prior to this meeting.
- C. Posted: The Contractor shall prepare operation instructions for all systems which shall be typewritten, reviewed by the Engineer, and mounted under glass adjacent to the appropriate temperature control panel. These instructions shall include applicable temperature control diagrams.
- D. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed, verbal and posted) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.09 RECORD DRAWINGS:

- A. The Contractor shall maintain a set of prints for the project as a record of all construction changes made. As the Work progresses, the Contractor shall maintain a record of all deviations in the Work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. buildings, curbs and walks. In addition, the water, gas, under-floor ducts, etc. within the building shall be recorded by offset distances from building walls. The original drawings will be made available to the Contractor from which he shall have a set of reproducible drawings made. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up prints and reproducibles) shall be submitted to the Engineer for review (as an alternative, the marked-up prints may be photocopied full size on reproducible stock).

PART 2 - PRODUCTS

2.01 PROTECTIVE COATING FOR UNDERGROUND PIPING:

- A. All ferrous pipe below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness, X-Tru Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Manville Corporation. Protective coating shall be extended 6" above surrounding grade.

2.02 CONCRETE ANCHORS:

- A. Concrete Anchors shall comply with CBC 1901A.3. Steel stud with expansion anchor requiring a drilled hole; powder driven anchors are not acceptable. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 10 diameters center-to-center and 5 diameters from center to edge of concrete. Maximum allowable stresses for tension and shear shall be 80% of the test report values "with special inspection". Anchors shall be Hilti, Philips - or Approved equal.

2.03 SEISMIC RESTRAINTS:

- A. All mechanical systems (all equipment, piping, etc.) shall be provided with seismic restraints in accordance with "Guidelines for Seismic Restraint of Mechanical Systems" dated 2006 by SMACNA.

2.04 SYSTEM IDENTIFICATION:

- A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by preprinted markers or stenciled marking, and include arrows to show the direction of flow. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floor, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portion of lines. Marking of short branches and repetitive branches for equipment connections is not required.
- B. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/2" high lettering, white on black background. Nameplates shall be permanently secured to the unit.
- C. Valves: Provide valve tags on all valves of each piping system, excluding check valves, valves within equipment, shut-off valves at equipment and other repetitive terminal units. Provide brass tags or plastic laminate tags. Prepare and submit a tagged valve schedule, listing each valve by tag number, location and piping service. Mount in glazed frame where directed.
- D. Controls: Label all panels, thermostats and by-pass timers with plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/4" high lettering, white on black background. Nameplates shall be permanently secured to the unit.

2.05 EQUIPMENT SUPPORT FRAMES:

- A. Unless specifically noted otherwise, it shall be the responsibility of Mechanical Contractor to furnish and install all support frames for its equipment.

PART 3 - EXECUTION

3.01 SCHEDULING OF WORK:

- A. All work shall be scheduled subject to the approval of the Engineer and Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site.

3.02 CONDUCT OF WORK:

- A. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work, and shall cause no delay to other Divisions engaged upon this project or to the Owner.
- B. Mechanical Contractor shall arrange for all cutting necessary for the proper installation of its work, providing all sleeves and chases necessary. Cutting shall not be done in such a manner to impair the strength of the structure. Any damage resulting from work shall be repaired by the Contractor at his expense to the satisfaction of the Engineer.
- C. Progressively, daily at the completion of each day's work, and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.
- D. **IAQ Management plan will be in effect for LEED Certification, including the sealing of duct ends before and during rough-in, specific requirements for the use of HVAC equipment during construction (if used at all), building flush-out, etc. Adhesives and mastic must comply with low VOC requirements and documentation (MSDS, etc.) shall be provided with submittals.**

3.03 EXCAVATION AND BACKFILL:

- A. Excavation: Trenches are to be excavated to grade and depth established by drawings. Unless otherwise noted, minimum earth cover above top of pipe shall be 24", not including base and paving in paved areas. Width of trenches at top of pipe shall be a minimum of 16" plus the outside diameter of the pipe. Provide all shoring required by site conditions. Barrel of pipe shall have uniform support on trench bottom, hand excavate additional depth at bells, hubs and fittings. Where over-excavation occurs, provide compacted selected backfill to pipe bottom. Where ground water is encountered, remove to keep excavation dry, using well points and pumps as required.
- B. Backfill:
 - 1. Around Pipe and to One Foot Above Pipe: Material shall be river run sand or native granular free flowing material, free of clay lumps, silt or vegetable matter and shall have 100% passing through the No. 4 sieve and a maximum of 3% passing through the No. 200 sieve. Place carefully around and on top of pipe, taking care not to disturb piping. Consolidate with vibrator.
 - 2. One Foot Above Pipe to Grade: Material to be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed, to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to approval by the Engineer.
 - 3. Remove all water sensitive settlement from trench backfill regardless of location and compaction requirements.
- C. Compaction: Compact to a density of 95% within building and 90% outside building. Demonstrate proper compaction by testing at one-half of the trench depth. Perform three tests per 100' of trench.

3.04 OPENINGS, CUTTING AND PATCHING:

- A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. The actual openings and the required cutting and patching shall be provided. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall also be provided. Cutting and coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

3.05 MANUFACTURER'S RECOMMENDATIONS:

- A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of a particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

3.06 QUIETNESS:

- A. Piping, ductwork and equipment shall be arranged and supported so that vibration is a minimum and is not carried to the building structure or spaces.

3.07 DAMAGES BY LEAKS:

- A. The Contractor shall be responsible for damages to other work caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages to other work caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

3.08 CLEANING:

- A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

*** END OF SECTION ***

SECTION 23 00 01

HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.01 GENERAL CONDITIONS:

- A. The foregoing Section 23 00 00, General Mechanical Provisions, shall form a part of this specification.

1.02 SCOPE:

- A. Included: Perform all work necessary and required to complete construction as indicated. Such work includes the furnishing of all labor, materials and services necessary for a complete, lawful and operating air conditioning, heating, ventilating system with all equipment as shown or noted on the drawings or as specified herein. The work includes, but is not necessarily limited to, the following:
 - 1. Heating, ventilating and air conditioning equipment.
 - 2. Air distribution system (Ductwork, Air Terminals, etc.).
 - 3. Piping systems.
 - 4. System insulation.
- B. Work Specified Elsewhere:
 - 1. Line voltage power wiring (60 volts or greater), motor starters in motor control centers and disconnect switches are included in the Electrical Section.
 - 2. Connection of gas and condensate drains to equipment.
 - 3. Access doors.
 - 4. Controls, control wiring, and conduit for control wiring.

PART 2 - MATERIALS

2.01 DUCTWORK MATERIALS:

- A. General: All ductwork materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL-723 not exceeding a flame spread of 25 and smoke developed of 50. All ductwork shall be per Chapter 6 of the CMC.
- B. Low Velocity Metal Ductwork: Metal ductwork shall be galvanized sheet steel, ASTM A527.
- C. Low Velocity Flexible Ductwork: Insulated flexible ductwork. Continuous internal liner bonded to galvanized steel wire helix. One pound per cubic foot glass fiber insulation, R-8. Thermal conductivity shall not exceed 0.13 Btu /hr sq. ft.-degrees F at a mean temperature of 75°F. Seamless vapor barrier jacket. Each length shall have a factory installed metal sleeve at each end. Duct shall be capable of continuous operation at 1.5" of water static pressure and 4000 ft./min. air velocity. Maximum length 5 ft., single piece at runouts to air terminals. Genflex, Lamborn or equal.
- E. Spiral Duct: Ductwork shall be galvanized steel with uni-seal spiral seamlock and uni-seal fittings, ASTM A653. United McGill Corp. All exposed spiral duct shall be painted, color selected by Owner.
- I. Round Duct on Roof: Ductwork shall be double wall insulated galvanized steel with solid welded seam longitudinal seam-K27. United McGill Corp.

- J. Fiberglass Ductwork: Fiberglass continuous strands impregnated with polyester corrosion resistant resins and filament wound under exacting conditions. Duct shall effectively resist corrosive effects of most acids, alkali's and organic solvents. Spunstrand or approved equal.
- K. Bonding Adhesive: Durodyne WBG, Scotchgrip Adhesive 4230, United McGill Uni-Tack.
- L. Duct Mastic: Minnesota Mining and Manufacturing Duct Sealer 800, Tuff-Bond No. 12, Glencoat Seal-Flex, United Duct Sealer.
- M. Fiber Tape: Mineral impregnated fiber tape and plastic activator - adhesive, Hardcast Inc, United McGill Uni-Cast or equal.
- N. Duct Joints:
 - 1. As an option to joints and seams designated by SMACNA or shown on Drawings, the following systems may be used:
 - a. Ducts with sides 24 inches to 48 inches, transverse duct joint system by Ductmate Jr., Nexus or equal (SMACNA "E" Type connection).
 - b. Ducts 48 inches and larger, Ductmate Regular, Nexus or equal (SMACNA "J" Type connection).

2.02 AIR TERMINALS AND DUCT FITTINGS:

- A. Grilles: (Grilles, Registers and Diffusers)
 - 1. Information on Drawings: Refer to the Air Distribution Schedule on the drawings for the list of grilles. Manufacturer's model numbers are listed to complete the description. Equivalent models of Anemostat, J & J, Krueger, Barber-Colman, Price, Environmental Air Products, Titus or equal. Refer to the floor plans for neck size, CFM, air diffusion pattern, and fire damper, if required.
 - 2. Performance: If, according to the certified data of the manufacturer of the proposed units, the sizes indicated on the drawings will not perform satisfactorily, the units shall be reselected by the Contractor for the proper diffusion, spread, drop and throw.
 - 3. Frame Accessories: All supply, return, and exhaust grilles shall be provided with cushion heads and attachments to structure, unless otherwise noted. All surface mounted grilles shall have a perimeter gasket and flanged edge. All grilles shall have frames suitable for mounting in the surfaces designated by the architectural drawing, coordinate prior to ordering.
 - 4. Finish: All ceilings and wall grilles shall have a paintable white finish unless otherwise noted. Interior components shall be flat black.
 - 5. Gyms: Provide 12 Ga. wire safety cables for all overhead grilles in Gym.
- B. Turning Vanes: Double wall, hollow metal, air-foil shape. Spacing in accordance with manufacturer's recommendations. Aero Dyne, HEP, or equal.
- C. Flexible Connection: UL listed neoprene coated 30-ounce fiberglass cloth. 3" metal, 6" fabric, 3" metal. Ventglas or equal.
- D. Branch Duct Volume Damper: Volume control damper (VCD) in rectangular ducts shall be as follows: Opposed blade, 6" maximum blade width, 16-gage blade, 48" maximum length, nylon or oil impregnated bronze bearings, 1/2" diameter pin shaft, 16-gage channel frame, actuating rod and linkage out of air stream. VCD in round duct shall be as follows: Damper blade full height of branch and 1" less than branch width. All branch dampers shall have regulator with stamped steel handle, spring loaded shaft nut, cast body and serrated self-locking die cast core. Regulator for horizontal ducts overhead shall be mounted on sides or bottom of ducts. Secure a 12" length of brightly colored plastic ribbon to handle for ease of location. Where

rectangular or round ductwork is insulated, slit insulation to allow handle to protrude. Ventlok 641 (with 607 end bearing for round ducts).

2.03 DUCTWORK INSULATION MATERIALS:

- A. General: All ductwork insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.
- B. Acoustic Lining: Glass fiber. One side coated to prevent fiber erosion up to 6000 ft./ min. Average noise reduction coefficient of 0.90. 0.13 Btu/ hr – sq. ft. – degrees F conductivity at a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal. Duct dimensions shown on drawings for lined duct are clear (net) opening inside of lining.
- C. Fiber Glass Blanket: Foil faced, 0.13 Btu/ hr – sq. ft. – degrees F conductivity at a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal.
- D. Bonding Adhesive: Benjamin Foster 85-15 or equal.

2.04 PIPING MATERIALS:

- A. Flue Piping:
 - 1. Gas Flue Piping: Flue pipe shall be type as recommended by equipment manufacturer for which the pipe is connected to. UL listed. Metalbestos, Amerivent or equal.
 - 2. Flue Cap: Designed to properly ventilate flue regardless of wind direction. Storm proof, bird proof. Metalbestos, Amerivent or equal.
- B. Miscellaneous Piping Items:
 - 1. Pipe Support:
 - a. Pipe Hanger: Adjustable split ring, swivel hanger and rod. Black malleable iron. Size and maximum loads per manufacturer's recommendations. Felt lined, B-Line B3690F, Unistrut, Superstrut.
 - b. Construction Channel: 12 gage 1-5/8" x 1-5/8" steel channel. Single or multiple sections. Self-locking nuts and fittings. B-Line, Unistrut, Superstrut.
 - 2. Pipe Sleeves: 24 gage galvanized steel. Adjus-to-Crete #10 with #99 thimble for floors. #100 for walls.
 - 3. Flashing: Flashing for piping through roof shall be prefabricated 24 gage galvanized steel roof jacks with 8" square flange around pipe. Seal with weatherproofing mastic.

2.05 PIPING INSULATION MATERIALS:

- A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.

2.06 EQUIPMENT:

- A. General Requirements:
 - 1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.
 - 2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Where Architectural screening is

- indicated, equipment shall not extend above or beyond screening. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.
3. Ratings:
 - a. Gas: Gas burning equipment shall be furnished with 100% safety gas shut-off, intermittent pilot ignition, and be CSA (US) certified, except that boilers shall be CSA (US) certified or UL listed.
 - b. Electrical: Electrical equipment shall be in accordance with NEMA Standards and UL or ETL listed where applicable standards have been established.
 4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.
 5. Electrical:
 - a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be manual reset, shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
 - b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts and other devices shall be in ungrounded conductors.
 - c. Motors: Shall be rated, constructed and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip proof, NEMA B design on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction unless otherwise noted. Design shall limit starting inrush current and running current to values shown on drawings. Motors 1 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B. Motors exposed to weather shall be TEFC. Motors in a fan air stream shall be TEFC or TEAO. Vertical motors outdoors shall be ODP or TEFC and shall have rain caps.
 - d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.
 - e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
 - f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommend external wiring.
 6. Fan Selection:
 - a. Fan Curves: Performance curves shall be submitted for all units of 3000 CFM or greater. Operating point for forward curved fans shall be from point of maximum efficiency towards increased CFM limited by horsepower scheduled. Operating point for backward inclined fans shall be selected near point of maximum efficiency. Curves shall plot CFM verses static pressure with constant brake horsepower, RPM and efficiency lines.
 - b. Static Pressure: Unless otherwise noted, pressure scheduled as external static pressure (ESP) includes all ductwork and accessory losses external to the unit housing. Unless otherwise noted, pressure scheduled as total static pressure includes all ductwork, filter, coil, cabinet, damper and other accessory losses. Unless otherwise noted, pressure scheduled as duct static pressure includes all supply and return ductwork and accessory

losses external to the unit housing and plenum (as applicable). The allowance for filter losses is 0.3" WC, unless otherwise noted. Submit itemized static pressure losses for all components.

7. Filters:

- a. General: Tested and rated in accordance with ASHRAE Standard 52.2 and Title 24, C.C.R. Furnish and install one complete change of all filters after air balance in completed and prior to acceptance. Provide pressure differential gage across all filter banks.
 - b. Filter Media: 2" media. MERV-11. Clean filter resistance 0.25" water at 500 fpm. Throw-away frame. Class 2. Camfil Farr AP-Eleven.
 - c. Pressure Differential Gage: Diaphragm actuated. 4" dial. Zero adjustment. Accuracy +/- 2% of full scale. Range as required. Provide static pressure sensors, tubing and mounting brackets. Dwyer Series 2000. Mark gage to indicate filter replacement pressure, coordinate point with filter and equipment manufacturers.
8. Mixing Dampers: Opposed blade, 16-gage. Six-inch maximum blade width, 48" maximum length. Nylon or oil impregnated bronze bearings. One-half inch diameter pin shaft. 16-gage channel frame. One percent maximum leakage at 4" WC in accordance with AMCA 500 for outside air dampers. Actuating rod out of air stream. Arrow.
9. Sound Ratings: Shall be in accordance with ASHRAE 36-72. Sound ratings shall not exceed scheduled values.
10. Drives: Unless noted as direct connected, drives shall be V-belt, rated at 150% of motor horsepower. Multiple drive belts shall be matched set. Drive sheaves shall be dynamically balanced, adjustable, range +/- 10%, selected at mid range. Adjustable relative movement shall be lockable to shaft. Belts shall be aligned within 1-1/2 degrees at all times. Open drives shall be provided with OSHA approved open mesh belt guards. Belt guards exposed to weather shall be weatherproof enclosure with louvered face for adequate ventilation. Driving motor shall be mounted on adjustable rails. T.B. Woods, Browning. Submit RPM range of driven machine with drive selection.

B. Air Conditioning Unit (25 tons):

1. General: Self-contained cooling only unit designed for outdoor installation. Factory assembled and tested. Provide all starters and relays required for operation. 24 volt control circuit from integral transformer. Weatherproof cabinet, galvanized steel with enamel finish. Drain pan. ARI certified. Manufactured by BDP, Trane, Carrier, McQuay, and York.
2. Refrigeration: Sealed hermetic compressor with internal vibration isolating mount. Crank case heater, high/low pressure switch, anti-recycle timer. Air-cooled condenser with propeller fans. Non-ferrous finned coils. Low ambient control to 25°F unless otherwise noted.
3. Supply Fans: Double inlet, forward curved fans, statically and dynamically balanced and factory tested. Adjustable sheave drive, blower and drive assembly mounted on common base, with base isolated from unit by double deflection rubber shear isolators.
4. Return Fans: Modulating 100% exhaust/ return, double inlet, forward curved fans, statically and dynamically balanced and factory tested. Adjustable sheave drive, blower and drive assembly mounted on a common base with base isolated from unit by double direction rubber shear isolators.
5. Speed Control: Provide an adjustable frequency controller to convert 460V/3 phase, 60 hertz utility power to adjustable voltage and frequency, 3 phase, AC power for stepless motor control from 10% to 110% of base speed. One speed controller shall control both the supply and return fans of each VAV unit. Reliance IVT Series, or Eaton.
6. Motors: Provide high efficiency motors on supply and return/ exhaust fans.
7. Automatic Shutoff: Provide smoke detector in supply air stream to automatically shut off all power to air moving equipment and sound the fire alarm system when smoke is detected. (in accordance with UMC Section 609).
8. Economizer: Units shall have a fully modulating economizer operated through the primary temperature controls.

9. Roof Curb: Provide spring-curb rail with internal seismic restraint, 2 in. detection. Vibrex "Vibro-Curb II".
 10. Controls: Tie-in to existing BMS system.
 11. Condenser Pre-Cooler: Provide evaporative pre-cooler for condenser section with solenoid valve interlocked to open when compressors start.
 12. Guarantee: Provide 5 year extended warranty on the condenser coil and compressor.
 13. Provide Herosite coating on condenser coils.
- C. Fly Fans:
1. Cabinet: Shall be made of a heavy duty high impact material which is corrosion & chemical resistant.
 2. Motor & Blower Wheels: Motor shall have lifetime pre-lubricated sealed ball-bearings, resilient mounted and automatic thermal overload switch.
 3. Warranty: 5 year manufacturers warranty on all parts. Manufacturers Mars Powered Aire.

PART 3 - EXECUTION

3.01 DUCTWORK INSTALLATION:

A. General:

1. Standards: Unless otherwise noted, all ductwork shall be constructed and installed in accordance with current SMACNA "HVAC Duct Construction Standards." Ductwork and accessories shall be installed in a manner to prevent vibration and rattling.
2. Seismic bracing: All ducts shall be braced and supported per SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems" and OSHPD pre-approval no. 0010. **OSHPD**
3. Duct Access Doors: Provide access doors as required to adjust equipment and dampers.
4. Flexible Connections: Connections of ductwork to all equipment shall be with 6" (min.) flexible connection. Install with ample slack and uniform gap after deflection of vibration isolators. There shall be no metal to metal contact across flexible connection. Protect outdoor connections with weatherproof metal shroud on top and sides, no metal-to-metal contact. Provide at all seismic joints.
5. Open ends of ductwork shall be covered during construction to keep inside clean.

B. Low Velocity-Low Pressure (up to 2000 ft/min; up to 2.0 in. water):

1. Sheet Metal Ductwork:
 - a. Ells: Ells with less than standard radius and square ells shall be fitted with turning vanes.
 - b. Tees: Tees shall be straight tap-in with extractor or 45 degree takeoff, as shown on drawings.
 - c. Duct Joints: Seal duct joints airtight with fibre tape and adhesive per manufacturer's printed instructions. Ducts in weather shall be sealed air and water tight with duct mastic before closing and taping.
 - i. Where Ductmate type of joints are used the manufacturer's designated procedure shall be followed. Ductmate joints on roof shall have continuous cleat on top duct flange to prevent water from collecting on gasket.
 - d. Dampers: Install volume control damper and damper regulator in all branch ducts.
 - e. Duct dimensions shown on drawings for lined ducts are clear net openings inside of lining.
 - f. Top of ducts exposed to weather shall be cross broken and sloped slightly to each side to allow rain water to run off. Ducts that do not drain off top will be rejected and need to be replaced at contractors' expense.

2. Flexible Glass Fiber Ductwork: Hangers shall be 2" wide metal straps spaced to prevent sagging, 3 feet spacing maximum. Insert 6" wide fiberglass pad between duct and hanging strap. All joints and fittings shall be sheet metal and shall be installed with metal bands or 3 (min.) self-tapping screws and fiber tape. Maximum length of flexible duct shall be 5 ft., single piece minimum length shall be 3 ft. Minimum turn radius shall be in accordance with SMACNA Standards (turn radius to duct centerline not less than 1.5 times the duct diameter).
3. Fiberglass Ductwork: Install per manufacturers instructions.

3.02 AIR TERMINALS AND DUCT FITTINGS INSTALLATION:

- A. General: Unless otherwise noted, all air terminals and duct fittings shall be installed in accordance with current SMACNA "HVAC Duct Construction Standards", details on drawings and manufacturers instructions. Terminals and fittings shall be installed in a manner to prevent vibration and rattling.
- B. Fire Damper: Fire dampers shall be installed in accordance with their State Fire Marshal approval and the manufacturer's recommendations.

3.03 DUCTWORK INSULATION INSTALLATION:

- A. General: All supply and return sheet metal ductwork shall be insulated.
- B. Concealed Ductwork: Wrap ductwork with fiberglass blanket lapped 2" minimum. Secure with foil tape at all joints for a complete vapor barrier.
- C. Acoustic Lining: All ductwork in equipment rooms, where exposed to weather, and elsewhere as indicated on drawings, shall have acoustic lining (except downstream of final filters). Increase each sheet metal dimension to accommodate lining and maintain clear inside duct dimensions shown on drawings. Apply lining with bonding adhesive in accordance with manufacturer's recommendations and also secure with mechanical fasteners in accordance with SMACNA Standards. Seal exposed edges of lining with bonding adhesive.

3.04 PIPING INSTALLATION:

- A. General:
 1. Piping Layout: Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by Architect. No structural member shall be weakened by cutting, notching, boring or otherwise unless specifically allowed by structural drawings and/ or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Expansion joints and/or flexible connectors shall be installed as required. Vertical lines shall be installed to allow for building settlement without damage to piping. Lines shall be adequately braced against vertical and lateral movement.
 2. Pipe Support:
 - a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below. Actual spacing requirements will depend on structural system. Refer to drawings for additional requirements and attachment to structure. Vertical piping shall be supported at floor

and ceiling. Support pipe within 12" of all changes in direction. No perforated straphanger shall be used in any work.

- b. Refrigerant Piping: Pipe shall be cut square. Joint surfaces shall be thoroughly cleaned, fitted and erected before brazing. Install specified accessories. After installation, evacuate to 29 inches of mercury, ambient temperature during evacuation shall not be less than 70 degrees F. After evacuation, fill with dry nitrogen to 250 psi and maintain for two-hour period without additional charge. After nitrogen test, purge with refrigerant charged through dryer and maintain holding charge in system and equipment. Refrigerant piping below grade shall be run in 4" (min.) PVC conduit with long radius ells. Seal ends of conduit watertight.
- c. Flue Piping: Flue piping shall be installed in accordance with its UL listing and manufacturer's instructions. All welders shall be certified in accordance with AWS Standard D9.1, Specifications for welding sheet metal.

3.05 HVAC DUCT CLEANING:

- A. General: Duct cleaning procedures shall be done per National Air Duct Cleaners Association (NADCA), ACR 2006 Guidelines. Contractor shall thoroughly clean all existing ductwork and grilles to remain shown on drawings with a brush and vacuum system. All workers who may potentially breathe duct contaminants or biocides should wear suitable protective breathing apparatus. Also workers should look for other types of problems, such as holes or gaps in the ducts. After duct cleaning, a video inspection shall be done for owner review. Inspector to be present during video inspection. The video shall be performed on all ductwork runs with adequate lighting at the camera and adequate reference point, grilles, etc.
- B. Work Schedule: All work shall be performed in accordance with the time provisions of the contract. Contractor shall perform work according to a pre-approved schedule with General Contractor, and to complete the work on schedule.
- C. Power Vacuum Equipment: Vacuum shall be equipped with final High efficiency Particulate Efficiency (HEPA) filtration to protect surrounding environment from recontamination by disbursement of contaminants removed from air ducts. As an option, contractor may use a collection unit outside of the building. It shall be the contractor's responsibility to remove and dispose of all contaminants from jobsite at contractor's expense.
- D. Supervision: All work shall be supervised by an on-site skilled foreman with thorough knowledge and experience in the cleaning of heating, ventilating and air conditioning systems. Supervisor shall have a minimum of 5 years experience in duct cleaning.
- E. Cleaning Process: All ducts shall be cleaned and inspected as work proceeds. Ductwork shall be cleaned by attachment of HEPA power vacuum hose to isolated section of air duct and by combining brushes and reverse air nozzles, to remove all contaminants from the surface of air duct interior. As the brushes and reverse air nozzle are being operated, all contaminants shall be drawn into the HEPA vacuum unit (minimum 5,000 CFM HEPA vacuum to maintain velocity necessary to keep particulate airborne – 3500 FPM). All foreign materials such as dust, mold, soot, lint, bacteria and other air residues shall be removed from air ducts. Fan powered high efficiency dust and particulate collection units shall be connected to the supply outlets. The collection systems shall be a self-contained unit, with appropriate components to adequately prevent dirt and debris, loosened from upstream ducts during cleaning operations, from entering the conditioned spaces by capturing this debris within the collection device.
 1. Special care and attention shall be given to air ducts having interior lining and a light vacuum process shall be used to prevent damage to air side surfaces. All loose fibrous materials shall be removed by a combination of controlled air pressure and power vacuum.
 2. Any major repairs not included in contract shall be brought to the owner's attention.

3. The air handling unit should not be used during the cleaning process. Also, after duct cleaning has been completed, the air handler should be run one (1) hour to allow at least 8 air changes in the area cleaned before being occupied.
 4. When gaining access to sheet metal ducts for cleaning use existing duct systems openings where possible. However, where holes need to be cut for access it is essential to seal the access hole properly in order to maintain the integrity of the HVAC system.
- F. Clean Up: Contractor shall, at the end of each shift, remove all waste, dirt and debris, resulting from work performed. Such materials shall be removed from the property and disposed of at the expense of the contractor.
- G. Place filter media in all supply diffusers to ensure no contaminants are emitted into areas during cleaning.
- H. Cut access panels where necessary by use of sheet metal cutting devise. Access into supply side, then cover with 24 gauge metal gasket seal. Apply sheet metal screws for an airtight seal. Where necessary in concealed attic spaces Contractor will install ceiling access points. Provide gasketed removable access panels at the following locations:
1. Adjacent to turning vanes.
 2. Adjacent to dampers (balancing, fire, control, back-draft, splitter, etc.).
 3. Upstream of VAV boxes.
 4. Next to duct transitions, offsets and changes of direction.
 5. Adjacent to all other in-duct mechanical components and sensors.
- I. At any time when ducts are large enough Contractor will enter the ductwork to clean by hand.
- J. Wherever the grilles and/ or diffusers are removable, they shall be removed, vacuum cleaned, washed, dried and then replaced at the original setting. Welded grilles may be cleaned in place.
- K. Sanitizing the air distribution network shall be performed as required. Using a suitable atomizing spray wand inserted through the access points, coat all interior surfaces of the duct work with a fine mist of a EPA registered sanitizing fluid: Oxine or equal.
- L. Where necessary place plastic covers on all office furnishings and equipment to protect it from dirt and debris.
- M. Supply color codes on blueprints to indicate work performed during the last shift.
- N. Supply progress report to the Engineer on work completed and work to be performed on a shift by shift basis.
- O. Supply M.S.D.S. sheets on all cleaners that are used in the cleaning process.

3.06 EQUIPMENT INSTALLATION:

- A. General: It shall be the responsibility of the contractor to insure that no work done under other specification sections shall in any way block, or otherwise hinder access panels or diminish the effectiveness of equipment vibration isolation.
- B. Connections to Equipment: Where size reductions are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet. Connections made to equipment mounted on vibration isolators shall be with flexible connectors, installed adjacent to equipment.
- C. Start Up: Engage manufacturer or factory-authorized service representative to perform start up supervision. Manufacturer shall provide on-site start up and commissioning assistance through

job completion. Complete installation and start up checks according to manufacturer's written instructions.

3.07 TEMPERATURE CONTROL SYSTEM:

- A. Thermostat shall have the capability of terminating all heating at a temperature of no more than 70°F, or terminating all cooling at a temperature of no less than 78°F, and to provide a temperature range of up to 10°F between full heating and full cooling. Thermostats shall be 7 day programmable, Carrier, Robertshaw or equal with sub-base capable of battery back up or capacitor to retain program in the event of a power outage. All control wiring, regardless of voltage, shall be installed in conduit.

3.08 SYSTEM AIR BALANCE:

- A. Scope: Provide the services of a qualified independent test and balance agency certified by the Associated Air Balance Council (AABC) or The National Environmental Balancing Bureau (NEBB) to test, adjust and balance, retest, and record performance of the system to obtain design quantities as specified. Balancing contractor must also be TABB certified and have a C-20 license.
- B. Qualifications: Prior to commencing work, the agency shall be approved by the Owner's Representative.
- C. Instruments: All instruments shall be accurately calibrated; calibration histories shall be available for examination. Application of instrumentation shall be in accordance with AABC standards.
- D. Procedure: General: Balanced quantities shall be plus 5%, minus 5% of design quantities. All name-plate data, manufacturer, model, and serial numbers shall be recorded for each item tested.
- E. Extended Warranty: The test and balance agency shall include an extended warranty of 90 days after completion of test and balance work, during which time the Owner's Representative at his discretion may request a recheck or resetting of any item or items in test report. The agency shall provide technicians to assist the Owner's Representative in making any tests he may require during this period of time.
- F. Air Balance Procedure (for Each Air Conditioning Unit):
 - 1. All air filters shall be clean when air balance is performed.
 - 2. Provide a sketch of the equipment showing exactly where all pressure readings were taken.
 - 3. Adjust blower RPM to design requirements.
 - 4. Record motor full load amperes.
 - 5. Make pitot tube traverse of main supply and return ducts and obtain design CFM at fans.
 - 6. Record system static pressures, inlet and discharge.
 - 7. Record filter quantity, size(s) and pressure drop across filter(s) at each filter bank.
 - 8. Adjust system for design CFM recirculated air.
 - 9. Adjust system for design CFM outside air.
 - 10. Record entering air temperatures. (DB heating, DB and WB cooling.)
 - 11. Record leaving air temperatures. (DB heating, DB and WB cooling.)
 - 12. Adjust all main supply and return air ducts to design CFM.
 - 13. Adjust all zones to design CFM, supply and return.
 - 14. Adjust all diffusers, grilles and registers to plus 10%, minus 0% of design requirements.
 - 15. Adjust CFM at all exhaust fans, make-up units, etc. (high and low speed, where applicable). Record applicable data from items 1 through 11 above.

16. Each grille, diffuser and register shall be identified as to location.
 17. Verify proper diffusion pattern for all ceiling grilles and that all sidewall grilles are set for 5 degrees downward deflection unless otherwise noted. Make a notation of any that are not set properly.
 18. Size, type and manufacturer of diffusers, grilles, registers and all tested items shall be identified and listed. Manufacturer's ratings shall be used to make required calculations on all items.
 19. Readings and tests of diffusers, grilles, and registers shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
 20. In cooperation with the control manufacturer's representative, set adjustments of automatically operated dampers to operate as specified. Testing agency shall check all controls for proper calibrations and list all controls requiring adjustment by control installers.
 21. All diffusers, grilles and registers shall be adjusted for required air patterns and to minimize drafts.
 22. As a part of the work of this contract, THE AIR CONDITIONING CONTRACTOR shall make any changes in pulleys, belts, dampers or the addition of dampers cleaning of insect screens and replacement of filters required for correct balance as recommended by air balance agency, at no additional cost to Owner.
 23. Set, test and adjust packaged heating/ cooling unit economizer operation in cooperation with controls contractor. Record minimum and maximum outside and exhaust airflows.
- G. Acoustic Performance Testing: Provide acoustic performance testing in accordance with the requirements of EQ3.0 of the "California Criteria for High Performance Schools, Best Practices Manual, 2009 Edition".
1. Maximum Background Noise Level: Unoccupied classrooms must have a maximum background noise level of no more than 45 dBA LAeq. The standard anticipates two primary noise sources, steady HVAC equipment noise and the usually unsteady exterior environmental noise. Where the measured ambient noises due to sources other than HVAC are within 5 dB of the measured overall noise (HVAC and exterior intrusive noise) a measurement of at least ½ hour duration shall be made in at least two classrooms in each building in the worse case (noisiest) locations on the school site during normal school days and hours.
 - a. To evaluate the significance of intrusive exterior noise, a 30-minute Equivalent Sound Level (LAeq30, in general conformance with ANSI S12.60-2002, Annex E3) measurement shall be made in the classroom that is subjectively assessed to represent the worse case exposure to exterior noise, with the HVAC system not in operation. This Leq30 measurement shall be repeated with the HVAC in operation. If the second "HVAC-on" sound level is more than 5 dB greater than the initial "HVAC-off" measurement, exterior noise intrusion shall be deemed "not significant".
 - b. Where intrusive exterior noise has been deemed "not significant" short-term (15 second) A-weighted sound level measurements shall be made in each classroom with the HVAC systems in operation. Where exterior intrusive noise has been deemed "significant" (per the evaluation method noted above), LAeq30 sound level measurements shall be made in each classroom with the HVAC system in operation. In either case, where classrooms are served by variable-air-volume systems, the systems shall be operated at maximum nominal flow (typically by means of varying the thermostat set point).
 - c. Where exposure to exterior noise varies significantly between groups of classrooms (e.g. one side of a classroom wing adjacent to a street, the other side facing away), separate evaluations of exterior noise significance can be conducted to limit the need for LAeq30 measurements.
 2. Maximum Reverberation: Classrooms less than 10,000 cubic feet must have a 0.6-second maximum (unoccupied) reverberation time and classrooms with volumes between 10,000 cubic feet and 20,000 cubic feet must have a 0.7-second maximum (unoccupied, furnished, and fitted-out) reverberation time. (ANSI Standard S12.60-2002). The reverberation times shall be measured in each classroom in three octave bands with center frequencies of 500,

1000, and 2000 Hz. The arithmetic average of the three measured values shall be compared to the standard.

*** END OF SECTION ***

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Provide all work for electrical systems required in the project to be properly installed, tested and performing their intended function.

1.3 QUALITY ASSURANCE

- A. Perform all work in accordance with the latest edition of the national electrical code, and local codes.
- B. All electrical materials and distribution, and utilization equipment shall be UL Listed.
- C. All equipment and materials shall be new and unused and of United States Domestic manufacture unless approved otherwise by engineer or owner.
- D. Eliminate any abnormal sources of noise that are considered by the architect not to be an inherent part of the electrical systems as designed.

1.4 COORDINATION WITH OTHER TRADES

- A. Coordinate the work of this division with all other divisions to ensure that all components of the electrical system will be installed at the proper time and fit the available space.
- B. Locate and size all openings in work of other trades required for the proper installation of the electrical system components.
- C. Make all electrical connections to all equipment furnished by this division and any other division.
- D. Make all electrical connections from all 120 volt and greater dampers and switches to associated exhaust fan(s) furnished by any other division.

1.5 DRAWINGS

- A. The drawings are schematic in nature, but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the building. Determine exact locations by review of equipment manufacturer's data, by job site measurements, by checking the requirements of other trades, and by reviewing all Contract Documents. The size of the electrical equipment indicated on the Drawings may be based on the dimensions of a particular manufacturer. While other listed manufacturers will be acceptable, it is the responsibility of the Contractor to determine if the equipment that Contractor proposes to furnish will fit in the space. The drawings are not intended to show exact locations of conduit and wire, or to indicate all

wire terminators, connectors, conduit fittings, boxes or supports, but rather to indicate distribution, circuitry, and control.

- B. The Electrical Drawings are necessarily diagrammatic in character and cannot show every connection in detail or conduit in its exact location. These details are subject to the requirements of ordinances and also structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid crippling of structural members. All exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.
- C. When the mechanical and electrical Drawings do not give exact details as to the elevation of pipe, conduit and ducts, physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system involved. Exposed conduit is generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner. The Drawings do not show all required offsets and their location details. Work shall be concealed in all finished areas.

1.6 SUBMITTALS

- A. Specification Review:
 - 1. Include a paragraph-by-paragraph written specification review for each product listed requiring a submittal. Denote any proposed deviations from specifications.

1.7 EXISTING CONDITIONS

- A. Do all work required to maintain electrical services to the Owner occupied portions of the building during construction.
- B. No connection to existing services or utilities shall be made without Owner's knowledge and permission. All such connections shall be planned and scheduled to minimize the length of service interruption required. Request for shutdown shall be made to Owner at least two (2) weeks in advance and shall be accompanied by detailed written schedule of activities during shutdown and list of materials required for connection and renewal of service. It shall be understood that all such service interruptions shall be made at the Owner's convenience, not the Contractor's. No increase in contract amount will be allowed for reasons of premium time, inefficiency of operations or other considerations not calculated in original bid.
- C. All items removed shall be stored on-site. Schedule a review of the items with the Owner. Remove from site all items the Owner does not choose to keep. Deliver Owner designated items to Owner's storage facility.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.
- C. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

PART 2 - PRODUCTS

- A. NOT USED.

PART 3 - EXECUTION

3.1 EXISTING WORK

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction.
- C. When performing work on energized equipment or circuits, use personnel experienced and trained in similar operations.
- D. Remove, relocate, and extend existing installations to accommodate new construction.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.

3.2 OWNER INSTRUCTION

- A. Provide on-site Owner training for all new equipment.
- B. Use Operation and Maintenance manuals and actual equipment installed as basis for instruction.
- C. At conclusion of on-site training program have Owner personnel sign written certification they have completed training and understand equipment operation. Include copy of training certificates in final Operation and Maintenance manual submission.

END OF SECTION 26 05 00

SECTION 26 05 01 – SELECTIVE ELECTRICAL DEMOLITION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes:
 - 1. Electrical demolition.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work shall be as specified in individual sections.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Contractor to walk job to observe existing conditions and account for variance as needed.
- B. Verify field measurements and circuiting arrangements as shown on drawings.
- C. Verify that abandoned wiring and equipment serve only abandoned facilities.

3.2 PREPARATION

- A. Disconnect electrical systems as required under this contract.
- B. Coordinate work with the District. No demolition work shall begin without the District's approval.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, observe provisions of NFPA 70E and CALOSHA, use personnel experienced in such operations.
- D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area as required.
- E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted, or alternate arrangements have been made with owner (e.g. – Fire Watch). Disable system only to make switchovers and connections. Coordinate outages with Owner and local fire service. Notify Owner/Owner's representative at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to

maintain service in areas adjacent to work area.

- F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system to make switchovers and connections. Notify Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Demolish and extend existing electrical work under provisions of this section.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Electrical Contractor is responsible for demolished electrical materials, and shall remove from the site and dispose properly or recycle.
- D. Remove abandoned wiring to source of supply.
- E. Remove exposed abandoned conduit. Cut conduit flush with walls and floors, and patch surfaces as required to match existing.
- F. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- G. Disconnect and remove abandoned panelboards and distribution equipment.
- H. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- I. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- J. Discarded electrical components and lamps containing hazardous waste (i.e., mercury in fluorescent lamps) shall be disposed of as required by the State Laws and Local Ordinances regarding hazardous materials.
- K. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
- L. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4 INSTALLATION

- A. Install relocated and replacement materials and equipment as shown.

END OF SECTION 26 05 01

SECTION 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Provide a complete system of building wire and cable to all electrical loads.

1.3 SYSTEM DESCRIPTION

- A. Product Requirements: Provide products as follows:
 - 1. Provide stranded conductors for all wiring.
 - 2. Conductor not smaller than 12 AWG for power and lighting circuits.
 - 3. Conductor not smaller than 16 AWG for control circuits.
 - 4. 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet
 - 5. 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.
 - 6. Copper.
- B. Wiring Methods: Provide the following wiring methods:
 - 1. Concealed Dry Interior Locations: Use only Type THHN/THWN insulation, in raceway.
- C. Branch Circuit Conductors: No branch circuit conductors are allowed in any slab or under slab on grade unless specifically indicated on drawings.

1.4 COORDINATION

- A. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

- A. Manufacturers:
 - 1. Diamond Wire & Cable Co.
 - 2. Southwire
 - 3. General Cable Co.
- B. Product Description: Single conductor insulated wire.
- C. Conductor: Copper.
- D. Insulation: NFPA 70; Type THHN/THWN insulation for feeders and branch circuits.

2.2 TYPE AC CABLE

- A. Manufacturers:
 - 1. AFC
 - 2. Southwire
- B. Product Description: A fabricated assembly of insulated conductors in a flexible metallic enclosure.
- C. Comply with CEC 320.
- D. Support, provide separate support to structure for all Type AC cable, spacing not exceeding three (3) feet and at each junction box.
- E. Provide an insulated green grounding conductor in all Type AC cable.
- F. Acceptable Use: Install, at Contractor's option, only for service to light fixtures above accessible ceilings, limit length to six (6) feet whips from accessible junction box to light fixtures.
- G. Provide insulated throat fittings at all terminations of Type AC cable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify interior of building has been protected from weather.
- B. Verify mechanical work likely to damage wire and cable has been completed.
- C. Verify raceway installation is complete and supported.

3.2 EXISTING WORK

- A. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.
- B. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.
- C. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.
- D. Extend existing circuits using materials and methods compatible with existing electrical installations, or as specified.

3.3 INSTALLATION

- A. Route wire and cable to meet Project conditions.
- B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

- C. Identify and color code wire. Identify each conductor with its circuit number or other designation indicated.
- D. Special Techniques - Wiring Connections:
 - 1. Clean conductor surfaces before installing lugs and connectors.
 - 2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
 - a. MDF/IDF room branch circuits: All branch circuits shall be dedicated and unspliced. Provide dedicated branch circuit 20 or 30 amperes, #10 and or #12 wire, unspliced from wiring device all the way back to the overcurrent device. Do not share ground with any other circuit.
 - b. Computer branch circuits: All branch circuits shall be dedicated. Provide dedicated branch circuit 20 amperes, #10 and or #12 wire from wiring devices all the way back to the overcurrent device. Do not share neutral with any other circuit.
 - c. Kitchen branch circuits: All branch circuits for 125 volt, single phase, 15 and 20 ampere receptacles shall be dedicated. Provide dedicated branch circuit 20 amperes, #10 and or #12 wire from wiring devices all the way back to the overcurrent device. Do not share neutral or ground with any other circuit.
 - 3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
 - 4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
 - 5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
 - 6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

3.4 WIRE COLOR

A. COLOR CODES FOR CONDUCTORS FOR BRANCH CIRCUITS AND FEEDERS

| System/Phase | Wire Sizes #10 and Smaller: Use Continuous Color Coded Insulation (Note 01) | | | | Wire Sizes #6 and Smaller: Use Continuous Color Coded Insulation (Note 02) | |
|---------------------|--|----------|----------|--------------------------------|---|---------------------|
| | A | B | C | N | G | IG |
| 120/208 | Black | Red | Blue | White | Green | Green/Yellow Stripe |
| 120/240 | Black | Orange | Blue | White w/color stripe (Note 03) | Green | Green/Yellow Stripe |
| 277/480 | Brown | Purple | Yellow | Gray | Green | Green/Yellow Stripe |

Table Notes:

- 1. Wire size #8 and larger, black conductors with color marking tape at each termination and where accessible; colors as noted above.

2. Wire sizes #4 and larger, black conductor with green marking tape at each termination and where accessible.
 3. Provide white (no stripe) insulation when 120/208V system is not present at this installation.
- B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number and provide color coding at each junction box containing more than one neutral.
- C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.
- D. Feeder Circuit Conductors: Uniquely color code each phase.
- E. Ground Conductors:
For 6 AWG and smaller: Green.
For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.5 GROUPING OF CIRCUITS

- A. Limit the number of current carrying conductors per conduit to 6. Neutrals serving computer receptacle branch circuits shall be counted as current carrying. Grounds shall not be counted.
- B. Grouping of different voltages is not allowed.
- C. Provide metal box sizes per CEC Table 314.16 (A).
- D. Provide conduit per CEC Annex C.
- E. Neutrals serving branch circuits shall not be shared. Provide dedicated neutral per circuit.

3.6 POWER LIMITED CIRCUIT INSTALLATION

- A. Provide a complete system of raceway and covered junction boxes for all power limited circuits installed in finished spaces and spaces without a ceiling.
- B. Provide raceway for all power limited circuit wiring within wall cavities and above sheet rock, plaster and other "hard" (non-lay-in) ceiling types of construction.
- C. Labeling: Provide label on all junction boxes.
 1. Provide permanent labeling with indelible black marker, in neat, legible print indicating the system wiring name.

END OF SECTION 23 05 19

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide a continuous low-impedance grounding system for the entire electrical wiring system.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers:
 - 1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
 - 2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.
- B. California Electrical Code.

1.3 SYSTEM DESCRIPTION

- A. Grounding systems use the following elements as grounding electrodes:
 - 1. Metal building frame.
 - 2. Rod electrode.

1.4 SUBMITTALS

- A. Product Data: Submit data on grounding electrodes and connections.

1.5 QUALITY ASSURANCE

- A. Provide grounding materials conforming to requirements of CEC, IEEE 142, and UL labeled.

PART 2 – PRODUCTS

2.1 ROD ELECTRODES

- A. Manufacturers:
 - 1. Apache Grounding/Erico Inc.
 - 2. Copperweld, Inc.
 - 3. Erico, Inc.
 - 4. O-Z Gedney Co.
 - 5. Thomas & Betts
 - 6. VFC
- B. Product Description:
 - 1. Material: Copper-clad steel
 - 2. Diameter: 3/4 inch

3. Length: ten (10) feet

2.2 WIRE

- A. Material: Stranded copper.
- B. Foundation Electrodes: #2 AWG.
- C. Grounding Electrode Conductor: Copper conductor bare.
- D. Bonding Conductor: Copper conductor bare.

2.3 MECHANICAL CONNECTORS

- A. Manufacturers:
 1. Apache Grounding/Erico Inc.
 2. Copperweld, Inc.
 3. Erico, Inc.
 4. ILSCO Corporation
 5. O-Z Gedney Co. .
 6. Thomas & Betts, Electrical
 7. VFC
- B. UL Listed for grounding applications.
- C. Description: Brass connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.4 EXOTHERMIC CONNECTIONS

- A. Manufacturers:
 1. Cadweld by Erico, Inc.
- B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

- A. Remove paint, rust, mill oils, and surface contaminants at connection points.

3.3 EXISTING WORK

- A. Modify existing grounding system to maintain continuity to accommodate renovations.
- B. Extend existing grounding system using materials and methods compatible with existing electrical installations.

3.4 INSTALLATION

- A. Install a green equipment grounding conductor in all feeders and branch circuits, minimum size per CEC Table 250.122.

3.6 EQUIPMENT GROUNDING SYSTEM

- A. General: Make a firm bond between all enclosures, equipment and metallic raceway system. Grounding conductors shall be continuous from origin to termination and properly bonded with lugs at both ends. The metallic raceway systems shall be made up properly to form a grounding path that has an impedance back to the main system ground that is as low as can be practically obtained.
- B. Over 250 Volts: Provide locknuts and/or listed fittings per CEC 250-97 for bonding of metal raceways in all circuits of over 250 Volts to ground. In case of oversized, concentric or eccentric knockouts, comply with CEC 250-92(B). The use of snap-in, wedge-type, or pivot-type connectors is prohibited.

3.7 FIELD QUALITY CONTROL

- A. Grounding Tests:
 - 1. Test the electrical system after installation is complete. Inspect and test for stray currents, unintended ground shorts, and proper physical condition of grounding system. Correct any deficiencies and re-test to verify satisfactory installation.
 - 2. Provide written test report to document all findings, test values, work done and certification of grounding system.
 - 3. Use true-RMS meters for all voltage and current measurements.
 - 4. Perform ground resistance and continuity testing in accordance with IEEE 142.
 - 5. When improper grounding is found on receptacle, check receptacles in entire project and correct. Perform retest.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 1. Conduit supports.
 2. Formed steel channel.
 3. Spring steel clips.
 4. Sleeves.
 5. Mechanical sleeve seals.
 6. Firestopping relating to electrical work.
 7. Firestopping accessories.
 8. Equipment bases and supports.

1.3 REFERENCES

- A. Underwriters Laboratories Inc.:
 1. UL 263 - Fire Tests of Building Construction and Materials.
 2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
 3. UL 1479 - Fire Tests of Through-Penetration Firestops.
 4. UL - Fire Resistance Directory.

1.4 DEFINITIONS

- A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.5 PERFORMANCE REQUIREMENTS

- A. Firestopping: Conform to Building Code and UL for fire resistance ratings and surface burning characteristics.

1.6 SUBMITTALS

- A. Product Data:
 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with the Building Code.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

- A. Manufacturers:
 - 1. Allied Tube & Conduit Corp.
 - 2. Electroline Manufacturing Company
 - 3. O-Z Gedney Co.
 - 4. Appleton
- B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.
- C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.
- D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
- E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.
- F. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.

2.2 FORMED STEEL CHANNEL

- A. Manufacturers:
 - 1. Allied Tube & Conduit Corp.
 - 2. B-Line Systems
 - 3. Midland Ross Corporation, Electrical Products Division
 - 4. Unistrut Corp.
- B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.3 SLEEVES

- A. Sleeves for raceway Through Non-fire Rated Floors: 18 gage galvanized steel.
- B. Sleeves for raceway Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage galvanized steel.
- C. Sleeves for raceway Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL Listed.
- D. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.4 SPRING STEEL CLIPS

- A. Product Description: Mounting clamp, and screw.

2.5 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
 - 1. Thunderline Link-Seal, Inc.
 - 2. NMP Corporation

- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FIRESTOPPING

- A. Manufacturers:
 - 1. Dow Corning Corp.
 - 2. Fire Trak Corp.
 - 3. Hilti Corp.
 - 4. International Protective Coating Corp.
 - 5. 3M fire Protection Products
 - 6. Specified Technology, Inc.
- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
 - 1. Silicone Firestopping Elastomeric Firestopping: Multiple component silicone elastomeric compound and compatible silicone sealant.
 - 2. Foam Firestopping Compounds: Multiple component foam compound.
 - 3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
 - 4. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
 - 5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
 - 6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
 - 7. Firestop Pillows: Formed mineral fiber pillows.

2.7 FIRESTOPPING ACCESSORIES

- A. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- B. General:
 - 1. Furnish UL Listed products.
 - 2. Select products with rating not less than rating of wall or floor being penetrated.
- C. Non-Rated Surfaces:
 - 1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
 - 2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive sleeves.
- B. Verify openings are ready to receive firestopping.

3.2 INSTALLATION - HANGERS AND SUPPORTS

- A. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Provide precast inserts, expansion anchors, powder actuated anchors or preset inserts as required.
 - 2. Steel Structural Elements: Provide beam clamps, spring steel clips, steel ramset fasteners or welded fasteners as required.
 - 3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors as required.
 - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts or hollow wall fasteners as required.
 - 5. Solid Masonry Walls: Provide expansion anchors or preset inserts as required.
 - 6. Sheet Metal: Provide sheet metal screws.
 - 7. Wood Elements: Provide wood screws.
- B. Inserts:
 - 1. Install inserts for placement in concrete forms.
 - 2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over four (4) inches.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.
- C. Install conduit and raceway support and spacing in accordance with NEC.
- D. Do not fasten supports to suspended ceiling support system, pipes, ducts, mechanical equipment, or conduit.
- E. Install multiple conduit runs on common hangers.
- F. Supports:
 - 1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
 - 2. Install surface mounted cabinets and panelboards with minimum of four anchors.
 - 3. In wet and damp locations install steel channel supports to stand cabinets and panelboards one (1) inch off wall.
 - 4. Support vertical conduit at every floor.

3.3 INSTALLATION - FIRESTOPPING

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.
- B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.
- D. Compress fibered material to maximum 40 percent of its uncompressed size.

- E. Place intumescent coating in sufficient coats to achieve rating required.
- F. Remove dam material after firestopping material has cured.
- G. Fire Rated Surface:
 - 1. Seal opening at all rated floors and walls as follows:
 - a. Install sleeve through opening and extending beyond minimum of one (1) inch on both sides of building element.
 - b. Size sleeve allowing minimum of one (1) inch void between sleeve and building element.
 - c. Pack void with backing material.
 - d. Seal ends of sleeve with UL Listed fire resistive silicone compound to meet fire rating of structure penetrated.
 - 2. Where cable tray, bus, or conduit, penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.
- H. Non-Rated Surfaces:
 - 1. Seal opening through non-fire rated floors and walls as follows:
 - a. Install sleeve through opening and extending beyond minimum of one (1) inch on both sides of building element.
 - b. Size sleeve allowing minimum of one (1) inch void between sleeve and building element.
 - c. Install type of firestopping material recommended by manufacturer.
 - 2. Install escutcheons where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
 - 3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.

3.4 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Provide mechanical sleeve seals.
- B. Interior conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.
- C. Set sleeves in position in forms. Provide reinforcing around sleeves.
- D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- E. Extend sleeves through floors and walls one (1) inch above finished floor level. Caulk sleeves.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.1 SUMMARY

- A. Section includes conduit and tubing, wireways, outlet boxes, pull and junction boxes, and handholes.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
 - 2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
 - 3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).
- B. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
 - 3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - 6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - 7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

- A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
- B. Wet and Damp Locations: Provide rigid steel conduit. Provide cast metal junction and pull boxes. Provide flush mounting outlet box in finished areas.
- C. Concealed Dry Locations: Provide rigid steel intermediate metal conduit on electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
- D. Exposed Dry Locations: Provide rigid steel conduit, intermediate metal conduit or electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

- E. In Slab or Under Slab on Grade: No branch circuit raceway is allowed in any slab or under slab on grade unless specifically indicated on drawings.

1.4 DESIGN REQUIREMENTS

- A. Minimum Raceway Size: 3/4 inch.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- B. Protect PVC conduit from sunlight.

1.6 COORDINATION

- A. Coordinate installation of outlet boxes and raceway for equipment connected under other Divisions.
- B. Coordinate installation of conduit for control wiring in mechanical rooms and in inaccessible locations such as walls and hard ceilings.
- C. Coordinate installation of conduit for all other low-voltage systems in inaccessible locations and all other locations required by drawings or specifications for those systems.
- D. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes. Refer to Architectural elevations and equipment specifications and coordinate device locations prior to electrical rough-in.

PART 2 - PRODUCTS

2.1 METAL CONDUIT

- A. Manufacturers:
 - 1. Carlon Electrical Products
 - 2. Hubbell Wiring Devices
 - 3. Thomas & Betts Corp
 - 4. Walker Systems Inc.
 - 5. The Wiremold Co.
 - 6. Multi Cell
 - 7. O-Z Gedney
 - 8. Raco.
 - 9. or approved equal.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Intermediate Metal Conduit (IMC): Rigid steel.
- D. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit
- E. Electrical Metal Tubing (EMT): All EMT fittings shall be steel not die-cast metal. All conduit stub-ups above ceiling for low voltage and data to be provided with insulating bushing.

- F. Flexible Metal Conduit (Flex): Conduit fittings shall be steel. Provide plastic anti-short bushing for all flex fittings. Comply with CEC 348.
- G. Liquidtight Flexible Metal Conduit: Shall be same as flexible metal conduit specified above except Article 350 in CEC.
- H. PVC-Coated Rigid Steel Conduit: Galvanized rigid steel with additional external coating for 40 mil polyvinyl chloride jacket (PVC). Conforming to UL Standard 6. ANSI C80.1 and NEMA Standard No. RN.1.
 - 1. Manufacturer:
 - a. Ocal Inc.
 - b. Perma Cote Industries
 - c. Rob-Roy Industries
 - d. or Approved equal.
- I. PVC-Rigid Nonmetallic Conduit: PVC and fittings that are listed per the UL Standards. Comply with NEMA Standard TC-2.
- J. Nonmetallic Multi Duct: Provide nonmetallic multi duct that is UL Listed.
 - 1. Type: four (4) inches schedule 40 PVC outer duct, four 1.25 inch ducts of ribbed polyethylene. Duct shall have six (6) inch deep end bell on one end, spigot on the other end.
 - 2. Multi Duct shall have gaskets to seal the inside and outside walls of the inner duct.

2.2 ENCLOSURES

- A. Pull Boxes, Junction Boxes, Cabinets, and Wireways: Provide pull boxes, junction boxes, wireways, and cabinets wherever necessary for proper installation of various electrical systems according to the National Electrical Code and where indicated on the Drawings.
- B. Minimum Size: That size shown on the drawings, as required for the specific function, or as required by the National Electrical Code, whichever is larger.
- C. Construction:
 - 1. Indoors in Dry Areas and Not Buried in Slab: Code gage steel - NEMA 1 construction - sides formed and welded, screw covers unless indicated hinged cover or door on drawings. Hinged doors shall be similar to panelboard doors with the same type locking device. Knockouts shall be factory made or formed O-Z Gedney Type PB or approved equal.
 - 2. Outdoors or Indoors in Wet Areas and Not Buried in Slab: Same as specified above for indoor except provide NEMA 3R (designated by 3R or RT) unless indicated or specified to be NEMA 4 (designated by 4 or WP) or other type rating.
 - 3. Indoors Buried in Slab: Watertight, galvanized cast iron in floors on or below grade, otherwise concrete tight stamped steel.
 - 4. Outdoors Buried in Earth: Watertight, Polymer concrete similar to Hubbell Power System, Inc. "Quazite" or precast concrete type manufactured by Brooks Product, Inc brand for Oldcastle Precast, Inc. Precast box shall have appropriate structural rating for intended use. Install on a level poured concrete base to provide a solid bearing surface. Provide a bolted cast iron traffic cover with foundry-cast marking "Electrical", "Communications" or "Telephone" as applies. Top of enclosure shall be one (1) inch above finished grade in earth. Top of enclosure shall be flush with finished pavement.

2.2 OUTLET BOXES

- A. Manufacturers: Same as Metal Conduit.
- B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
 - 2. Concrete Ceiling Boxes: Concrete type.
- C. Cast Boxes: NEMA FB 1, Type FD, cast fer alloy. Furnish gasketed cover by box manufacturer.
- D. Wall Plates: As specified in Section 26 27 26.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 EXISTING WORK

- A. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.
- B. Remove concealed abandoned raceway to its source.
- C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.
- D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.
- E. Extend existing raceway and box installations using materials and methods compatible with existing electrical installations, or as specified.
- F. Clean and repair existing raceway and boxes to remain or to be reinstalled.

3.3 INSTALLATION - RACEWAY

- A. Ground and bond raceway and boxes in accordance with Section 26 05 26.
- B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 25 29.
- C. Identify raceway and boxes in accordance with Section 26 05 53.
- D. Arrange raceway and boxes to maintain headroom and present neat appearance.
- E. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.
- F. Arrange raceway supports to prevent misalignment during wiring installation.

- G. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- H. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29.
- I. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports
- J. Do not attach raceway to ceiling support wires or other piping systems.
- K. Construct wireway supports from steel channel specified in Section 26 05 29.
- L. Route exposed raceway parallel and perpendicular to walls.
- M. Route raceway installed above accessible ceilings parallel and perpendicular to walls.
- N. Maximum Size Conduit in Slab Above Grade: 3/4 inch.
- O. Maintain clearance between raceway and piping for maintenance purposes.
- P. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees Fahrenheit.
- Q. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- R. Bring conduit to shoulder of fittings; fasten securely.
- S. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.
- T. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes. DO NOT route conduit through the top of any outdoor disconnects, panels, etc. conduits must be routed through side or bottom only.
- U. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install hydraulic one-shot bender to fabricate factory elbows for bends in metal conduit larger than two (2) inch size.
- V. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
- W. Install fittings to accommodate expansion and deflection where raceway crosses expansion joints.
- X. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
- Y. Install suitable caps to protect installed conduit against entrance of dirt and moisture.
- Z. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.
- AA. Close ends and unused openings in wireway.
- BB. Provide tracer wire on all underground raceway outside building slab on grade.

3.4 RACEWAY TYPES

- A. The following raceway types are to be used in the following locations:
1. Under Slab on Grade: Schedule 40 PVC.
 2. Outdoor Locations, Above Grade: Rigid galvanized steel.
 3. Wet and Damp Locations: Rigid galvanized steel.
 4. Exposed or Concealed Dry Locations, Indoors: EMT, IMC, or rigid galvanized steel.
 5. Underground:
 - a. All underground electrical wire in schedule 40 PVC or rigid galvanized steel, 208 volts or greater shall be encased in red concrete two (2) inches thick on all sides. Encasement not required under building slabs, parking lots or other paved surfaces. Red dye may not be applied to the top of the concrete.
 - b. All underground electrical wire in schedule 40 PVC or rigid galvanized steel, 120 volts or less shall have red warning tape 6" above raceway.
 6. Transformers and Motors: 24 inch flexible metal conduit to equipment.
 7. Kitchens and outdoor motor and transformer connections: Liquidtight flexible metal conduit for all exposed raceway.
 8. Cooling Towers: PVC coated rigid galvanized steel within 50 feet of tower.

3.5 INSTALLATION - BOXES

- A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings and as approved by the Architect.
- B. Adjust box location up to ten (10) feet prior to rough-in to accommodate intended purpose.
- C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- F. Do not fasten boxes to ceiling support wires or other piping systems.
- G. Support boxes independently of conduit. Provide rigid support to structure for all junction boxes. Mount junction boxes within 18" of finished ceilings to facilitate future access. Locate junction boxes to allow ready access to junction box covers without removing any equipment.
- H. All outdoor boxes shall be UL listed for wet location service.
- I. Provide rigid support to structure for all junction boxes.
- J. Provide rigid support to structure for all conduit within 3 feet of each junction box and a maximum spacing of 10 feet.
- K. Install junction boxes above ceilings in readily accessible with no obstructions, locate within 18 inches of finished ceiling to facilitate easy access.

- L. For all flexible whips to light fixtures provide wire support at mid-length of whip to structure above with UL listed conduit support clip.
- M. Provide outlet boxes to meet depth requirement of Architectural walls. Refer to Architectural Spec Section 09 21 16 Gypsum Board Assemblies for wall partitions.

3.6 ADJUSTING

- A. Install knockout closures in unused openings in boxes.

3.7 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish.

3.8 ADJUSTING

- A. Adjust floor box flush with finish material.

3.9 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.

3.11 ABOVE CEILING JUNCTION BOXES

- A. Labeling: Provide label on all above ceiling junction boxes.
 - 1. Provide permanent labeling with indelible black marker, in neat, legible print indicating the panelboard name, branch circuit number(s) and voltage of conductors within the junction box. Junction boxes used for emergency power circuits to be painted red.

END OF SECTION 26 05 33

SECTION 26 05 34 - CABINETS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes:
 - 1. Cabinets where shown on the contract drawings and specified herein.
- B. Related work:
 - 1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL
 - 2. Sections 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS

PART 2 PRODUCTS

2.1 MATERIALS

- A. Type: Cabinets shall be flush or surface mounted type as indicated on the contract drawing, as per Code and U.L. Standard 50.
- B. Cabinet Construction: Sizes as indicated, constructed of code gauge sheet steel with hinged lockable doors, common keyed with panelboards. Equip cabinets with 3/4" fire retardant treated plywood backboards and/or barriers as applicable, terminal blocks for connection; index card holders and cards mounted behind heavy plastic on inside of cabinet doors.
- C. Finish: Cabinets shall be chemically cleaned and the fronts shall be finished in same way as panelboards and switchboards.
- D. Controls: As indicated on the contract drawings.
- E. Identification: Provide on exterior of cabinet doors engraved plastic nameplate identifying the cabinet as designated on the Contract Drawing. Lettering shall be white on black finish and shall be minimum 3/16" high. Affix nameplates to cabinet doors with a minimum of two escutcheon pins or screws.

PART 3 EXECUTION

3.1 GENERAL

- A. Required: To be located where indicated on the Contract Drawing and installed as per manufacturer's instruction. Securely fasten to structural members or Unistrut support in vertical and plumb position and at heights indicated.
- B. Nameplates: Conform to provisions noted in 2.1E above or as designated on the plans.

END OF SECTION 26 05 34

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Underground Warning Tape.
 - 3. Lockout Devices.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical identification, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and standards: Comply with the following:
 - 1. California Electrical Code
 - 2. NEMA standards applicable to the product provided.
 - 3. UL standards applicable to the product provided.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to the following:
 - 1. Panduit Corp.
 - 2. American Labelmark Co.
 - 3. Markal Corp.
 - 4. Calpico, Inc.
 - 5. Ideal Industries, Inc.

2.2 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.
- B. Emergency Power panels and Equipment: Laminated three-layer plastic with engraved white letters on **RED** background.
- C. Letter Size:
 - 1. 1/4 inch high letters for identifying individual equipment and loads.
- D. Minimum nameplate thickness: 1/8 inch.

2.3 UNDERGROUND WARNING TAPE

- A. Description: four (4) inch wide plastic tape, colored red with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install identifying devices after completion of painting.
- B. Nameplate Installation:
1. Install nameplate parallel to equipment lines.
 2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
 3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
 4. Secure nameplate to equipment front using screws, rivets, or adhesive.
 5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
 6. Install nameplates for the following:
 - a. Switchboards
 - b. Panelboards
 - c. Transformers
 - d. Service Disconnects
 - 1) Enclosed Switches
 - e. Motor Control Centers
 - f. Stand-alone Motor Controllers
 - g. Generators
 - h. Contactors
- C. Underground Warning Tape Installation:
1. Install underground warning tape along length of each underground conduit, raceway, or cable six (6) to eight (8) inches below finished grade, directly above buried conduit, raceway, or cable. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker.
 2. Install line marker for underground wiring, both direct buried and in raceway.
- D. Printed Panelboard Directory:
1. Provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker for that panel, switchboard, or motor control center.
 2. Panelboard directory shall include a legend indicating insulation color corresponding each phase and voltage in the building electrical system.
 3. Copy in Owner's Manual.

3.3 ABOVE CEILING JUNCTION BOXES

- A. Labeling: Provide label on all above ceiling junction boxes.
 - 1. Provide permanent labeling with indelible black marker, in neat, legible print indicating the panelboard name, branch circuit number(s) and voltage of conductors within the junction box.

3.4 ARC FLASH WARNING LABEL

- A. Switchboards, panel boards and motor control centers requiring examination, adjustments, servicing or maintenance while energized shall be field marked to warn persons of arc flash hazards. Marking shall be located so as to be clearly visible to qualified persons before servicing or maintenance.

END OF SECTION 26 05 53

SECTION 26 05 70

SEISMIC CONTROLS FOR ELECTRICAL WORK

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 & 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes seismic restraints and other earthquake-damage-reduction measures for electrical components. It complements optional seismic construction requirements in the various electrical component Sections.

1.03 DEFINITIONS

- A. CBC: California Building Code.
- B. Seismic Restraint: A fixed device (a seismic brace, an anchor bolt or stud, or a fastening assembly) used to prevent vertical or horizontal movement, or both vertical and horizontal movement, of an electrical system component during an earthquake.
- C. Mobile Structural Element: A part of the building structure such as a slab, floor structure, roof structure, or wall that may move independent of other mobile structural elements during an earthquake.

1.04 SUBMITTALS

- A. Product Data: Illustrate and indicate types, styles, materials, strength, fastening provisions, and finish for each type and size of seismic restraint component used.
 - 1. Anchor Bolts and Studs: Tabulate types and sizes, complete with report numbers and rated strength in tension and shear as evaluated by ICC Evaluation Service.
- B. Shop Drawings: For anchorage and bracing not defined by details and charts on Drawings. Indicate materials, and show designs and calculations signed and sealed by a professional engineer.
 - 1. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
- C. Coordination Drawings: Plans and sections drawn to scale and coordinating seismic bracing for electrical components with other systems and equipment, including other seismic restraints, in the vicinity.
- D. Product Certificates: Signed by manufacturers of seismic restraints certifying that products furnished comply with requirements.
- E. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- F. Material Test Reports: From a qualified testing agency indicating and interpreting test results of seismic control devices for compliance with requirements indicated.

1.05 QUALITY ASSURANCE

- A. Comply with seismic restraint requirements in California Building Code, unless requirements in this Section are more stringent.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing seismic engineering services, including the design of seismic restraints, that are similar to those indicated for this Project.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated.

1.06 PROJECT CONDITIONS

- A. Project Seismic Zone and Zone Factor as Defined in CBC: Zone 4, Zone Factor 0.40.

1.07 COORDINATION

- A. Coordinate layout and installation of seismic bracing with building structural system and architectural features, and with mechanical, fire-protection, electrical, and other building features in the vicinity.
- B. Coordinate concrete bases with building structural system.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amber/Booth Company, Inc.
 - 2. B-Line Systems, Inc.
 - 3. Erico, Inc.
 - 4. GS Metals Corp.
 - 5. Loos & Company, Inc.
 - 6. Mason Industries, Inc.
 - 7. Powerstrut.
 - 8. Thomas & Betts Corp.
 - 9. Unistrut Corporation.

2.02 MATERIALS

- A. Use the following materials for restraints:
 - 1. Indoor Dry Locations: Steel, zinc plated.
 - 2. Outdoors and Damp Locations: Galvanized steel.
 - 3. Corrosive Locations: Stainless steel.

2.03 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

- A. Strength: Defined in reports by ICC Evaluation Service or another agency acceptable to authorities having jurisdiction.
 - 1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.

- B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type.
- C. Concrete Inserts: Steel-channel type.
- D. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
- E. Welding Lugs: Comply with MSS SP-69, Type 57.
- F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
- G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
- H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.04 SEISMIC BRACING COMPONENTS

- A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch-thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.
 - 1. Materials for Channel: ASTM A 570, GR 33.
 - 2. Materials for Fittings and Accessories: ASTM A 575, ASTM A 576, or ASTM A 36.
 - 3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
 - 4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.
- B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.
- C. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.
 - 1. Arrange units for attachment to the braced component at one end and to the structure at the other end.
 - 2. Wire Rope Cable: Comply with ASTM 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.
- D. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install seismic restraints according to applicable codes and regulations and as approved by authorities having jurisdiction, unless more stringent requirements are indicated.

3.02 STRUCTURAL ATTACHMENTS

- A. Use bolted connections with steel brackets, slotted channel, and slotted-channel fittings to spread structural loads and reduce stresses.
- B. Attachments to New Concrete: Bolt to channel-type concrete inserts or use expansion anchors.
- C. Attachments to Existing Concrete: Use expansion anchors.

- D. Holes for Expansion Anchors in Concrete: Drill at locations and to depths that avoid reinforcing bars.
- E. Attachments to Solid Concrete Masonry Unit Walls: Use expansion anchors.
- F. Attachments to Hollow Walls: Bolt to slotted steel channels fastened to wall with expansion anchors.
- G. Attachments to Wood Structural Members: Install bolts through members.
- H. Attachments to Steel: Bolt to clamps on flanges of beams or on upper truss chords of bar joists.

3.03 ELECTRICAL EQUIPMENT ANCHORAGE

- A. Anchor rigidly to a single mobile structural element or to a concrete base that is structurally tied to a single mobile structural element.
- B. Anchor panelboards, motor-control centers, motor controls, switchboards, switchgear, transformers, unit substations, fused power-circuit devices, transfer switches, busways, battery racks, static uninterruptible power units, power conditioners, capacitor units, communication system components, and electronic signal processing, control, and distribution units as follows:
 - 1. Size concrete bases so expansion anchors will be a minimum of 10 bolt diameters from the edge of the concrete base.
 - 2. Concrete Bases for Floor-Mounted Equipment: Use female expansion anchors and install studs and nuts after equipment is positioned.
 - 3. Bushings for Floor-Mounted Equipment Anchors: Install to allow for resilient media between anchor bolt or stud and mounting hole in concrete.
 - 4. Anchor Bolt Bushing Assemblies for Wall-Mounted Equipment: Install to allow for resilient media where equipment or equipment-mounting channels are attached to wall.
 - 5. Torque bolts and nuts on studs to values recommended by equipment manufacturer.

3.04 SEISMIC BRACING INSTALLATION

- A. Install bracing according to spacings and strengths indicated by approved analysis.
- B. Expansion and Contraction: Install to allow for thermal movement of braced components.
- C. Cable Braces: Install with maximum cable slack recommended by manufacturer.
- D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to the structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.05 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Make flexible connections in raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate at electrical equipment anchored to a different mobile structural element from the one supporting them.

3.06 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform the following field quality-control testing:
- B. Testing: Test pull-out resistance of seismic anchorage devices.
 - 1. Provide necessary test equipment required for reliable testing.

2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to the structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. If a device fails the test, modify all installations of same type and retest until satisfactory results are achieved.
7. Record test results.

END OF SECTION

SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

- A. The requirements of this Section apply to all sections of Division 26.
- B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 01 91 13 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 13 GENERAL COMMISSIONING REQUIREMENTS. A Commissioning Agent (CxA) appointed by the owner will manage the commissioning process.

1.3 RELATED WORK

- A. Division 1 GENERAL REQUIREMENTS.
- B. Section 01 91 13 GENERAL COMMISSIONING REQUIREMENTS.

1.4 SUMMARY

- A. This Section includes requirements for commissioning the Facility electrical systems, related subsystems and related equipment. This Section supplements the general requirements specified in Section 01 91 13 General Commissioning Requirements.
- B. Refer to Section 01 91 13 GENERAL COMMISSIONING REQUIREMENTS for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.5 DEFINITIONS

- A. Refer to Section 01 91 13 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.6 COMMISSIONED SYSTEMS

- A. Commissioning of a system or systems specified in Division 26 is part of the construction process. Documentation and testing of these systems, as well as training of the OWNER's Operation and Maintenance personnel in accordance with the requirements of Section 01 91 13 and of Division 26, is required in cooperation with the OWNER and the Commissioning Agent.
- B. The Facility electrical systems commissioning will include the systems listed in Section 01 91 13 General Commissioning Requirements:

1.7 SUBMITTALS

- A. The commissioning process requires review of selected Submittals that pertain to the systems to be commissioned. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the OWNER prior to forwarding to the Contractor. Refer to Section 01 33 00 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.
- B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 13 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 CONSTRUCTION INSPECTIONS

- A. Commissioning of Electrical systems will require inspection of individual elements of the electrical systems construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 13 and the Commissioning plan to schedule electrical systems inspections as required to support the Commissioning Process.

3.2 PRE-FUNCTIONAL CHECKLISTS

- A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the OWNER and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 13 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.3 CONTRACTORS TESTS

- A. Contractor tests as required by other sections of Division 26 shall be scheduled and documented in accordance with Division 1 GENERAL REQUIREMENTS. All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

- A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 13 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

3.4 TRAINING OF OWNER PERSONNEL

- A. Training of the OWNER operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit training agendas and trainer resumes in accordance with the requirements of Section 01 91 13. The instruction shall be scheduled in coordination with the OWNER Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 13 GENERAL COMMISSIONING REQUIREMENTS and Division 26 Sections for additional Contractor training requirements.

END OF SECTION 26 08 00

SECTION 26 09 43 - DIGITAL LIGHTING CONTROLS

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes a networked lighting control system comprised of the following components:
 - 1. System Software Interfaces
 - a. Management and Visualization Interface
 - b. Historical Database and Analytics Interface
 - c. Personal Control Applications
 - d. Smartphone Programming Interface for wired devices
 - 2. System Backbone and Integration Equipment
 - a. System Controller
 - b. OpenADR Interface
 - 3. Wired Networked Devices
 - a. Wall Switches, Dimmers and Scene Controllers
 - b. Graphic Wall Stations
 - c. Auxiliary Input/Output Devices
 - d. Occupancy and Photocell Sensors
 - e. Power Packs and Secondary Packs
 - f. Networked Luminaires
 - g. Relay and Dimming Panel
 - 4. Wireless Networked Devices
 - a. Sensor Interface
 - b. Light Controllers
 - c. Digital Sensor Attachments
 - d. Networked Luminaires
 - e. Communication Bridge
- B. The networked lighting control system shall meet all of the characteristics and performance requirements specified herein.
- C. The contractor shall provide, install and verify proper operation of all equipment necessary for proper operation of the system as specified herein and as shown on applicable drawings.

1.2. RELATED DOCUMENTS

- A. Section 262726 Wiring Devices
- B. Section 265000 Lighting

1.3 SUBMITTALS

- A. Submittal shall be provided including the following items.
 - 1. Bill of Materials necessary to install the networked lighting control system.
 - 2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
 - 3. Riser Diagrams showing device wiring connections of system backbone and also typical per room/area type.

4. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
5. Other Diagrams and Operational Descriptions – as needed to indicate system operation or interaction with other system(s).
6. Contractor Startup/Commissioning Worksheet (must be completed prior to factory start-up).
7. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.
8. Hardware and Software Operation Manuals.

1.4 APPROVALS

- A. Prior approval from owner's representative is required for products or systems manufactured by companies not specified in the Network Lighting Controls section of this specification.
- B. Any alternate product or system that has not received prior approval from the owner's representative at least 10 days prior to submission of a proposal package shall be rejected.
- C. Alternate products or systems require submission of catalog datasheets, system overview documents and installation manuals to owner's representative.
- D. For any alternate system that does not support any form of wireless communication to networked luminaires, networked control devices, networked sensors, or networked input devices, bidders shall provide a total installed cost including itemized labor costs for installing network wiring to luminaires, control devices, sensors, input devices and other required system peripherals.

1.5 QUALITY ASSURANCE

- A. Product Qualifications
 1. System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled with required markings as applicable.
 2. System shall be listed as qualified under DesignLights Consortium Networked Lighting Control System Specification V2.0.
 3. System luminaires and controls are certified by manufacturer to have been designed, manufactured and tested for interoperability.
 4. All components shall be subjected to 100% end of line testing prior to shipment to the project site to ensure proper device operation.
 5. All components and the manufacturing facility where product was manufactured must be RoHS compliant.
- B. Installation and Startup Qualifications
 1. System startup shall be performed by qualified personnel approved or certified by the manufacturer.
- C. Service and Support Requirements
 1. Phone Support: Toll free technical support shall be available.
 2. Remote Support: The bidder shall offer a remote support capability.
 3. Onsite Support: The bidder shall offer onsite support that is billable at whole day rates.
 4. Service Contract: The bidder shall offer a Service Contract that packages phone, remote, and onsite support calls for the project. Response times for each type of support call shall be indicated in the terms of the service contract included in the bid package.

1.6 WARRANTY

- A. The manufacturer shall provide a minimum five-year warranty on all hardware devices supplied and installed. Warranty coverage shall begin on the date of shipment.
- B. The hardware warranty shall cover repair or replacement any defective products within the warranty period.

1.7 MAINTENANCE & SUSTAINABILITY

- A. The manufacturer shall make available to the owner new parts, upgrades, and/or replacements available for a minimum of 5 years following installation.

PART 2 – EQUIPMENT

2.1 MANUFACTURERS

- A. Manufacturers that are listed with DesignLights Consortium Networked Lighting Control System Specification V2.0.
- B. Approved Manufacturers
 - 1. nLight
 - 2. Sensorswitch
 - 3. Fresco
- C. Basis of Design System: **Acuity Controls nLight**

2.2 SYSTEM PERFORMANCE REQUIREMENTS

- A. System Architecture
 - 1. System shall have an architecture that is based upon three main concepts: (a) networkable intelligent lighting control devices, (b) standalone lighting control zones using distributed intelligence, (c) optional system backbone for remote, time based and global operation between control zones.
 - a. Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.
 - b. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wallstations without requiring connection to a higher level system backbone; this capability is referred to as “distributed intelligence.”
 - c. System must be capable of interfacing directly with networked luminaires such that either low voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches and system backbone (see *Control Zone Characteristics* sections for each type of network connection, wired or wireless).
 - 2. The system shall be capable of providing individually addressable switching and dimming control of the following: networked luminaires, control zones to include multiple switch legs or circuits, and relay and dimming outputs from centralized panels to provide design flexibility

appropriate with sequence of operations required in each project area or typical space type. A single platform shall be used for both indoor and outdoor lighting controls.

3. Lighting control zones shall be capable of being networked with a higher level system backbone to provide time based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software.
4. All system devices shall support remote firmware update, such that physical access to each device is not necessary, for purposes of upgrading functionality at a later date.
5. System shall be capable of “out of box” sequence of operation for each control zone. Standard sequence is:
 - a. All switches control all fixtures in a zone
 - b. All occupancy sensors automatically control all fixtures in the control zone with a default timeout.

B. Wired Networked Control Zone Characteristics

1. Following proper installation and provision of power, all networked devices connected together with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g., software application, handheld remote, pushbutton). The “out of box” default sequence of operation is intended to provide typical sequence of operation so as to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.
2. System shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.
3. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:
 - a. Low-Voltage power sensing: These devices shall automatically provide 100% light level upon detection of loss of power sensed via the low voltage network cable connection.
 - b. UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay(s) and provide 100% light output upon detection of loss of power sensed via line voltage connections.
 - c. Emergency egress devices shall be provided and UL labeled by the lighting control manufacturer.

C. Wireless Networked Control Zone Characteristics

1. Following proper installation and provision of power, all wireless networked devices paired, meshed or grouped together shall automatically follow the “out of box” default sequence of operations.
2. Wireless network communication shall support uniform and instant response such that all luminaires in a lighting control zone respond immediately and synchronously in response to a sensor or wallstation signal.
3. To support the system architecture requirement for distributed intelligence, wireless network communication shall support communication of control signals from sensors and wallstations to networked luminaires and wireless load control devices, without requiring any communication, interpretation, or translation of information through a backbone device such as a wireless access point, communication bridge or gateway.

4. All wireless communication shall be encrypted using at least 128-bit Advanced Encryption Standard (AES).
5. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:
 - a. UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay(s) and provide 100% light output upon detection of loss or interruption of power sensed via line voltage connections.

D. System Integration Capabilities

1. The system shall interface with third party building management systems (BMS) to support two-way communication using the industry standard BACnet/IP or BACnet/MSTP protocols.

2.3 SYSTEM SOFTWARE INTERFACES

A. Management Interface

1. System shall provide a web-based management interface that provides remote system control, live status monitoring, and configuration capabilities of lighting control settings and schedules.
2. Management interface must be compatible with industry-standard web browser clients, including, but not limited to, Microsoft Internet Explorer®, Apple Safari®, Google Chrome®, Mozilla Firefox®.
3. All system software updates must be available for automatic download and installation via the internet.

B. Historical Database and Analytics Interface

1. System shall provide a browser-based trending and monitoring interface that stores historical data for all occupancy/daylight sensors and lighting loads. Additionally, the system shall optionally upload that data to a cloud based server.

C. Visualization Interfaces

1. System shall provide an optional web-based visualization interface that displays a graphical floorplan. System data, to include status of occupancy sensors, daylight sensors and light output shall be overlaid to the floorplan to provide a graphical status page.

D. Portable Programming Interface for Standalone Control Zones

1. Portable handheld application interface for standalone control zones shall be provided for systems that allows configuration of lighting control settings.
2. Programming capabilities through the application shall include, but not be limited to, the following:
 - a. Switch/occupancy/photosensor group configuration
 - b. Manual/automatic on modes
 - c. Turn-on dim level
 - d. Occupancy sensor time delays
 - e. Dual technology occupancy sensors sensitivity
 - f. Photosensor calibration adjustment and auto-setpoint
 - g. Trim level settings

2.4 SYSTEM BACKBONE AND SYSTEM INTEGRATION EQUIPMENT

A. System Controller

1. System Controller shall be a multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.
2. System Controller shall perform the following functions:
 - a. Facilitation of global network communication between different areas and control zones.
 - b. Time-based control of downstream wired and wireless network devices.

- c. Linking into an Ethernet network.
 - d. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
 - e. Connection to various software interfaces, including management interface, historical database and analytics interface, visualization interface, and personal control applications.
3. System Controller shall not require a dedicated PC or a dedicated cloud connection.
 4. Device shall automatically detect all networked devices connected to it, including those connected to wired and wireless communication bridges.
 5. Device shall have a standard and astronomical internal time clock.
 6. Shall be capable of connecting to the customers Local Area Network (LAN) via IEEE 802.11.x Wireless and IEEE 802.3 Wired connection.
 7. System Controller shall support BACnet/IP and BACnet/MSTP protocols to directly interface with BMS and HVAC equipment without the need for additional protocol translation gateways.
 - a. BACnet/MSTP shall support a minimum of 50 additional BACnet MS/TP controllers in addition to the Expansion I/O modules.
 - b. BACnet/MSTP shall support 9600 to 115200 baud.
 - c. System Controller shall be BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.
 - d. System controller must support BACnet/IP Broadcast Management Device (BBMD) and Foreign Device Registration (FDR).
- B. OpenADR Interface
1. System shall provide an interface to OpenADR protocol Demand Response Automation Servers (DRAS) typically provided by local electrical utility.
 2. OpenADR interface shall meet all of the requirements of Open ADR 2.0a Virtual End Nodes (VEN), including:
 - a. Programmable with the account information of the end-user's electrical utility DRAS account credentials.

2.5 WIRED NETWORKED DEVICES

- A. Wired Networked Wall Switches, Dimmers, Scene Controllers
1. Wall switches & dimmers shall support the following device options:
 - a. Number of control zones: 1, 2 or 4
 - b. Control Types Supported: On/Off or On/Off/Dimming
 2. Scene controllers shall support the following device options:
 - a. Number of scenes: 1, 2 or 4
 - b. Control Types Supported:
 - 1) On/Off or On/Off/Dimming
 - 2) Preset Level Scene Type
 - 3) Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene
 - 4) Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones

B. Wired Networked Graphic Wall Stations

1. Device shall have a full color touch screen.
2. Device shall enable configuration of all switches, dimmers, and lighting preset scenes via password protected setup screens.
3. Graphic wall stations shall support the following device options:
 - a. Number of control zones: Minimum of 16
 - b. Number of scenes: Minimum of 16
 - c. Optional password protection for setup screens.

C. Wired Networked Auxiliary Input / Output (I/O) Devices

1. Auxiliary Input/Output Devices shall be specified as an input or output device with the following options:
 - a. Contact closure input
 - 1) Input shall be programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, ramp light level up or down, or toggle lights on/off.
 - b. 0-10V analog input
 - 1) Input shall be programmable to function as a daylight sensor.
 - c. RS-232/RS-485 digital input
 - 1) Input supports activation of up to 4 local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.
 - d. 0-10V dimming control output, capable of sinking a minimum of 20mA of current
 - 1) Output shall be programmable to support all standard sequence of operations supported by system.

D. Wired Networked Occupancy and Photosensors

1. Sensors shall utilize passive infrared (PIR) or passive dual technology (PDT) to detect both major and minor motion as defined by NEMA WD-7 standard.
2. Sensing technologies that are acoustically passive, meaning they do not transmit sound waves of any frequency do not require additional commissioning. Ultrasonic or Microwave based sensing technologies may require commissioning due to the active nature of their technology, if factory required.
3. Sensor programming parameter shall be available and configurable remotely from the software and locally via the device.
4. Sensor mounting type shall match project design requirements as shown on plans.
 - a. Sensors shall have optional features for photosensor/daylight override, dimming control, and low temperature/high humidity operation.
2. The system shall support the following types of photocell-based control:
 - a. On/Off: The control zone is automatically turned off if the photocell reading exceeds the defined setpoint and automatically turned on if the photocell reading is below the defined setpoint. A time delay or adaptive setpoint adjustable behavior may be used to prevent the system from exhibiting nuisance on/off switching.
 - b. Continuous Dimming: The control zone automatically adjusts its dimming output in response to photocell readings, such that a minimum light level consisting of both

electric light and daylight sources is maintained at the task. The photocell response shall be configurable to adjust the photocell setpoint and dimming rates.

E. Wired Networked Wall Switch Sensors

1. Wall switches sensors shall support the following device options:
 - a. User Input Control Types Supported: On/Off or On/Off/Dimming
 - b. Occupancy Sensing Technology: PIR only or Dual Tech
 - c. Daylight Sensing Option: Inhibit Photosensor

F. Wired Networked Embedded Sensors

1. Embedded sensors shall support the following device options:
 - a. Occupancy Sensing technology: PIR only or Dual Tech
 - b. Daylight Sensing Option: Occupancy only, Daylight only, or combination Occupancy/Daylight sensor

G. Distributed System Power, Switching and Dimming Controls

1. Devices shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output, and contribute low voltage Class 2 power to the rest of the system.
2. Device programming parameters shall be available and configurable remotely from the software and locally via the device push-button.
3. Device shall be plenum rated.
4. Devices shall be UL Listed for load and load type as specified on the plans.

H. Wired Networked Luminaires

1. Networked luminaire shall have a factory installed mechanically integrated control device and carry a UL Listing as required.
2. Networked LED luminaire shall provide low voltage power to other networked control devices.
3. System shall be able to maintain constant lumen output over the specified life of the LED luminaire (also called lumen compensation) by automatically varying the dimming control signal to account for lumen depreciation.
4. System shall be able to provide control of network luminaire intensity, in addition to correlated color temperature of specific LED luminaires.
5. Controls manufacturer is responsible for primary troubleshooting and tech support of complete fixture.

I. Wired Networked Relay and Dimming Panel

1. Relay and dimming panel(s) shall be capable of providing the required amount of relay capacity, as required per panel schedules shown on drawings, with an equal number of individual 0-10V dimming outputs.
2. Standard relays used shall have the following required properties:
 - a. Configurable in the field to operate with normally closed or normally open behavior.
 - b. Provides visual status of current state and manual override control of each relay.
 - c. Be individually programmable
3. 0-10 dimming outputs shall support a minimum of 100mA sink current per output.
4. Panel shall be UL924 listed for control of emergency lighting circuits.
5. Panel shall provide a contact closure input that acts as a panel override to activate the normally configured state of all relays (i.e., normally open or normally closed) in the panel.

2.6 WIRELESS NETWORKED DEVICES

- A. Wireless Networked Sensor Interface
 - 1. The device shall be capable of broadcasting the following manual wall control commands: on, off, and adjust dim level.
- B. Wireless Networked Light Controllers (No Sensor)
 - 1. The wireless light controller shall be capable of providing continuous dimming and on/off control of one commercial light fixture including fluorescent, HID, induction and LEDs.
 - 2. An external antenna attached to the luminaire shall not be allowed.
 - a. Each wireless light controller shall provide measurement capability of the amperage, voltage, wattage, and watt-hours of its controlled lighting.
- C. Wireless Networked Digital Sensors
 - 1. In addition to providing Wireless Networked Light Controllers functionality, also provides:
 - a. Integrated digital occupancy sensing and digital photocell sensor.
 - b. Sensor shall connect directly to the wireless light controller and shall be suitable for embedding into the enclosure of a luminaire.
 - c. Sensor shall have software-adjustable settings
 - d. Photocell shall be suitable for closed and open loop applications.
- D. Wireless Network Communication Bridge
 - 1. A communication bridge device shall be provided that interfaces with the System Controller via Owner's LAN connection and interfaces with wireless network.
 - 2. Device shall be capable of communicating with a group of a minimum of 250 wireless networked devices and luminaires, so as to reduce the amount of communication bridges required in the system.

PART 3 – EXECUTION

3.1 INSTALLATION REQUIREMENTS

- A. Installation Procedures and Verification
 - 1. The successful bidder shall review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.
 - 2. The successful bidder shall install and connect the networked lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals and plans specifications.
 - 3. The successful bidder shall be responsible for testing of all low voltage network cable included in the bid. Bidder is responsible for verification of the following minimum parameters:
 - a. Wire Map (continuity, pin termination, shorts and open connections, etc.)
 - b. Length
 - c. Insertion Loss
- B. Coordination with Owner's IT Network Infrastructure
 - 1. The successful bidder is required to coordinate with the owner's representative to secure all required network connections to the owner's IT network infrastructure.
 - a. The bidder shall provide to the owner's representative all network infrastructure requirements of the networked lighting control system.

- b. The bidder shall provide, to the manufacturer's representative, all necessary contacts pertaining to the owner's IT infrastructure, to ensure that the system is properly connected and started up.

C. Coordination with Mechanical Division

- 1. The successful bidder shall provide all integration equipment detailed in Division 260943.
- 2. The successful bidder to verify integration scope with the Mechanical Contractor prior to submittal phase and provide all necessary schedules to the Lighting Control manufacturer.

D. Documentation and Deliverables

- 1. The installing contractor shall be responsible for documenting installed location of all networked devices, including networked luminaires. This includes responsibility to provide as-built plan drawing showing device addresses corresponding to locations of installed equipment.
- 2. The installing contractor is also responsible for the following additional documentation to the manufacturer's representative if visualization / graphical floorplan software is provided as part of bid package:
 - a. As-Built floor plan drawings showing wired network control zones outlined, in addition to device address locations required above. All documentation shall remain legible when reproducing\scanning drawing files for electronic submission.
 - b. As-Built electrical lighting drawings (reflected ceiling plan) in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.
 - 1) CAD files shall have layers already turned on/off as desired to be shown in the graphical floorplan background images. The following CAD elements are recommended to be hidden to produce an ideal background graphical image:
Titleblock
Text- Inclusive of room names and numbers, fixture tags and drawings notes
Fixture wiring and homeruns
Control devices
Hatching or poché of light fixtures or architectural elements
 - 2) CAD files shall be of AutoCAD 2013 or earlier. Revit file overall floor plan views shall be exported to AutoCAD 2013.

3.2 SYSTEM STARTUP

- A. Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed by an authorized representative of the manufacturer.
 - 1. Low voltage network cable testing shall be performed prior to system startup at the discretion of the manufacturer.
- B. System start-up and programming shall include:
 - 1. Verifying operational communication to all system devices.
 - 2. Programming the network devices into functional control zones to meet the required sequence of operation.
 - 3. Programming and verifying all sequence of operations.
 - 4. Customization of owner's software interfaces and applications.
- C. Initial start-up and programming is to occur on-site. Additional programming may occur on-site or remotely over the Internet as necessary.

3.3 PROJECT TURNOVER

A. System Documentation

1. Submit software database file with desired device labels and notes completed.

B. Owner Training

1. Provisions for onsite training for owner and designated attendees to be included in submittal package.

END OF SECTION 26 05 29

SECTION 26 20 00 - ELECTRICAL DISTRIBUTION EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Conditions of the Contract Documents and Division 1 - General Requirements as applicable, apply to this Section.

1.2 SUMMARY

- A. Provide all electrical distribution and motor control equipment and accessories required to distribute electrical power to all motors, outlets and systems requiring power.

1.3 QUALITY ASSURANCE

- A. New: Provide all new equipment.
- B. Single Manufacturer: All equipment of each type shall be the product of one manufacturer.
- C. UL: Equipment shall be UL listed. Service entrance equipment shall bear UL Service Entrance label.
- D. CEC: Equipment and installation shall comply with the California Electrical Code.
- E. Wet Locations: Equipment and enclosures installed outdoors and in wet locations shall be approved for the purpose.
- F. IEEE: Institute of Electrical and Electronics Engineers Standard 1015-1997 (Blue Book) Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.

1.4 LABELING

- A. Nameplates and labeling shall be provided in accordance with Section 26 05 53. All feeders shall be labeled at the feeder device.

1.5 FINISHES

- A. All equipment shall have a factory applied gray finish applied over a rust inhibiting treatment. Any items which have the finish marred shall be touched up or refinished to a new condition before final acceptance. This shall include, but shall not be limited to, sanding and properly removing rust or other contaminants and completely repainting equipment if damage is extensive. Overall acceptance is subject to approval of the Engineer.

1.6 SUBMITTALS

- A. Provide complete product data for each equipment type. Provide electric service studies when required.
- B. Submittal shall include written recommendation from manufacturer of settings for all electronic trip adjustment setting on all equipment furnished with adjustable trip settings.

Contractor is responsible for adjusting all electronic trip settings per manufacturer recommendations.

- C. Electrical connections to all equipment furnished by any other division shall be coordinated with final approved equipment submittals from other divisions including but not limited to circuit breaker sizes, conduit sizes, wire sizes, fuse sizes, disconnect switch sizes and starter sizes that differ from those shown on the drawings prior to submitting Electrical Distribution Equipment submittal.

1.7 SHORT CIRCUIT CURRENT RATINGS

- A. General: All switchboards and panelboards shall be fully rated and marked with a maximum short circuit current rating. The equipment manufacturer shall have verified this rating with high-amperage testing. All short circuit current ratings are expressed as amperes RMS symmetrical at the applied voltage unless otherwise noted. All equipment shall withstand the specified level of fault current. All overcurrent devices shall interrupt the specified level of fault current.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Unless indicated otherwise, all equipment in this section shall be provided from a single manufacturer. The product designations listed are to establish a level of quality. Acceptable manufacturers are,
 - 1. Eaton
 - 2. Siemens
 - 3. G.E.
 - 4. Square D

2.2 ENCLOSED SWITCHES

- A. General: Provide heavy duty enclosed switches similar to Square D Class 3100 Type HD.
- B. Switch Interior:
 - 1. All switches shall have switch blades which are visible when the switch is OFF and the cover is open.
 - 2. Lugs shall be front removable and UL Listed for 75 degrees Celsius conductors.
 - 3. All current carrying parts shall be plated to resist corrosion.
 - 4. Switches shall have removable arc suppressors to facilitate easy access to line side lugs.
 - 5. Switches shall have provisions for a field installable electrical interlock.
- C. Switch Mechanism:
 - 1. Switch operating mechanism shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.
 - 2. The operating handle shall be an integral part of the box, not the cover.
 - 3. Provisions for padlocking the switch in the OFF position with at least three padlocks shall be provided.

4. The handle position shall travel at least 90 degrees between OFF and ON positions to clearly distinguish and indicate handle position.
 5. All switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is ON and prevent turning the switch ON when the cover is open. The cover interlock mechanism shall have an externally operated override but the override shall not permanently disable the interlock mechanism. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.
- D. Switch Enclosures:
1. Switch covers shall be attached with welded pin-type hinges.
 2. The enclosure shall be finished with gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated steel.
 3. The enclosure shall have ON and OFF markings stamped into the cover.
 4. The operating handle shall be provided with a dual colored, red/black position indication,
 5. All switches shall have provisions to accept up to three (3) 3/8 inch hasp padlocks to lock the operating handle in the OFF position.
 6. Tangential knockouts shall be provided to facilitate ease of conduit entry.
- E. Switch Ratings:
1. Switches shall be horsepower rated for ac and/or dc as indicated on the plans.
 2. The UL Listed short circuit current rating of the switches shall be 200,000 rms symmetrical amperes when used with or protected by Class J fuses.
 3. Non-Fusible: 10,000 rms symmetrical amps.
- F. Fuse Clips: NEMA FU 1, Class J fuses.

2.3 SINGLE CIRCUIT BREAKERS WITH ENCLOSURES

- A. Product Description: Enclosed, molded-case circuit breaker conforming to NEMA AB 1, suitable for use as service entrance equipment where applied.
- B. Circuit Breakers: Molded case, quick make, quick break, trip free, common thermal magnetic trip.
- C. Ratings: Continuous current, poles as required, 480 volt system breaker shall interrupt short circuits up to 14,000 rms amps symmetrical; on 120/208 - 240 volt system, 10,000 amp rms symmetrical.
- D. Enclosure: NEMA AB 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
1. Interior Dry Locations: Type 1.
 2. Exterior Locations: Type 3R.
- E. Nameplate: Provide a nameplate showing load served.

2.4 COMBINATION DISCONNECT / MOTOR STARTERS

- A. Square D - Class 8538 Type S (Fusible or no fuse, as shown on plans).
1. Description: Combine magnetic motor controllers with fusible switch disconnect in common enclosure. Switch shall have a color coded externally operated handle. Operating handle shall give positive visual indication of ON/OFF with red and black color-coding.

2. Fusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate Class J fuses and visible blades. Operating handle shall give positive visual indication of ON/OFF with color-coded operating handle.
3. Magnetic Motor Controllers: Refer to paragraph(s) specifying magnetic motor controllers for requirements.

2.5 FUSES (600 VOLTS AND BELOW)

- A. Manufacturers:
 1. Bussmann.
 2. Little Fuse
 3. Ferraz Shawmut
- B. Dimensions and Performance: NEMA FU 1, Class as specified or as indicated on Drawings.
- C. Voltage: Rating suitable for circuit phase-to-phase voltage.
- D. Class J (Time Delay) Fuses
 1. Dimensions and Performance: NEMA FU 1.
 2. Voltage: Rating suitable for circuit phase-to-phase voltage.
 3. Dual-element, time delay ten (10) seconds (minimum) at 500 percent rated current.
- E. Spares: Spare fuses shall be provided in the amount of ten (10) percent of each type and size installed. Replacement for fuses and limiters blown during construction shall not count as spares.

2.6 TRANSFORMERS FOR NONLINEAR LOADS

- A. Nonlinear load transformer shall be as specified for two winding transformers except as modified by this Section.
- B. Product Description: NEMA ST 20, factory-assembled, air cooled dry type transformers, designed to supply nonlinear load, UL K-9 rated.
- C. Primary Voltage: 480 volts, 3 phase.
- D. Secondary Voltage: 208Y/120 volts, 3 phase.
- E. Insulation and temperature rise: Class 220 insulation system with 115 degrees Celsius average winding temperature rise over 40 degrees Celsius ambient.
- F. Coil Conductors: Continuous copper windings with terminations brazed or welded. Individually insulate secondary conductors and arrange to minimize hysteresis and eddy current losses at harmonic frequencies. Size secondary neutral conductor at 1.73 times the phase conductor ampacity.
- G. Enclosure: NEMA ST 20, Type 1 or Type 3R ventilated. Furnish lifting eyes or brackets.
- H. Isolate core and coil from enclosure using vibration-absorbing mounts.
- I. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

2.7 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Square D I- Line, Class 2110.
- B. Product Description: NEMA PB 1, circuit breaker type panelboard.
- C. Panelboard Bus: copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
- D. Continuous current rating shall be sufficient to protect wiring and equipment served.
 - 1. Panels 400A and smaller, 35,000 amperes rms symmetrical.
 - 2. Panels greater than 400A: 65,000 amperes rms symmetrical.
- E. Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
- F. Main Circuit Breaker:
 - 1. When distribution panel has main circuit breaker, provide molded case circuit breaker with electronic trip unit. Current sensing to be true-rms.
 - 2. Main breaker shall have minimum interrupting rating of 65,000 amperes rms symmetrical at applied voltage.
 - 3. Electronic trip shall be Square D micrologic with adjustable long-time, short-time and instantaneous pick-up set points.
- G. Cabinet Front: Safety dead front type. Conform to NEMA 1; NEMA 3R if located outdoors.

2.8 BRANCH CIRCUIT PANELBOARDS

- A. Manufacturers: Square D Type NQ for 208/120V, type NF for 480/277V.
- B. Product Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
- C. Panelboard Bus: Copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard;
- D. For non-linear load applications subject to harmonics furnish 173 percent rated, plated copper, solid neutral.
- E. Minimum Integrated Short Circuit Rating: 14,000 amperes rms symmetrical for 208-240/120 volt panelboards; 22,000 amperes rms symmetrical for 480 volt panelboards.
- F. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.
- G. Enclosure: NEMA PB 1, Type 1 or Type 3R. All panelboards located in kitchen areas shall be flush mount with NEMA 4X Stainless Steel enclosures.
- H. Cabinet Front: Safety dead front type with concealed trim clamps, concealed hinge, metal directory frame, and flush lock keyed alike. Finish in manufacturer's standard gray enamel.

- I. Provide ground-fault circuit breaker for each heat trace branch circuit.
- J. Panelboards indicated to have thru-feed lugs shall be furnished with thru-feed lugs in all sections of panelboard.

PART 3 - EXECUTION

3.1 MOUNTING:

- A. General: All equipment shall be securely fastened in place.
- B. Locations: In all cases mounting locations shall comply with the requirements of the National Electrical Code. This shall include providing suitable working clearances.
- C. Concrete Pads:
 - 1. Provide concrete in accordance with the Division of the Specifications for that product.
 - 2. Indoor concrete pads shall consist of a four (4) inch pad with beveled edges extending two (2) inches beyond the perimeter of supported equipment. Switchboards, motor control centers, transformers greater than 15 KVA, and engine generators shall be installed on a pad. Refer to the drawings and the specifications for each piece of equipment to determine what other equipment shall be mounted on a pad.
 - 3. All equipment, ground mounted outdoors, shall be mounted on a pad. Outdoor pads shall be minimum of one foot thick reinforced with #4 rebar one (1) foot on center each way. Size outdoor pads with at least four (4) feet working clearance in front of equipment and one (1) foot on all sides. Provide anchor bolts for pad-mounted equipment. Refer to Detail on drawings.
- A. Wall Mounted Equipment: Wall mounted equipment shall be suitably positioned on the wall. Equipment mounted on exterior basement wall shall have unistrut channels between the wall and the equipment to prevent condensation problems. Where wall mounted equipment is specified, but a convenient wall not available, a suitable unistrut mounting stanchion anchored in concrete shall be provided. In lieu of this stanchion, small devices may be mounted on to the equipment served if approved by the equipment manufacturer.
- B. Motor rated disconnects: Install disconnects in a vertical orientation with off in the down position.

3.2 DELIVERY, STORAGE AND HANDLING:

- A. General:
 - 1. Store all types of electrical power distribution equipment in a clean, heated building affording appropriate physical protection. Control access to prevent unauthorized tampering with the equipment. However, equipment may be stored in other inside or outside environments under approved conditions.
 - 2. Inspect equipment when received at Project site for shipping damage. Report as required by freight carrier to recover repair or replacement costs from the freight carrier in the event damage was sustained.
 - 3. Covers are required unless indoor, ventilated storage conditions exist. Canvas tarpaulins or the equivalent are preferred over other coverings because they provide better humidity control and enclosure scuff protection. Where exposed to moisture, covers shall be waterproof.

4. The manufacturer's shipping skids shall be left on the equipment to provide structural support until the equipment is set in final resting place.
 5. Refer to Section 26 05 00 for additional requirements. Contractor shall furnish new equipment to replace any equipment that is exposed to weather or subjected to other deleterious effects of construction.
- B. Approved Conditions for Equipment Storage:
1. General: Where storage conditions specified above are not available, indoor or outdoor storage shall comply with the following.
 2. Switchboards, Motor Control and Other General Distribution and Utilization Equipment:
 - a. Store metal-enclosed equipment in the upright position. Provide good ventilation of the shelter and protection from dirt, moisture and physical damage.
 - b. Space heaters furnished with the equipment shall be connected to a continuous source of power of the proper rating. Where space heaters are supplied from auxiliary power transformers, care shall be taken that low-voltage heater circuits are properly isolated before power source connection to prevent inadvertent energizing of the auxiliary transformer and associated high-voltage primary wiring.
 - c. Ambient conditions may allow condensation inside waterproof covers. If condensation is occurring, temporary heaters or lamp banks shall be provided of sufficient wattage to prevent condensation.
 - d. Contractor shall ensure that equipment stored in shipping cases receives adequate ventilation to avoid mildew and prevent condensation.
- C. Transformer
1. Indoor storage shall be provided for all transformers.

3.3 GROUND FAULT PROTECTION OF EQUIPMENT:

- A. General: Provide for system performance testing as required by the California Electrical Code. Provide each ground fault relay, sensing device or ground fault protection system with instructions and a test form. The form shall be retained by those in charge of the building's electrical installation and be available to the authority having jurisdiction. The instruction content shall be as required by UL.

3.4 TRANSFORMER VIBRATION ISOLATION:

- A. Floor Mounted Transformers: Install on concrete housekeeping pad with Mason Industries Type WM Neoprene Waffle pad, or equal. Provide Type WM isolation for elevated rack installation.
- B. Wall Mounted Transformers: Install Mason Industries Type WM Neoprene Waffle pad between the wall brackets and the wall.
- C. Suspended Transformers: Install Mason Industries PC30 Pre-compressed spring hanger with neoprene isolator.
- D. Floor Mounted Transformers Greater than 150 kVA: Install on Mason Industries, Inc, or equal, unhoused spring isolators with acoustical pad bonded to bottom. Isolators shall be undamped free-standing spring isolators sized for a minimum of two (2) inches of static deflection. The spring outside diameter shall be no less than 80 percent of the spring operating height. The spring shall have remaining travel to solid of no less than 50 percent of the static deflection. Provide a 1/4 inch neoprene friction pad bonded to the

spring base. Bolt each vibration isolator unit to concrete pad, and bolt transformers to the vibration isolator units, using the leveling bolts and nuts provided with the unit.

3.5 TRANSFORMER VENTILATION:

- A. Transformers with ventilating openings shall be installed so that the ventilating openings are not blocked by walls or other obstructions. The required clearances shall be clearly marked on the transformer.

3.6 POWER SHUT OFF UNDER KITCHEN HOODS:

- A. NFPA:
 - 1. Comply with NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations. The operation of any extinguishing system shall automatically shut off all sources of fuel and heat to all equipment requiring protection by that extinguishing system.
 - 2. Comply with NFPA 17, Standard for Dry Chemical Extinguishing Systems.
 - 3. Comply with NFPA 17A, Standard for Wet Chemical Extinguishing Systems.
- B. Shunt Trip: All electrical sources located under the ventilating equipment (cooking equipment hood) shall be shut off upon the operation of a wet chemical or water fire extinguishing system. Provide shunt trip accessory on each circuit breaker serving an electrical appliance under the hood. Install control wiring between shunt trips and the hood extinguishing system. Coordinate all wiring with supplier of hood fire suppression system for proper selection of shunt trip coil voltage, momentary or maintained-contact closure to activate shunt trip and inter-connections. Operation of a hood extinguishing system shall automatically shunt trip all associated circuit breakers.
- C. Fire Alarm System: The operation of any extinguishing system shall automatically signal the building fire alarm system. Refer to Section 26 05 53 for additional fire alarm system requirements.

3.7 LABELING:

- A. Nametag: Provide a nametag for each piece of distribution equipment; see Section 26 05 53, Electrical Identification.

END OF SECTION 26 20 00

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes wall switches; wall dimmers; receptacles; device plates and box covers. All devices shall be installed in outlet boxes of required size and volume.

1.3 REFERENCES

- A. National Electrical Manufacturers Association: Wiring devices shall comply with NEMA Standards WD-1 and WD-6.
- B. Wet Locations: Wiring devices and their enclosures installed outdoors and in wet locations shall be approved for that purpose.
- C. Minimum Raceway Size: 3/4 inch.

1.4 SUBMITTALS

- A. Submit manufactures product data for all wiring devices, indicate intended color and coverplate.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All devices shall be suitable for use intended, and have voltage and current ratings adequate for loads being served.

2.2 MOTOR RATED SWITCHES

- A. Provide where a switch is indicated as a local disconnect for all mechanical and plumbing equipment.
- B. Leviton MMS Series.

2.3 RECEPTACLES

- A. Single Convenience Receptacle:
 - 1. Leviton 5362A Series, 20A/125V.
- B. Duplex Convenience Receptacle:
 - 1. Leviton 5362 Series, 20A/125V, respectively.
- C. GFCI Receptacle:

1. Leviton 7899 Series, 20A/125V.
 2. Provide GFCI receptacles for all receptacles on 120v circuits installed in kitchens, bathrooms and outdoors (including rooftops).
- D. Isolated Ground Duplex Receptacle:
1. Leviton 5362-IG, 20A/125V.
- E. Duplex Tamper Resistant Receptacle/ USB Charger
1. Leviton T5832. Duplex 20A/125V receptacle with two 3.6A, 5VDC, 2.0 Type A USB Chargers.
- F. Provide 20 amp receptacle for single-receptacle branch circuits.
- G. For locations where a quadruplex or fourplex is required, provide 2-duplex receptacles under common coverplate.
- H. Color: As selected by Architect.

2.4 WALL PLATES

- A. Type 302 Stainless Steel with matching mounting screws.

2.5 MANUFACTURERS

- A. Each type of wiring device shall be furnished by one (1) manufacturer. The following will be acceptable providing the project specifications:
1. Leviton
 2. Pass & Seymour
 3. Hubbell / Bryant
 4. Cooper

PART 3 - EXECUTION

3.1 EXISTING WORK

- A. Disconnect abandoned circuits and remove raceway, wire, and cable. Remove abandoned boxes when connecting wire and cable is abandoned and removed. Install blank cover for remaining abandoned boxes.
- B. Maintain access to existing boxes and wiring connections remaining active and requiring access.
- C. Extend existing circuits using materials and methods compatible with existing electrical installations, or as specified.

3.2 INSTALLATION

- A. Route raceway and cable to meet Project conditions.
- B. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
- C. Adjust box location up to ten (10) feet prior to rough-in when required to accommodate intended purpose.

- D. Do not install flush mounting box back-to-back in walls; install boxes with minimum 24 inches separation.
- E. Install devices plumb and level.

3.3 MOUNTING HEIGHTS

- A. As indicated on Drawings or if not indicated in accordance with the Architects instructions. All other telephone, Data, TV, etc. outlets shall be same as receptacle.

3.4 GANGED SWITCHES

- A. Install permanent barrier between all 277 Volt light switches ganged into one outlet box.
- B. Where multiple switches are grouped on one location, install switches under a one piece, multi-gang cover plate.
- C. Other telephone, data, TV, etc. outlets shall be same as receptacle.

3.5 GFCI

- A. Provide ground-fault circuit-interrupter type receptacles for all 15 and 20 amp receptacles shown on drawings in bathrooms, kitchens, mechanical rooms and outdoors.

END OF SECTION 26 27 26

SECTION 26 43 00 - SURGE PROTECTION DEVICES (SPDs) FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Section 262000 – Surge Protection Devices, individually mounted and switchboard mounted. Switchboards: Surge Protection Device integrated in switchboards.

1.3 REFERENCES

- A. IEEE C62.41.1, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits,
- B. IEEE C62.41.2, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits,
- C. IEEE C62.45, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.
- D. California Electrical Code: Article 285
- E. UL 1283 - Electromagnetic Interference Filters
- F. UL 1449, Third Edition, effective September 29, 2009 – Surge Protection Devices

1.4 SUBMITTALS

- A. Product Data: Submit capacity, dimensions, weights, details, and wiring configuration.
- B. Submittals shall include UL 1449 3rd Edition Listing documentation verifiable by visiting www.UL.com, clicking "Certifications" link, searching using UL Category Code: VZCA and VZCA2:
 - 1. Short Circuit Current Rating (SCCR)
 - 2. Voltage Protection Ratings (VPRs) for all modes
 - 3. Maximum Continuous Operating Voltage rating (MCOV)
 - 4. I-nominal rating (I-n)
 - 5. SPD shall be UL listed and labeled as Type 1 or Type 4 intended for Type 1 or Type 2 applications.
- C. Upon request, an unencapsulated but complete SPD formally known as TVSS shall be presented for visual inspection.
- D. Minimum of ten (10) year warranty Manufacturer's Installation Instructions: Submit installation instructions and connection requirements.

1.5 QUALITY ASSURANCE

- A. List individual units under UL 1449 (Third Addition) and UL 1283.
- B. Single manufacturer: All equipment of each type shall be the product of one manufacturer.
- C. SPD shall comply with CEC Article 285 and shall be permanently marked with the short-circuit current rating of the device.
- D. Manufacturer Qualifications: Engage a firm with at least 5 years experience in manufacturing transient voltage surge suppressors.
- E. Manufacturer shall be ISO 9001 or 9002 certified.
- F. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- G. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept equipment on site in factory packaging. Inspect for damage.
- B. Protect equipment from damage by providing temporary covers until construction is complete in adjacent space.
- C. Handle and store equipment in accordance with manufacturer's Installation and Maintenance Manuals. One (1) copy of this document to be provided with the equipment at time of shipment.

PART 2 - PRODUCTS

2.1 SURGE PROTECTION DEVICES (SPDs)

- A. Manufacturers:
 - 1. Current Technology
 - 2. Liebert
 - 3. Siemens
 - 4. Square D
 - 5. GE
- B. Product Description: Surge protection devices for protection of AC electrical circuits.
- C. Unit Operating Voltage: As indicated on Drawings.
- D. Construction:
 - 1. Finish: Factory finish of baked enamel.
 - 2. Balanced Suppression Platform: Equally distribute surge current to Metal Oxide Varistor (MOV) components to ensure equal stressing and maximum

performance. Furnish surge suppression platform with equal impedance paths to each matched MOV.

3. Internal Connections: Hardwired with connections using low impedance conductors and compression fittings.
4. Safety and Diagnostic Monitoring: Equipped with standard overcurrent protection:
 - a. Continuous monitoring of fusing system.
 - b. Monitor individual MOV's (including neutral to ground). Capable of identifying open circuit failures not monitored by conventional fusing systems.
 - c. Monitor for overheating in each mode due to thermal runaway.
 - d. Furnish green and red solid state indicator light on each phase. Absence of green light and presence of red light indicates which phases have been damaged. Fault detection activates flashing trouble light. Units not capable of detecting open circuit damage, thermal conditions, and over current will not be accepted.
5. Labeling: Permanently affix UL 1449 (Third Addition) suppression voltage ratings and CSA to unit.

E. Types:

1. Switchboards; locate as integral part of switchboard, coordinate mounting with switchboard manufacturer.
2. Panelboards; locate as stand-alone. Component in housing adjacent to protected panelboard.

F. Protection Modes: For Wye configured system, furnish device with directly connected suppression elements between line-neutral (L-N), line-ground (L-G), and neutral-ground (N-G). For Delta configured system, furnish device with suppression elements between line to line (L-L) and line to ground (L-G).

G. Swithboards:

1. The SPD shall be UL 1449 labeled as Type 1 or as Type 4 intended for Type 1 or Type 2 applications.
2. SPD shall meet or exceed the following criteria:
 - a. Maximum 7-Mode surge current capability shall be 300kA per phase.
 - b. UL 1449 - Third Edition Revision; effective September 29, 2009, Voltage Protection Ratings shall not exceed the following:

| | MCOV | | | | |
|----------|-------|-------|-------|-------|------|
| VOLTAGE | L-N | L-G | N-G | L-L | |
| 208Y/120 | 800V | 800V | 800V | 1200V | 150V |
| 480Y/277 | 1200V | 1200V | 1200V | 2000V | 320V |

3. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

| System Voltage | Allowable System Voltage Fluctuation (%) | MCOV |
|----------------|--|------|
| 208Y/120 | 25% | 150V |
| 480Y/347 | 15% | 320V |

4. SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of - 50dB at 100 kHz.
5. Suppression components shall be heavy duty 'large block' MOVs, each exceeding 30mm diameter.
6. SPD shall include a serviceable, replaceable module.
7. SPD shall be equipped with the following diagnostics:
 - a. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.

- b. Audible alarm with on/off silence function and diagnostic test function (excluding branch).
- c. Form C dry contacts one normally open (NO) and one normally closed (NC) for remote status monitoring.
- d. Surge Counter

No other test equipment shall be required for SPD monitoring or testing before or after installation.

- 8. SPD shall have a response time no greater than 1/2 nanosecond.
- 9. SPD shall have a 10 year warranty.

H. Distribution and Lighting Panelboards:

- 1. Listing requirements: SPD shall bear the UL Mark and shall be Listed to most recent editions of UL 1449 and UL 1283. "Manufactured in accordance with" is not equivalent to UL listing and does not meet the intent of this specification.
- 2. Listing requirements: SPD and performance parameters shall be posted at www.UL.com under Category Code: VZCA. Products or parameters without posting at UL.com shall not be approved. (To access UL Category Code click on Certifications in the left menu bar of UL's home page. Type "VZCA" into the Category Code search box and click Search.)
- 3. SPD shall be UL 1449 labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.
- 4. SPD shall be UL 1449 labeled as Type 1 intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.
- 5. SPD shall be UL 1449 labeled with 20kA I-nominal (I-n) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
- 6. Standard 7 Mode Protection paths: SPD shall provide surge current paths for all modes of protection: L-N, L-G, L-L, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems
- 7. If a dedicated breaker for the SPD is not provided in the switchboard, the service entrance SPD shall include an integral UL Recognized disconnect switch. A dedicated breaker shall serve as a means of disconnect for distribution SPD's.
- 8. SPD shall meet or exceed the following criteria:
- 9. Minimum surge current capability (single pulse rated) per phase shall be:
 - a. Distribution applications:
 - 1) Siemens Model TPS3 09 with Maximum surge current capability of 100kA per phase

- 10. UL 1449 Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

| VOLTAGE | L-N | L-G | N-G |
|-----------|-------|-------|-------|
| 208Y/120V | 700V | 700V | 700V |
| 480Y/277V | 1500V | 1500V | 1500V |

UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

| System Voltage | Allowable System Voltage Fluctuation (%) | MCOV |
|----------------|--|------|
| 208Y/120 | 25% | 150V |
| 480Y/277V | 20% | 320V |

11. SPD shall include a serviceable, replaceable module (excluding Distribution). (Deletable note: Delete or adjust as appropriate.)
12. Service Entrance SPD shall have UL 1283 EMI/RFI filtering with minimum attenuation of -50dB at 100kHz.
13. SPD shall have a warranty for a period of ten (10) years, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period.
14. SPDs shall be equipped with the following diagnostics:
 - a. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
 - b. Audible alarm with on/off silence function and diagnostic test function (excluding branch).
 - c. Form C dry contacts one normally open (NO) and one normally closed (NC) for remote status monitoring.
 - d. Surge Counter

No other test equipment shall be required for SPD monitoring or testing before or after

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify mounting area is ready for equipment.
- B. Verify circuit rough-ins are at correct location.

3.2 INSTALLATION

- A. Install in accordance with IEEE 1100.
- B. Install service entrance suppressors in switchboard.
- C. Install suppressors for panelboards adjacent to panel.
- D. Install surge counter in face of switchboard.
- E. Include surge counter for stand-alone SPD.
- F. Install with maximum conductor length of 24 inches. Install suppressor with internal fusing.
- G. Provide 30 amp, 3 pole circuit breaker in panelboards to feed SPD.

END OF SECTION 26 43 00

SECTION 26 50 00 - LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes interior luminaires, lamps, ballasts, and accessories. Provide all luminaires complete with all new lamps, completely wired, controlled, and securely attached to supports.

1.3 SUBMITTALS

- A. Product Data: Submit dimensions, ratings, and performance data.
- B. Photometric data for each luminaire, lamp and ballast. Include indications of all options and accessories as well as finish color.
- C. Specification Review: A complete item by item, line by line specification review.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Provide luminaires listed by U.L.
 - 2. Luminaires installed in outdoor areas unprotected from weather to be U.L. Listed for wet locations.
 - 3. Insulated ceilings: Luminaires installed into insulated ceilings shall be U.L. Listed Type IC.
- B. Certification: Certify that fixtures submittal have trim compatible with ceilings being installed.
- C. Concrete for outdoor lighting poles foundations shall be provided per Section 03 30 00 - Concrete.

1.5 EXTRA MATERIALS

- A. Provide extra materials for Owners use. All parts shall packaged in suitable carton.
- B. Provide two (2) spare drivers for each fixture type. Deliver to Owner in original packaging.

PART 2 - PRODUCTS

2.1 LUMINAIRES

- A. Acceptable Manufacture: Provide per Fixture Schedule on drawings.

1. Approved equal: Contractor may submit luminaires from other manufacturers. Contractor shall provide a full set of submittals per paragraph 1.2 of this specification section for Engineer and Architects approval. Contractor must have approved submittals stamped and dated from the Engineer and Architect minimum 10 days prior to bid.
- B. Product Description: Complete luminaire assemblies, with features, options, and accessories as scheduled.
- C. All luminaires shall be new and of specification grade.
- D. Manufacturer nomenclature in fixture schedule or otherwise described on the Drawings is given only to show the general fixture series. Contractor shall provide fixture with all required accessories and mounting frame type.
- E. Wire guard at fixtures in mechanical, electrical, and high abuse areas.

2.2 LED LUMINAIRES

- A. Quality Assurance
 1. DOE Lighting Facts certified.
- B. LED Specifications
 1. Lumen maintenance of the LEDs has been tested in accordance with IESNA LM-80-08 reporting methodology.
 2. CRI: >82 minimum (general); >90 healthcare and retail.
 3. SDCM: <2.5 in linear pendants and linear recessed; <3.5 in discrete recessed.
 4. R9: .0 (general office/school environments); >50 in healthcare and retail environments.
 5. Outdoor luminaires to be rated at a minimum of 40⁰ C.
- C. Lumen Maintenance
 1. Minimum L70 at 50K hours based on TM-21 Addendum A Lifetime report at an ambient temperature of 25⁰ C, outdoors at an ambient temperature of 40⁰ C.
- D. Thermal Testing
 1. ISTM testing in accordance to UL 1598-2008.
- E. Driver
 1. 0-10V enabled.
 2. Output Class 2 rated.
 3. Dimming range: 5-100%.
 4. Constant current.
 5. THD @ max load: <20%.
 6. Power factor: >0.95
 7. Environment protection rating: UL Damp and dry.
 8. Approbations: certified to UL8750, UL1310, UL935, CSA-C22.2 No. 250.13-12, CSA 22.2 No. 223.
 9. ROHS Compliant
- F. Fixture photometry
 1. Conducted by a NVLAP accredited testing lab with IESNA LM 79-08.
 2. System flux measured in delivered lumens.

- G. Warranty
 - 1. 5 year total system warranty.

2.3 EMERGENCY BATTERY PACKS

- A. Provide Emergi-Lite FPSIU series, or approved equal, battery pack for fluorescent fixtures designated to have emergency battery back-up.
- B. Fixture shall include lighted push button test switch installed in visible, accessible location adjacent to fixture.
- C. Provide unswitched alternating current power source per manufacturer's instructions.
- D. Provide connection to local switch where indicated on drawings, connect such that fixture can be controlled on/off from local switch without discharge of battery.
- E. For fixtures designated to have emergency battery pack and be on a contactor controlled circuit, provide unswitched alternating current source ahead of contactor and wiring as required to allow automatic on/off control from the contactor without discharge of battery and local on/off switching where indicated.
- F. Battery pack shall provide 1100 lumen output for 90 minutes per 2'x4' light fixture.
- G. Provide integral battery pack for all exit signs where emergency generator power is not available. Battery pack shall provide minimum of 90 minutes output.

2.4 DOWNLIGHT FIXTURES

- A. Provide recessed light fixtures with trim rings compatible with the ceiling material where fixture is to be installed.

2.5 EXIT SIGNS

- A. Exit signs shall meet visibility requirements and be listed per UL 924 "Emergency Lighting and Power Equipment". Also shall meet Federal, State and Local Codes.
- B. Chevron Directional Indicator: Provide Chevron per NFPA 101 Section 5-10.4.1.2.
- C. Product Description:
 - 1. LED Exit Sign:
 - a. Provide exit sign with Light Emitting Diodes (LED) illuminance source. Cover LED with diffuser.
- D. Housing: Diecast aluminum with stencil face and matte white paint finish.
- E. Input Voltage: 120/277 volt, dual input voltage.
- F. EPA Energy Star Label.
- G. Wire Guards: Install wire guard on all exit signs installed in gyms, lockers rooms, and athletic wing.

PART 3 - EXECUTION

3.1 EXISTING WORK

- A. Disconnect and remove abandoned luminaires, lamps, poles and accessories.
- B. Extend existing luminaire installation using materials and methods compatible with existing installation, or as specified.
- C. Clean and repair existing luminaires to remain or to be reinstalled.

3.2 INSTALLATION

- A. General: All luminaires shall have proper supports.
- B. Install suspended luminaires using pendants supported from swivel hangers.
- C. Locate recessed ceiling luminaires as indicated on Drawings.
- D. Install surface mounted ceiling luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- E. Chain Hung: Unless otherwise indicated all fluorescent fixtures in Mechanical, Electrical and Elevator Equipment Rooms shall be chain hung. Verify exact mounting height with Architect before installing fixtures. Provide pendant hangers when equipment room has fire-resistive ceiling.
- F. Suspended Ceilings:
 - 1. Provide means of support for luminaires per CEC 410-36. T-bar clips shall be installed on the luminaire and shall be field secured to the inverted ceiling tees so that the luminaire is securely fastened to the ceiling system framing members.
 - 2. Ceiling tiles shall not bear the weight of luminaires. Surface mount luminaires, recessed downlights, light track, exit signs, etc. shall be supported by proper frames or other attachment to main ceiling system grid or building structure above ceiling.
 - 3. Luminaires shall be centered in ceiling tile.
 - 4. Luminaire shall have flange or trim ring for closure of ceiling cutout or opening.
 - 5. Fire-rated Ceiling Assembly: For Luminaires to be flush-mounted into a fire-rated ceiling or surface mounted to a fire-rated ceiling, install with independent, secure support. Raceway, cable assemblies, boxes and fittings located above a fire-rated floor/ceiling or roof ceiling assembly shall not be secured to, or supported by, the ceiling assembly including the ceiling support wires. Provide an independent means of secure support. Independent support wires shall be distinguishable by color, tagging, or other effective means from those that are part of the fire-rated design.
- G. Verify weights and recommended mounting methods of all luminaires with manufacturers. Furnish and install supports. Luminaires weighing more than 30 pounds shall be supported independently of the outlet box.

3.3 LOCATIONS

- A. Luminaires shown on the Electrical Drawings represent general arrangements only. Refer to Architectural Drawings and to Architect on jobsite for more exact locations. Coordinate location with all other trades before installation. Coordinate all light fixtures in

Mechanical Rooms with the final installed piping and ductwork layouts. Adjust fixture mounting height and location if required so that light output is not obstructed by piping and ductwork.

3.4 FIRE INTEGRITY OF CEILING PENETRATIONS

- A. Where ceiling is part of a fire-rated assembly, maintain integrity of that assembly with methods given in Section Electrical Hangers and Supports. Obtain ceiling system UL Fire Resistance Directory Design Number from Architectural Drawings.

3.5 AIMING AND ADJUSTMENT

- A. General: All adjustable lighting units shall be aimed, focused, and locked by the Contractor under the supervision of the Architect/Owner. All aiming and adjusting shall be carried out after the entire installation is complete.

3.6 CLEANING

- A. Lens: Clean lenses of all luminaires after space is finished and prior to project acceptance.
- B. Louvers: Remove plastic bag from parabolic louver luminaires after space is finished and prior to project acceptance. Do not remove bags until luminaires have been cleared by the air-balance subcontractor.

3.7 RFI

- A. Provide flexible braided metal electrical bonding strap from grounded housing to door frame of all fluorescent parabolic fixtures in designated rooms. Bonding strap shall be braided conductor designed for field installation to either long door side.

END OF SECTION 26 50 00

SECTION 27 13 00 COMMUNICATIONS CABLING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 27 51 26 ASSISTIVE LISTENING SYSTEMS

1.2 SUMMARY

- A. This Section Includes:
 - 1. Telecommunications Cabling at the new or remodeled buildings for the project. Backbone and horizontal cabling comprised of copper and fiber cabling, and support systems are covered under this document.
 - 2. The Horizontal (workstation) Cabling System shall consist of a minimum of two (2) 4-pair Unshielded Twisted Pair (UTP) Copper Cables to each work area outlet unless otherwise noted for specific locations. The cables shall be installed from the Work Area Outlet to the Telecommunications Room (TR) located on the same floor, and routed to the appropriate rack serving that area and terminated as specified in this document.
 - 3. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Telecommunications contractor as detailed in this document.
 - 4. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types will be provided as an attachment to this document. If the bid documents are in conflict, this specification shall take precedence. The successful vendor shall meet or exceed all requirements for the cable system described in this document.
- B. Description:
 - 1. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The Telecommunications contractor will provide and install all of the required material to form a complete system.
 - 2. The work shall include, but not be limited to the following:
 - a. Furnish and install a complete telecommunications wiring infrastructure as described on the plans and in these specifications.
 - b. Furnish, install, and terminate all UTP and Optical Fiber cable.
 - c. Furnish and install all wall plates, jacks, patch panels, and patch cords.
 - d. Furnish and install all required cabinets and/or racks as required and as indicated.
 - e. Furnish any other material required to form a complete system.
 - f. Perform link testing (100% of horizontal and/or backbone links) and certification of all components.
 - g. Furnish test results of all cabling to the owner on disk and paper format, listed by each closet, then by workstation ID.
 - h. Adhere and comply with all requirements of the product certification programs.
 - i. Provide owner training and documentation. (Testing documentation and As-built drawings).
- C. Regulatory References:
 - 1. All work and materials shall conform in every detail to the rules and requirements of the

National Fire Protection Association, the local Electrical Code and present manufacturing standards.

2. All materials shall be UL Listed and shall be marked as such. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.
3. All modular jacks, patch cords, consolidation point, and patch cords performance shall be verified (not just tested) by a third party to be category 6 component and channel compliant.
4. The cabling system described in this is derived from the recommendations made in recognized telecommunications industry standards. The following documents are incorporated by reference:
 - a. ANSI/TIA/EIA – 568.0, Generic Telecommunications Cabling for Customer Premises.
 - b. ANSI/TIA/EIA – 568.2, Balanced Twisted Pair Cabling Components, Addendum 1.
 - c. ANSI/TIA/EIA – 606, Administration Standard for Telecommunications Infrastructure of Commercial Buildings, February 2002.
 - d. ANSI/ TIA/EIA – 758, Customer-Owned Outside Plant Telecommunications Cabling Standard.
 - e. BICSI - TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM).
 - f. National Fire Protection Agency (NFPA – 70), National Electrical Code (NEC).
5. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.
6. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project.

D. Drawings:

1. It shall be understood that the electrical details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the telecommunications contractor in bidding the job. The telecommunications contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.
2. The telecommunications contractor shall verify all dimensions at the site and be responsible for their accuracy.
3. Prior to submitting the bid, the telecommunications contractor shall call the attention of the Engineer to any materials or apparatus the telecommunications contractor believes to be inadequate and to any necessary items of work omitted.

1.3 SUBMITTALS

- A. Under the provisions of this request for proposal, prior to the start of work the telecommunications contractor shall:
 1. Submit proof from manufacturer of contractor's good standing in manufacturer's program.
 2. Submit appropriate cut sheets and samples for all products, hardware and cabling.
- B. Work shall not proceed without the Owner's approval of the submitted items.
- C. The telecommunications contractor shall receive approval from the Owners on all substitutions of material. No substituted materials shall be installed except by written approval from the Owner.

1.4 QUALITY ASSURANCE

- A. The Telecommunications Contractor must be a Certified Installer for the products and/or system being supplied. A copy of certification documents must be submitted with the quote in order for such quote to be valid. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with said certification.
- B. The telecommunications contractor shall staff the project with qualified personnel. All products shall be new and in good condition.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and receipt of products shall be at the site described in the Scope Section.
- B. Cable shall be stored according to manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location. If necessary, cable shall be stored off site at the contractor's expense.
- C. If the telecommunications contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner.

PART 2 PRODUCTS

2.1 EQUIVALENT PRODUCTS

- A. The Owner and engineer have selected specific products that achieve the desired level of performance and preference. The project has been designed around said products. Proposed substitutions must demonstrate equivalent performance in all areas to the satisfaction of the Owner and must be submitted for review at least 10 days prior to bid. The Owner shall not be required to entertain substitutions submitted after bid.

2.2 WORK AREA OUTLETS

- A. Work area cables shall each be terminated at their designated work area location in the connector types described in the subsections below. Included are modular telecommunication jacks. These connector assemblies shall snap into a faceplate.
- B. The Telecommunications Outlet Assembly shall accommodate:
 - 1. A minimum of two (2) modular jacks.
 - 2. Additional accommodations for specific locations as noted in the plans for optical fiber and/or additional copper cables as necessary.
 - 3. A blank filler will be installed when extra ports are not used.
 - 4. All modular jacks shall have their circuit number on the faceplate identifier strip.
 - 5. Multiple jacks that are identified in close proximity on the drawings (but not separated by a physical barrier) may be combined in a single assembly. The telecommunications contractor shall be responsible for determining the optimum compliant configuration based on the products proposed.
 - 6. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the telecommunications contractor shall submit the proposed configuration for each outlet assembly for review by the Owner.
 - 7. The modular jack shall incorporate printed label strip on the dust cap module for identifying the outlet. Printed labels shall be permanent and compliant with ANSI/TIA/EIA 606 standard specifications. Labels shall be printed using a printer such as a Brady hand held printer. Hand printed labels shall not be accepted.

- C. Faceplates - The faceplates shall:
1. Be as appropriate to fit the modular jack used.
 2. Be UL listed and CSA certified.
 3. Be constructed of high impact, ABS plastic UL 94V-0 construction (except where noted otherwise).
 4. Shall match the faceplate color used for other utilities in the building or match the color of the raceway if installed in surface raceway.
 5. Be compliant with the above requirements along with the following when incorporating optical fiber:
 - a. Be a low profile assembly.
 - b. Incorporate a mechanism for storage of cable and fiber slack needed for termination.
 - c. Position the fiber optic couplings to face downward or at a downward angle to prevent contamination and incorporate a shroud that protects the optical couplings from impact damage.
 6. Be available as single-gang or dual-gang.
 7. Provide easy access for adds, moves, and changes by front removal of jack modules.
 8. Possess recessed designation windows to facilitate labeling and identification.
 9. Include a clear plastic cover to protect labels in the designation window.
 10. Have mounting screws located under recessed designation windows.
 11. Comply with ANSI/TIA/EIA 606 work area labeling standard.
 12. Allow for the UTP modules to be inverted in place for termination purposes.
 13. Be manufactured by an ISO 9001 registered company.
- D. Data Jacks:
1. Data jacks shall be 8-position modular jacks and shall be Category 6 performance as defined by the references in this document including ANSI/TIA/EIA 568 series. All pair combinations must be considered, with the worst-case measurement being the basis for compliance. Modular jack performance shall be third-party verified by a nationally recognized independent testing laboratory.
 2. The modular jack shall use dual reactance modular contact array.
 3. The modular jack shall be both component, link and channel compliant to category specifications in ANSI/TIA/EIA 568 series.
 4. The modular jack's performance shall be third-party verified to ANSI/TIA/EIA 568 series Category 6 specifications.
 5. The modular jack shall have low emission IDC contacts.
 6. The modular jack shall use standard termination practice using 110 impact tool.
 7. The modular jack shall be backwards compatible to Category 3, 5, and 5e.
 8. The modular jack shall be center tuned to category 6 test specifications.
 9. Dust covers shall be used on each termination.

2.3 MODULAR PATCH PANELS

- A. The Modular Patch Panels shall:
1. Meet Category 6 component compliance and be verified by a third-party nationally recognized independent testing laboratory.
 2. Use low emission IDC contacts.
 3. Use dual reactance technology to enhance the signal-to-noise ratio.
 4. Require standard termination practices using a 110 impact tool or other manufacturer approved device.
 5. Use a single piece IDC housing designed to accept larger Category 6 conductors.
 6. Support both T568B and T568A wiring.
 7. Include easy to follow wiring labels.
 8. Include label fields.
 9. Allow for the use of icons.
 10. Include full length metal rear cable management.
 11. Be available in standard or high density.

12. Be backward compatible to Category 3, 5 and 5e.
13. Be center tuned to category 6 test specifications.

2.4 RACKS

- A. All racks and wire management shall be of one manufacturer or designed specifically to work together. The equipment rack shall provide vertical cable management and support for the patch cords at the front of the rack and wire management, support, and protection for the horizontal cables inside the legs of the rack. Waterfall cable management shall be provided at the top of the rack for patch cords and for horizontal cables entering the rack channels for protection and to maintain proper bend radius and cable support. Wire management shall also be mounted above each patch panel and/or piece of equipment on the rack. The rack shall include mounting brackets for cable tray ladder rack to mount to the top of the rack. Velcro cable ties shall be provided inside the rack channels to support the horizontal cable. Rack shall be black in color to match the patch panels and cable management.
- B. Wall Mounted Rack
 1. Wall mount rack shall:
 - a. Provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA 568 series.
 - b. Have top cable trough to route patch and distribution cables between racks.
 - c. Have EIA hole pattern on front and rear.
 - d. Rack height shall be specified as 7 ft / 2.13 m (44 rack units) or 4.0 ft/1.22 m (22 rack units).
 - e. Be available with a 6.5" (165 mm) or 14" (356 mm) channel depth.
 - f. Be available with hook and loop straps for securing cables inside the vertical U-channels.
 - g. Be available with vertical cable management rings for cord routing organization and strain relief.
 - h. Be available with vertical U-channels to protect and conceal distribution cables.
 - i. Provide floor and ceiling access for cable management and distribution.
 - j. Have wall mount braces with locator posts for easy wall mounting.
 - k. Have side access points that allow for access to manage/install distribution cables in the vertical channels.
 - l. Be available in standard color of black.
 - m. Be manufactured by an ISO 9001 registered company.

2.5 HORIZONTAL DISTRIBUTION CABLE

- A. All horizontal data station cable shall terminate on modular patch panels (copper or fiber) or patch/splice cabinets (fiber) in their respective Telecommunications Room or Equipment Room as specified on the drawings.
- B. 100 OHM Category 6 Unshielded Twisted Pair Cable (UTP):
 1. Physical Characteristics:
 - a. The diameter of the insulated conductor shall be .023 in. maximum.
 - b. Shall consist of (4) twisted pairs.
 - c. Shall be suitable for the environment in which they are to be installed.
 - d. The color coding of pairs shall be:

| | | | |
|--------|-----------|--------|----------|
| Pair 1 | Pair 2 | Pair 3 | Pair 4 |
| W-BL; | BL W-O; O | W-G; G | W-BR; BR |
 - e. The overall diameter of the cable shall be 0.320" nominal.
 - f. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.

- g. Cable shall withstand a bend radius of 1.2" at -20 degrees Celsius without jacket or insulation cracking.
- h. Cable shall be third party verified to meet ANSI/TIA/EIA 568 series standards.
2. Transmission Characteristics:
 - a. DC resistance of any conductor shall not exceed 9.38 Ohms per 100m max. at 20°C. Measured in accordance with ASTM D4566.
 - b. The mutual capacitance of any pair at 1 kHz for 100m of cable shall not exceed 5.1 Nf.
 - c. DC resistance unbalance between any two conductors of any pair shall not exceed 3% when measured at or corrected to 20°C in accordance with ASTM D4566.
 - d. The capacitance unbalance to ground at 1 kHz of any pair shall not exceed 330 pF per 100m.
3. Cable shall be Berk-Tek LANmark-1000 UTP or approved equal.
4. Cable installed underground/below slab in conduit shall be Berk-Tek LANmark series category 6 (wet location) or approved equal.

2.6 FIBER OPTIC CABLE

- A. Indoor/Outdoor Optical Fiber Non-Conductive Loose Tube with Laser Enhanced 9/125 Optical Fibers:
 1. Each Singlemode Fiber shall be:
 - a. Graded-index optical fiber wave-guide with nominal 9/125um-core/cladding diameter, OS2 or better industry rating.
 - b. The fiber shall comply with the latest revision of ANSI/TIA-4920000.
 - c. Information transmission capacity shall be measured in accordance with the latest revision of ANSI/EIA/TIA 455.
 - d. The measurements shall be performed at 23 degrees C +/- 5 degrees.
 - e. Maximum attenuation dB/Km @ 1310/1550 nm: 0.4/0.3.
 - f. Optical Fiber shall be laser optimized and guarantee Gigabit Ethernet distances of >5000m for 1310nm and 10 Gigabit Ethernet distances of >5000m for 1310nm.
 2. Physical Characteristics:
 - a. Shall be suitable for use in both outdoor and indoor applications without the use of a transition at the building entrance.
 - b. Shall be suitable for use in risers, plenums and horizontal applications as applicable to each space.
 - c. Shall have a dry water blocking system for cable core and buffer tubes.
 - d. Shall be available with a fiber strand count range from 6 to 72. District standard shall be 24-strands per cable.
 - e. Shall have a 3.0 mm sub-unit diameter.
 - f. Shall have and be marked with an UL-OFNR.
 - g. Shall comply with the requirements of ICEA S-83-596 & ANSI/ICEAS-87-640.
 - h. Strength members shall be dielectric and may be either fiberglass or aramid yarn.
 - i. Suitable for underground or aboveground conduits.
 - j. Loose Tube fibers shall be color coded in accordance with EIA/TIA 598 with an overall dark blue jacket.
 - k. Shall have a ripcord for overall jacket.
 - l. Suitable for operation between -40° to +75° C.
 - m. Shall be UV resistant.
 - n. Shall be of an all dielectric design.
 - o. Shall have a maximum installation tension of 300 lbs for cables without dielectric strength member and 600 lbs for cables with dielectric strength members.
 3. Design Make:
 - a. Berk-Tek Adventum OS2 optical fiber cable with 9/125 micron fiber or approved equal.

2.7 FIBER OPTIC CONNECTORS

- A. LC Fiber Optic Connectors:
 - 1. Each LC Fiber Connector shall:
 - a. Be a pre-polished fiber connector with a fiber stub or field-polish fiber connector.
 - b. Be available in single mode and multimode versions.
 - c. Have a domed zirconia ferrule.
 - d. Be a PC polish type connector.
 - e. Accept a nominal fiber diameter of 125 micrometers.
 - f. Have a typical insertion loss of 0.1 dB for multimode and 0.1 dB for single mode.
 - g. Have repairable tips.
 - h. Have an insertion loss change of less than 0.2 dB after 500 reconnects.
 - i. Be stable over an operating range of -40C to +75 degrees C.
 - 2. Design Make:
 - a. Leviton LC Fiber Optic Connectors and pigtails or approved equal.
 - 3. Splicing:
 - a. Connector shall be mated to cable plant using fusion splice only. No mechanical connections shall be permitted.

2.8 COPPER CABLE PROTECTION UNITS

- A. All copper circuits shall be provided with protection between each building with an entrance cable protector panel. All building-to-building circuits shall be routed through this protector. The protector shall be connected with a #6 AWG copper bonding conductor between the protector ground lug and the TC ground point. Approved manufacturer of protection units is Porta Systems.

2.9 PATCH CORDS

- A. The contractor shall provide factory terminated and tested UTP and optical fiber patch cords and equipment cords for the complete cabling system. The UTP patch cables shall meet the requirements of ANSI/TIA/EIA 568 series for patch cord testing.
- B. Copper (UTP) patch cords shall:
 - 1. Use 8-position connector with impedance matched contacts and designed using dual reactance.
 - 2. Be constructed of 100 ohm, 4 pair stranded conductor, unshielded twisted pair copper per the requirements of the ANSI/TIA/EIA 568 series standards.
 - 3. Meet TIA Category 6 component specifications in ANSI/TIA/EIA 568 series.
 - 4. 100% factory tested to meet Category 6A performance and ETL or any other nationally recognized 3rd party verification.
 - 5. Be center tuned to category 6 performance specifications by using paired bi-level contact array.
 - 6. Be capable of universal T568A or T568B wiring schemes.
 - 7. Modular connector shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
 - 8. Have a performance marking indelibly labeled on the jacket (by the manufacturer).
 - 9. Have the ability to accept color-coded labels and icons to comply with ANSI/TIA/EIA-606 labeling specifications.
 - 10. Have "snag less" protection for the locking tab to prevent snagging and to protect locking tab in tight locations and provide bend relief.
 - 11. Be available in three standard colors.
 - 12. Be available in 3 foot, 5 foot, 7 foot, 9 foot, and 15 foot standard lengths.
 - 13. Be backwards compatible to Category 3, 5, 5e and 6.
 - 14. Be manufactured by an ISO 9001 registered company.
- C. Optical Fiber patch cords shall:
 - 1. Contain two (2) single mode optical fibers.
 - 2. Use multi-mode, graded-index fibers with a 9 micron core, corresponding with installed

- cable plant.
3. Be capable of transmission at both 1310 nm and 1550 nm wavelengths or single-mode.
 4. Include listing of actual loss of patch cord when packaged.
 5. Be manufactured in standard lengths of 1 m (3.27 ft), 2 m (6.56 ft), 3 m (9.84 ft), 4 m (13.11 ft), 7 m (22.95 ft), and 10 m (32.79 ft), and special ordered in any other lengths.
 6. Be manufactured by an ISO 9001 registered company.

2.10 GROUNDING AND BONDING

- A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607 Telecommunications Bonding and Grounding Standard.
- B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.
- C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, ungrounded conduits, etc. entering or residing in the TR or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.
- D. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

2.11 FIRESTOP

- A. A firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.
- B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.
- C. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestop system, stamped/embossed by the PE shall be provided to the Owner's Technical Representative prior to installing the firestop system(s).

PART 3 EXECUTION

3.1 WORK AREA OUTLETS

- A. Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12" of UTP and 12" of fiber slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.
- B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA 568 series, manufacturer's recommendations and best industry practices.
- C. Work-area outlets shall consist of (1) 5-inch square recessed junction box and minimum (1) 1- 1/4" raceway to accessible ceiling space. If no accessible ceiling space exists, routing shall be provided to the nearest adjacent accessible ceiling space stubbed in the direction of least distance from the serving telecommunications room (TR). Each outlet shall be capable of accommodating up to (4) modular jacks, but as few as (1). Jack counts per work area outlet shall be installed per telecommunications plans, if no count is provided on the plans, (2) jacks shall be installed.
- D. Pair untwist at the termination shall not exceed 12 mm (one-half inch).
- E. Bend radius of the horizontal cable shall not be less than 4 times the outside diameter of the UTP cable.
- F. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.
- G. Data jacks shall be identified according to district standards as outlined on drawings.
- H. There is no difference between voice and data jacks, voice cross-patching to VOIP system shall be coordinated with Owner representative.

3.2 HORIZONTAL DISTRIBUTION CABLE INSTALLATION

- A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.
- B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
- C. Cable raceways shall not be filled greater than the ANSI/TIA/EIA 569 maximum fill for the particular raceway type or 40%.
- D. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
- E. Where transition points, or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.
- F. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
- G. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 to 60 inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
- H. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable

bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.

- I. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
- J. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.
- K. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
- L. Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA 606. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
- M. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
- N. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.
- O. Cables installed underground or below slab shall be suitable for use in wet locations and outdoors in duct or conduit. If wet location cable is exposed in the building after exiting the wet area, it must transition to an appropriate category dry cable within 50 feet (15M) of exiting conduit.

3.3 HORIZONTAL COPPER TERMINATION AND INSTALLATION

- A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA 568 series standards, manufacturer's recommendations and best industry practices.
- B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).
- C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
- D. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
- E. The cable jacket shall be maintained as close as possible (within 25mm – 1 inch) to the termination point.
- F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.4 OPTICAL FIBER TERMINATION HARDWARE

- A. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

- B. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.
- C. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.
- D. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.
- E. A maximum of 12 strands of fiber shall be spliced in each tray.
- F. All spare strands shall be installed into spare splice trays.

3.5 BACKBONE CABLE INSTALLATION

- A. Backbone cables shall be installed separately from horizontal distribution cables
- B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
- C. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits
- D. Where backbone cables are installed in an air return plenum, riser rated cable shall be installed in metallic conduit.
- E. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
- F. All backbone cables shall be securely fastened to the sidewall of the TR on each floor.
- G. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
- H. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
- I. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

3.6 RACKS

- A. Racks shall be securely attached to the concrete floor using a minimum 3/8" hardware or as required by local codes.
- B. Racks shall be placed with a minimum of 36-inch clearance from the walls on all sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in front of the row of racks and from the wall at each end of the row.
- C. All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 9.0 of this document.
- D. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.

- E. Wall mounted termination block fields shall be mounted on 4' x 8' x .75" void free plywood. The plywood shall be mounted vertically 12" above the finished floor. The plywood shall be painted with two coats of white fire retardant paint.
- F. Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18" from the finished floor.

3.7 FIRESTOP SYSTEM

- A. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.8 GROUNDING SYSTEM

- A. The TBB shall be designed and/or approved by a qualified PE, licensed in the state that the work is to be performed. The TBB shall adhere to the recommendations of the ANSI/TIA/EIA- 607 standard, and shall be installed in accordance with best industry practice.
- B. Installation and termination of the main bonding conductor to the building service entrance ground shall be performed by a licensed electrical contractor.

3.9 IDENTIFICATION AND LABELING

- A. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. Labeling shall follow the guidelines of ANSI/TIA/EIA 606.
- B. Outside Plant cables passing through a pull box or vault shall have a cable label that is water and mud proof.
- C. All label printing will be machine generated by Ortronics LabelMo, or similar software, using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

3.10 TESTING AND ACCEPTANCE

- A. General
 - 1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-B. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
 - 2. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the Certification Program Information Manual provided by the product manufacturer and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and

resolution.

B. Copper Link Testing

1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance.
2. Horizontal cabling shall be tested using a Level III test unit for category 6 and category 6A performance compliance, corresponding with the installed cable type.
3. The basic tests required are:
 - a. Wire Map.
 - b. Length.
 - c. Attenuation.
 - d. NEXT (Near end crosstalk).
 - e. Return Loss.
 - f. ELFEXT Loss.
 - g. Propagation Delay.
 - h. Delay skew.
 - i. PSNEXT (Power sum near-end crosstalk loss).
 - j. PSELFEXT (Power sum equal level far-end crosstalk loss).
4. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
5. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA 568 series standards. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
6. Category 6 Performance shall meet the link requirements outlined below for a 90-meter, 4-connector permanent link.

| Frequency (MHz) | Maximum Insertion Loss (dB) | Minimum NEXT (dB) | Minimum PSNEXT (dB) | Minimum ELFEXT (dB) | Minimum PSELFEXT (dB) | Minimum Return Loss (dB) |
|-----------------|-----------------------------|-------------------|---------------------|---------------------|-----------------------|--------------------------|
| 1.0 | 2.1 | 74.3 | 72.3 | - | - | 20.0 |
| 4.0 | 3.8 | 65.3 | 63.3 | - | - | 23.0 |
| 10.0 | 5.9 | 59.3 | 57.3 | - | - | 25.0 |
| 16.0 | 7.5 | 56.2 | 54.2 | - | - | 25.0 |
| 20.0 | 8.4 | 54.8 | 52.8 | - | - | 25.0 |
| 31.25 | 10.5 | 51.9 | 49.0 | - | - | 23.6 |
| 62.5 | 15.0 | 47.4 | 45.4 | - | - | 21.5 |
| 100.0 | 19.1 | 44.3 | 42.3 | - | - | 20.1 |
| 250.0 | 31.1 | 38.3 | 36.3 | - | - | 17.3 |
| 350.0 | 37.2 | 36.1 | 34.1 | - | - | 16.3 |
| 400.0 | 40.1 | 35.3 | 33.3 | - | - | 15.9 |
| 500.0 | 45.3 | 33.8 | 31.8 | - | - | 15.2 |

C. Fiber Testing:

1. All fiber testing shall be performed on all fibers in the completed end-to-end system. Testing shall consist of an end-to-end power meter test performed per EIA/TIA 455.

The system loss measurements shall be provided at 850 and/or 1300 nanometers for multimode fibers and 1310 and/or 1550 nanometers for single mode fibers. These tests also include continuity checking of each fiber.

2. Backbone multimode fiber cabling shall be tested at both 1310 and 1550 nm in both directions.
3. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526 standard, Method B.
4. Where links are combined to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. **Only link test is required.** The contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the ANSI/TIA/EIA Standard.
5. Attenuation testing shall be performed with an approved hand held tester from an industry recognized test equipment manufacturer.

3.11 SYSTEM DOCUMENTATION

- A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Engineer for approval. Documentation shall include the items detailed in the sub-sections below.
- B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the telecommunications contractor shall provide copies of the original test results.
- C. The Engineer may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.12 TEST RESULTS

- A. Test documentation shall be provided on disk within three weeks after the completion of the project. The disk shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
- B. The field test equipment shall meet the requirements of ANSI/TIA/EIA 568 series including applicable TSB's and amendments. The appropriate Level III tester shall be used to verify Category 6A cabling systems.
- C. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. The telecommunications contractor must furnish this information in electronic form CD-ROM). If needed, provide manufacturers software require

to read the test results.

- D. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

PART 4 WARRANTY AND SERVICES

4.1 WARRANTY

- A. The manufacturer shall provide the warranty directly to the end-user.
- B. The Application Assurance Warranty shall cover the failure of the wiring system to support the applications that are designed for the link/channel specifications of ANSI/TIA/EIA-568 series. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, 10GBASE-T, 155Mb/s ATM, and 1Gb/s ATM.
- C. The contractor shall provide a warranty on the physical installation.

4.2 FINAL ACCEPTANCE AND SYSTEM CERTIFICATION

- A. Completion of the installation, in-progress and final inspections, receipt of the test and as-built documentation, and successful performance of the cabling system for a two-week period will constitute acceptance of the system. Upon successful completion of the installation and subsequent inspection, the end user shall be provided with a numbered certificate, from the product manufacturer, registering the installation.

END OF SECTION 27 13 00

SECTION 27 51 26 ASSISTIVE LISTENING SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Section 27 13 00 COMMUNICATIONS CABLING

1.2 SUMMARY

- A. Work included:
 - 1. Provide assisted listening system as described herein.
- B. **Assistive Listening Systems:**
 - 1. Assistive Listening Systems shall be provided in accordance with **CBC Section 11B-219** and shall comply with **CBC Section 11B-706**.
 - 2. The minimum number of receivers provided shall be equal to 4% of the total number of seats, but in no case less than two. 25% of the receivers provided, but no fewer than two, shall be hearing-aid compatible in accordance with **CBC Section 11B-706.3**.
 - 3. If the system provided is limited to specific areas or seats, then such areas or seats shall be within a 50-foot viewing distance of and have a complete view of the stage or playing area in accordance with **CBC Section 11B-219.4**.

1.3 SUBMITTALS

- A. Submit in accordance with Sections 01 33 00: Submittal Procedures and 26 05 00: Common Work Results for Electrical.

1.4 QUALITY ASSURANCE

- A. The quantity of wireless headsets on-site shall satisfy the ADA requirement of 4% of the occupancy in the largest conference room and/or assembly area. Refer to architectural sheets for occupancy loads/types.

1.5 WARRANTY

- A. The entire system shall be of one manufacturer and shall carry a 2-year (minimum) warranty. The system shall be as manufactured by Williams Sound Corp. or engineer approved equal.

PART 2 PRODUCTS

2.1 ASSISTED LISTENING SYSTEMS

- A. Provide and install complete, ADA compliant Assisted Listening Systems as follows:
 - 1. The campus shall have (as a minimum):
 - a. (1) Portable system consisting of a hard suitcase-style carrying case and containing:
 - 1) (1) Battery operated, belt (clip) FM transmitter unit with lapel microphone.
 - 2) (4) Battery operated, belt (clip) receivers with built in ambient (environmental) microphone and single (bud-style) earphone.
 - b. The portable systems shall be located in the Administration Office available for

check out. Refer to Architectural specifications for signage requirements at conference rooms and assembly areas.

PART 3 EXECUTION

3.1 COMMISSIONING

- A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, and servicing of the system. Provide a minimum of 2 hours of training. Operators Manuals and Users Guides shall be provided at the time of this training.
- B. Schedule training with Owner through the Architect, with at least seven days advance notice.

END OF SECTION 27 51 26

SECTION 28 31 00 FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section Includes:
 1. This specification is a performance-based Specification and all criteria to meet applicable state and local codes accordingly.
 2. This section of the specifications includes the furnishing, installation, connection and testing of microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated networked system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, Ethernet and/or digital alarm communications to central stations and wiring as shown on the drawings, specified herein, and per the manufacturer's requirements.
 3. The FACP and peripheral devices shall be manufactured or supplied 100% by a single U.S. manufacturer (or division thereof).
 4. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity.
 5. Existing Fire Alarm system. Contractor shall install all necessary devices per drawings. The entire installation shall conform to the National Fire Protection Association (NFPA) Standard 72, 90A & CEC Article 760 and authorities having jurisdiction as applicable. The system specified and depicted on the plan is a complete and approved system. Any routing of the system wiring that is significantly different than shown on the approved drawings shall have the approval of the engineer and must be obtained prior to construction.
 6. Provide all work and material as shown and / or required to provide a fully functional and adequate system as described hereon and as required by the California State Fire Marshal.
 7. If an existing panel is indicated, on the project drawings, to be reused; the contractor shall provide and install all applicable equipment and material required to accommodate the existing and new devices shown. It shall be the responsibility of the installing contractor to verify that the existing panel meets or exceeds the specifications below, including, but not limited to the approved manufacturer.
 8. Supervision: The fire alarm system shall monitor the integrity of all alarm initiating and indicating appliance circuits and provide local and remote status of all connected systems. The system shall be provided with automatically charged standby batteries to maintain system operation for 24 HRS in the normal supervisory mode and 5 minutes of alarm. Batteries shall be supervised for connection to the system and low voltage threshold. The automatic battery charger shall be capable of charging fully discharged system batteries to 100% in 8 hours.
 9. The system wiring and installation shall be as stated in drawings and as required by the manufacturer. All wiring shall be color coded, tagged and verified to assure that it is free from shorts and grounds and shall be rated for the appropriate environmental conditions such as well locations.
 10. Testing: The completed system shall be tested in accordance with NFPA Standard 72 7.6.6 and 7.8.2.

11. All Fire Alarm wiring shown in drawings shall be installed in conduit.
12. System Operation shall include:
 - a. Separate zone signaling and device status indication for all initiating devices.
 - b. Audible to sound the California uniform fire alarm signal in temporal mode. Devices shall be at least 15dBA above average ambient sound level, but not less than 75dBA at 10' or more than 120dBA.
 - c. Visual devices shall not exceed 2 flashes per second and shall not be slower than 1 flash per second. Visual devices shall be synchronized when 3 or more devices are within the same field of view.
 - d. Supervision of all circuits to indicate any abnormal wiring condition.
 - e. N.O./N.C. integral relays for external device interface or as indicated on drawings.
 - f. Central station connection capable of indicating (3) distinct separate signals as being tamper, trouble and alarm with point reporting capabilities.
13. All work shall be completed as shown on the plans and or as specified within this specification and shall include the following (but is not limited to):
 - a. Life safety fire alarm detection and signaling system.
 - b. Furnishing and installation of equipment and devices.
 - c. Conductors, connections and interconnections where specified and all in conduit system.
 - d. Conduit, wire and connections for control of heating and ventilation motors, smoke dampers and smoke exhaust.
 - e. Testing, cleaning and adjusting of completed work.
 - f. Wiring diagrams, as-built drawings and three (3) sets of equipment operations and maintenance instructions for Owner.
 - g. Complete maintenance for two years.
 - h. Proposal for subsequent maintenance contract.
 - i. All work and material for complete and operable systems as indicated or specified.
 - j. Permits, inspections and fees.
 - k. Identification and instruction to Owner Representative. Training shall consist of a minimum of two (2) 6-hour sessions.
14. Coordination with Section 26 05 33: Raceway and Boxes for Electrical Systems.
15. Furnishing of special back boxes where required for installation of fire alarm devices.
16. All conductors to be installed in conduit pursuant to Specification Section 26 05 33: Raceway and Boxes for Electrical Systems.
17. Qualifications: Contractor shall receive written approval and verified test results which shall be submitted to the owner for system from manufacturers recognized representative prior to completion and acceptance.
18. All initiating devices shall be separately addressed for individual identification at control panel.
19. As-Built Drawings: A complete set of reproducible "as-built" drawings showing installed wiring, color coding, wire tag notations exact locations of all installed equipment, specific interconnections between all equipment and internal wiring of the equipment shall be delivered to the owner upon completion of the system.
20. Maintenance Instructions: Three (3) submittals of maintenance instructions shall be provided and shall be complete, easy to read, understandable and shall provide the following information:
 - a. Instructions for replacing any components of the system, including internal parts.
 - b. Instructions for periodic cleaning and adjustments of equipment with a schedule of these functions.
 - c. A complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.
 - d. User operating instructions shall be prominently displayed on a separate sheet located next to the control unit in accordance with UL Standard 864. The contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defects for two years from the date of final acceptance.

- B. Substitutions
 - 1. Substitution of system components or manufacturer will require the contractor to separately obtain approval with the CSFM at Contractor's expense and shall meet all requirements of the system as designed and pre-approved.
 - 2. All proposed substitutions shall be listed with the California State Fire Marshal.

1.3 SUBMITTALS

- A. Comply with applicable provisions of Section 26 05 00: Common Work Results for Electrical.
- B. Product Data:
 - 1. A complete list of all supplied equipment including model numbers with catalog data sheets on each component.
 - 2. Data sheets show California State Fire Marshal Listing, U.L. listing, equipment ratings, dimensions and finishes.
 - 3. Highlight actual devices to be used and their amp draw in stand-by and alarm modes.
- C. Shop Drawings:
 - 1. Provide schematic layout, floor plan, drawings indicating location of all components and equipment, required size and location of conduit and outlets and type and quantity of system conductors. Include voltage drop calculations and battery calculations based on actual number of devices to be installed.
 - 2. Include riser and wiring diagrams for overall system and components including control panels, power supplies, initiating circuits, notification appliances, control devices and FATC. Address numbers shall be noted on all appliances.
 - 3. Include physical and electrical characteristics of equipment to indicate conformance with the Specifications.
 - 4. Describe system characteristics and function as well as device wiring diagrams.
 - 5. Voltage drop and battery calculations for each control panel and power supply and initiating circuits at 24-hour stand-by and 5 mins alarm.
 - 6. System operational matrix.
- D. Operating and Maintenance Instruction Manual:
 - 1. Manual shall include the following tailored to this specific project:
 - a. Operational description.
 - b. Coded cabling plan.
 - c. Two wire circuit diagrams.
 - d. Wiring destination schedule.
 - e. Schematic component diagrams and PC board layouts.
 - f. Maintenance and alignment procedures.
 - g. Voltage drop and battery calculations.

1.4 PERFORMANCE REQUIREMENTS

- A. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).
- B. Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.
- C. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.
- D. On Style 6 or 7 (Class A) configurations a single ground fault or open circuit on the system

Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

- E. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
- F. NAC circuits and control equipment shall be arranged such that loss of any one (1) NAC circuit will not cause the loss of any other NAC circuit in the system.
- G. Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions.

1.5 BASIC SYSTEM FUNCTIONAL OPERATION

- A. When a fire alarm condition is detected and reported by one of the systems initiating devices, the following functions shall immediately occur:
 - 1. The system Alarm LED on the FACP shall flash.
 - 2. A local sounder with the control panel shall sound.
 - 3. A backlit 80-character LCD display on the FACP shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
 - 4. In response to a fire alarm condition, the system will process all control programming and activate all system outputs (alarm notification appliances and/or relays) associated with the point(s) in alarm. Additionally, the system shall send events to a central alarm supervising station via either dial-up over PSTN or Internet or Intranet via PSDN or virtual private network.
 - 5. If there are any discrepancies between the drawings and specification or among themselves, the contractor shall request clarification prior to providing pricing for the scope of work. If a request is not issued and a response not provided via a posted addendum, the contractor shall provide pricing for the most costly scenario and obtain clarification during the course of the project.

1.6 QUALITY ASSURANCE

- A. Loads of Equipment and Components
 - a. Follow IEEE Standard where applicable.
 - b. Provide fuse protection for equipment and spare fuses.
 - c. Design systems for operation at 120 volts, normal or emergency power as indicated, 60 Hz nominal input.
 - d. Operating voltage dissipated by resistors shall not exceed 25% of ratings.
 - e. Operating voltage of capacitors shall not exceed 80% of rated voltage.
 - f. Operating loads and voltages on transistors and solid-state devices shall not exceed manufacturer's recommendation for normal full load operation.
 - g. Use electronic components of types and rating commonly available from stock of established commercial distribution.
- B. Regulatory Requirements
 - 1. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.
 - 2. National Fire Protection Association (NFPA) – USA:
 - a. NFPA 70: California Electrical Code (CEC)
 - b. NFPA 72: National Fire Alarm Code

- c. NFPA 101: Life Safety Code
- 3. Underwriters Laboratories Inc. (UL):
 - a. UL 38: Manually Actuated Signaling Boxes
 - b. UL 268: Smoke Detectors for Fire Protective Signaling Systems
 - c. UL 464: Audible Signaling Appliances
 - d. UL 521: Heat Detectors for Fire Protective Signaling Systems
 - e. UL 864: Control Units for Fire Protective Signaling Systems
 - f. UL 1480: Speakers for Fire Alarm and Signaling Systems, Including Accessories
 - g. UL 1481: Power Supplies for Fire Protective Signaling Systems
 - h. UL 1711: Standard for Amplifiers for Fire Protective Signaling Systems
 - i. UL 1712: Tests for Ampacity of Insulated Electrical Conductors Installed in Fire Protective System
 - j. UL 1971: Visual Notification Appliances
 - k. UL 2572: Mass Notification Systems
- 4. Local and State Building Code, including but not limited to:
 - a. California Building Code
 - b. California Electric Code
 - c. California Fire Code
- 5. All requirements of the Authority Having Jurisdiction (AHJ).

1.7 CONTRACTOR QUALIFICATIONS

- A. The installing contractor shall be the authorized representative of the Fire Alarm Manufacturer to sell, install, and service the proposed manufacturer's equipment. The installing contractor shall have represented the fire alarm manufacturer's product for at least two years.
- B. The installing contractor shall be licensed by the State Fire Marshall to sell, install, and service fire alarm systems as required by the California Insurance Code.
- C. The installing contractor shall have on his staff an installation technician licensed by the State Fire Marshall's office for such purpose and under whose supervision installation, final connections, and check out will take place as required by the California Insurance Code.
- D. The installing contractor or equipment supplier shall have on staff a minimum of two (2) certified NICET Level III state licensed fire alarm planning superintendents under whose supervision system design shall take place. In lieu of an alarm planning superintendent, the contractor may provide design supervision by a registered professional engineer.
- E. The installing contractor shall provide 24 hour, 365 days per year emergency service with factory trained, state licensed service technicians.
- F. The installing contractor must have a permanent office within a 75-mile radius of the project site and be an approved dealer/integrator, of the proposed system, in the nearest major metropolitan area.
- G. The installing contractor shall have been actively engaged in the business of selling, installing, and servicing fire alarm systems in the surrounding area for at least ten (10) years.
- H. All individuals installing the fire alarm system must be employees of the certified installer and at least 25% of the installing staff shall have undergone a training class given by the manufacturer. Current certification indicating the successful completion of the training course shall be available upon request at the project and submitted in the contractor's product submittals.
- I. The proposing contractor and the installing contractor must be the same company. No subcontractor to the proposing fire alarm system contractor will be allowed for any portion of the fire alarm system scope of work.

- J. Acceptable manufacturers:
 - 1. The system specified shall be that of [Manufacturer].
 - 2. No other manufacturers will be accepted.

1.8 ACCEPTABLE MANUFACTURER

- A. All fire alarm system devices and equipment shall be manufactured by [Manufacturer] or approved equivalent. No other manufacturers will be accepted.
- B. All equipment, materials, accessories, devices, etc. covered by the specifications and/or noted on the contract drawings shall be new and unused and be U.L. listed for their intended use.
- C. All equipment provided shall be available for purchase from at least two authorized distributors within the service area.

1.9 WARRANTY

- A. For a period of two years from date of final acceptance, the system shall be under full guarantee for materials and labor at no cost to the Owner. The system shall be under a service contract with a technician authorized by the manufacturer. Replacement parts and labor shall be readily available during normal business hours while the service contract is in effect. A complete system inspection and test shall be performed at five months and again at eleven months after final acceptance. Tests shall include all smoke detector sensitivity settings.
- B. Conform to applicable provisions of the General Requirements.
- C. Service technicians and replacement components for the system shall be available locally from a service representative of the manufacturer who is able to provide evidence of technical training and authorization by the manufacturer.
- D. All component failures shall be remedied to the satisfaction of the Owner.
- E. A continuing service contract shall be offered at time of bid to commence at the expiration of warranty included with the system.

PART 2 PRODUCT

2.1 SCOPE

- A. Main Fire Alarm Control Panel with voice evacuation (FACP)
- B. Power supply
- C. Area CO/Smoke Detectors
- D. Addressable Manual Pull Stations
- E. Relay and Monitor Modules
- F. Combination Speaker/ Strobes and Weatherproof Speaker

2.2 MATERIALS

- A. Main FACP or network node shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system-controlled devices.
- B. System Devices and components shall be provided as specified on the fire alarm equipment legend and as shown on associated electrical drawing.

2.3 COMPONENTS

- A. FACP
 - 1. The IFP-2100ECS (red) is intelligent analog/addressable Fire Alarm Control Panel combined with an Emergency Communication System (ECS). When the ECS features are enabled, they are integrated with the fire alarm and voice evacuation functions of the control panel. The IFP-2100ECS panel and accessories provide features to meet the requirements for Mass Notification Systems as described in UL 2572.
 - 2. This state of the art fire alarm control panel allows to choose one of three SLC protocols per system. The IFP-2100ECS panel contains one built in signaling line circuit (SLC), which can support 159 IDP/SK sensors and 159 IDP/SK modules or 127 SD devices per loop. Additional SLC loops can be added using the model 6815 SLC expander for System Sensor devices or model 5815XL for Hochiki devices to increase the overall point capacity to a maximum of 2100 points per panel.
 - 3. IFP-2100ECS has the interconnection capability for up to 32 panels. The system has two modes of operation, multiple panels covering one larger building, or multiple independent buildings. A separate network can be used for voice paging across all panels.
 - 4. The IFP-2100ECS supports a variety of devices, including RA-2000, RA-1000 or RA-100 remote annunciator, 5824 serial/ parallel printer interface module (for printing system reports), RPS-1000 power module, and IDP, SK or SD devices.
- B. Amplifier
 - 1. The ECS-50W is used to amplify the audio message for distribution throughout the facility. Since it is designed as a self-contained distributed amplifier it can be conveniently located near the area of protection to reduce wiring demands.
 - 2. Each ECS-50W is capable of producing 50-watts of audio power. Up to four ECS-50W's can be used on the voice evacuation system.
 - 3. The ECS-50W has its own power supply with battery backup and four speaker circuits which can be expanded to eight speaker circuits with the optional ECS-CE4.
 - 4. The ECS-50W is fully supervised by the main panel for trouble conditions.
- C. Annunciator
 - 1. The RA-2000 red remote annunciator can be used to operate and program the IFP-2000 or RPS-2000 FACP. The RA-2000's keypad and display match the built-in annunciator of the IFP-2000 control panel.
 - 2. The remote annunciator connects to the control panel via the RS-485 SBUS. When the system is in normal operation and has AC power, the Power LED is lit and all other LEDs are off. The other LEDs turn on as alarms, supervisories, troubles, and system silenced occur. The RA-2000 can be surface or flush mounted.
- D. Power Supply
 - 1. Each system power supply RPS-1000 shall be a minimum of 6 amps @ 24 vdc.

2. Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any alarm, trouble or operator acknowledgment signals.
 3. Each system power supply shall annunciate individually as a shall annunciate as a trouble signal, identifying the inoperable power supply.
 4. All standby batteries shall be continuously monitored by the system. Low battery and disconnection of battery power supply conditions shall immediately annunciate as a trouble signal, identifying the deficient batteries.
 5. All system power supplies shall be capable of recharging their associated batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 48 hours maximum.
- E. Addressable Manual Fire Alarm Box (manual station)
1. Addressable manual fire alarm boxes IDP-PULL-SA shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
 2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
 3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.
- F. Intelligent CO/ Smoke Detector
1. IDP-FIRE-CO-W is a plug-in, addressable device that provides both fire and carbon monoxide (CO) detection. For fire, the detector combines four separate sensing elements in one unit (smoke, CO, light/flame, and heat) to sense multiple components of a fire. This approach enables enhanced sensitivity to real fire with heightened immunity to nuisance particulate. For CO, the detector's electrochemical sensing cell creates a separate signal for life safety CO detection.
 2. The IDP-FIRE-CO-W is listed to the UL 2075 standard for system-connected life safety carbon monoxide monitoring.
 3. The IDP-FIRE-CO-W should be used in conjunction with the B200S intelligent sounder base which can generate either a Temp 3 pattern for fire or a Temp 4 pattern for CO alarm indication. With each sounder base carrying a unique address, the FACP can then command an individual sounder, or a group of sounders, to activate. The command set from the panel can be tailored to the specific event, allowing selection of tone, and group.
- G. Addressable Dry Contact Monitor Module
1. Addressable monitor module IDP-Monitor shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.
 2. The IDC zone shall be suitable for Style D/Class A or Style B/Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
 3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
 4. For multiple dry contact monitoring a module shall be available that provides 10 Style B or 5 Style D input circuits.

- H. Addressable Relay Module
 - 1. Addressable Relay Module IDP-Relay shall be available for HVAC control and other network building functions
 - 2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.
 - 3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary devices energize at the same time on the same pair of wires.
 - 4. For multiple relay control a module shall be available that provides 6 programmable Form-C relays.

- I. Ceiling Mounted Strobe
 - 1. The LED notification appliances shall be System Sensor SCRL Visual Strobe appliances for ceiling-mount applications with a low-profile design or approved equals. The Strobes shall be listed for UL Standard 1971 (Emergency Devices for the Hearing-Impaired) for Indoor Fire Protection Service.
 - 2. The Series shall be Restriction of Hazardous Substances (RoHS) compliant and contain no mercury or other hazardous substances.
 - 3. All Series shall meet the requirements of FCC Part 15 and ICES-003.
 - 4. All inputs shall be compatible with standard reverse polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP) with the ability to operate from 16 to 33 VDC.
 - 5. The Strobe appliances shall produce a flash rate of one (1) flash per second over the Regulated Voltage Range and shall incorporate a Light Emitting Diode (LED) as the light source with a rugged Lexan® lens. The appliances shall be of low current design. The LED strobe flash duration shall be 20 ms. Where multi-candela appliances are specified, the strobe intensity shall have 4 field selectable settings at 15, 30, 75, 95 candela for ceiling-mount applications. The selector switch for selecting the candela shall be tamper resistant. Appliances with candela settings shall show the candela selection in a visible location at all times when installed.
 - 6. The Strobe mounting options shall include Ceiling backboxes, 4" square, 1 1/2 or 2 1/8" deep and 4" Octagonal, 1 1/2" or 2 1/8" deep. Two wire appliance wiring shall be capable of directly connecting to the mounting base. Removal of an appliance shall result in a supervision fault condition by the Fire Alarm Control Panel (FACP).
 - 7. All notification appliances shall be backwards compatible.
 - 8. The LSTC3 ceiling models shall have a low profile measuring 6.26" Diameter with 1.5"D.
 - 9. When synchronization is required, the appliance shall be compatible with Sync Modules, PS Power Supplies, SAFE PATH products or other manufacturer's panels with built-in Wheelock® Patented Sync Protocol. The strobes shall not drift out of synchronization at any time during operation. If the sync protocol fails to operate, the strobe shall revert to a non-synchronized flash-rate and still maintain (1) flash per second over its Regulated Voltage Range. The appliance shall also be designed so that the audible signal may be silenced while maintaining strobe activation when used with patented sync protocol.

- J. Wall Mounted Strobe
 - 1. The notification appliances shall be System Sensor SR Visual Strobe appliances for wall-mount applications with a low-profile design or approved equals. The Strobes shall be listed for UL Standard 1971 (Emergency Devices for the Hearing-Impaired) for Indoor Fire Protection Service.
 - 2. All inputs shall be compatible with standard reverse polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP) with the ability to operate from 16 to 33 VDC.
 - 3. The Strobe appliances shall produce a flash rate of one (1) flash per second over the Regulated Voltage Range and shall incorporate a Light Emitting Diode (LED) as the light source with a rugged Lexan® lens. The appliances shall be of low current design.

The LED strobe flash duration shall be 20 ms. Where multi-candela appliances are specified, the strobe intensity shall have 4 field selectable settings at 15, 30, 75, 110, candela for wall-mount applications. The selector switch for selecting the candela shall be tamper resistant. Appliances with candela settings shall show the candela selection in a visible location at all times when installed.

4. The module shall be a System Sensor Sync.Circuit model MDL3 listed to UL 464 and shall be approved for fire protective service. The module shall synchronize SpectrAlert strobes at 1 Hz and horns at temporal three. Also, while operating the strobes, the module shall silence the horns on horn strobe models over a single pair of wires. The module shall mount to a 4 1/16 × 4 1/16 × 2 1/8-inch back box.
 5. The module shall also control two Style Y (class B) circuits or one Style Z (class A) circuit. The module shall synchronize multiple zones. Daisy chaining two or more synchronization modules together will synchronize all the zones they control. The module shall not operate on a coded power supply. All notification appliances shall be backwards compatible.
 6. The wall models shall have a low profile measuring 4.53"H x 2.76"W x 1.27"D.
 7. When synchronization is required, the appliance shall be compatible with Sync Modules, PS Power Supplies, SAFEPATH products or other manufacturer's panels with built-in Sync Protocol. The strobes shall not drift out of synchronization at any time during operation. If the sync protocol fails to operate, the strobe shall revert to a non-synchronized flash-rate and still maintain (1) flash per second over its Regulated Voltage Range. The appliance shall also be designed so that the audible signal may be silenced while maintaining strobe activation when used with sync protocol.
- K. Combination Ceiling mounted Speaker Strobes
1. The System Sensor SPSCRL Ceiling mounted Speaker Strobes are designed for high efficiency sound output for indoor applications. The product line features intelligible communications with crisp, clear voice messages and tone signaling, ideal for mass notification and voice evacuation.
 2. Providing a sleek aesthetic appearance, the wall and ceiling appliances feature dual voltage (25/70 VRMS) capability and field-selectable taps from 1/8 to 2 watts. For faster and easier installation, the low-profile design incorporates a speaker mounting plate, and each model has a built-in level adjustment feature and Snap-On cover with no visible mounting screws.
 3. For visible signaling to meet the hearing impaired, the E Speaker Strobe models incorporate the low current draw of the Strobes.
 4. Ceiling mount models are available in multi-candela ceiling strobe with field selectable intensities of 15/30/75/95/110/115cd or the high intensity strobe with field selectable 135/150/177/185cd.
 5. The strobe portion of all Speaker Strobes may be synchronized when used in conjunction with the Sync Modules, Power Supplies or other manufacturers panels incorporating the Wheelock Patented Sync Protocol.
Synchronized strobes offer an easy way to comply with ADA recommendations concerning photosensitive epilepsy.
 6. Speaker Strobes are UL Listed for indoor use under Standard 1971 (Signaling Devices for the Hearing-Impaired) and Standard 1480 (Speaker Appliances). All inputs employ IN/OUT wiring terminals for fast installation using #12 to #18 AWG wiring.
 7. The speakers shall be UL Listed under UL 1480 for Fire Protective Service and speakers equipped with strobes shall be listed under UL 1971 for Emergency Devices for the Hearing-Impaired. In addition, the strobes shall be certified to meet the requirements of FCC Part 15, Class A.
 8. All models shall have listed sound output of up to 87 dB at 10 feet and a listed frequency response of 400 to 4000 Hz. The speaker shall also incorporate a sealed back construction.
 9. The speaker and speaker strobe appliances shall be designed for indoor flush

mounting. The speaker and speaker strobe shall incorporate a speaker mounting plate with a snap-on grille cover with no visible screws for a level, aesthetic finish and shall mount to standard electrical hardware. The finish of the Speakers and Speaker Strobes shall be red. All speaker and speaker strobe appliances shall be backward compatible.

10. When synchronization is required, the strobe portion of the appliance shall be compatible with sync modules or the Power Supplies with built-in Patented Sync Protocol. The strobes shall not drift out of synchronization at any time during operation. If the sync module or Power Supply fails to operate, (i.e., contacts remain closed), the strobe shall revert to a non-synchronized flash rate.

L. Wall Mounted Combination Speaker/Strobe

1. The System Sensor L-Series of speakers and speaker strobes is using a plug-in design and universal mounting plate that allow the installer to pre-wire mounting plates, dress the wires, and confirm wiring continuity before plugging in the speakers. In addition, a protective plastic cover prevents nicked wires by covering exposed speaker components.
2. These devices also enable faster installations by providing instant feedback to ensure that wiring is properly connected, rotary switches to select voltage and power settings, and 7 field-selectable candela settings for wall speaker strobes.
3. The low total harmonic distortion of the speaker offers high fidelity sound output while still offering high volume sound output for use in high ambient noise applications.
4. The Audibles shall be UL Listed under Standard 464 (Fire Protective Signaling).
5. All inputs shall be compatible with standard reverse polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP) with the ability to operate from 16 to 33 VDC.
6. All inputs shall employ terminals that accept #12 to #18 AWG wire sizes.
7. The Audible Strobe appliances shall produce a flash rate of one (1) flash per second over the Regulated Voltage Range and shall incorporate a Light Emitting Diode (LED) as the light source with a rugged Lexan® lens. The appliances shall be of low current design. The strobe flash duration shall be 20 ms. Where Multi-Candela appliances are specified, the strobe intensity shall have 4 field selectable settings at 15, 30, 75, 95, 110, 135, 185 candela for wall mount applications. The selector switch for selecting the candela shall be tamper resistant. Appliances with candela settings shall show the candela selection in a visible location at all times when installed.
8. The audible shall have a minimum of two (2) field selectable settings for dBA levels and shall have a choice of continuous or temporal (Code 3) audible outputs.
9. The Audible Strobe mounting options shall include backboxes, single-gang backbox and to 4" square with adapter kit. Two wire appliance wiring shall be capable of directly connecting to the mounting base. Removal of an appliance shall result in a supervision fault condition by the Fire Alarm Control Panel (FACP). All notification appliances shall be backwards compatible. All notification appliances shall be backwards compatible.
10. When synchronization is required, the appliance shall be compatible with Sync Modules, PS Power Supplies, SAFEPATH products or other manufacturer's panels with Patented Sync Protocol. The strobes shall not drift out of synchronization at any time during operation. If the sync protocol fails to operate, the strobe shall revert to a non-synchronized flash rate and still maintain (1) flash per second over its Regulated Voltage Range. The appliance shall also be designed so that the audible signal may be silenced while maintaining strobe activation when used with patented sync protocol.

M. Weatherproof Speaker

1. System Sensor SPRK Weatherproof notification appliances shall be UL listed for outdoor use. The appliances shall be available for optional wall mounting or ceiling

mounting to weatherproof backboxes using either exposed conduit, concealed conduit, or semi-flush mounting to a recessed electrical box in walls or ceilings using Wheelock mounting accessories.

2. Wall-mount outdoor speakers can be used indoors or outdoors in wet or dry applications, and can provide reliable operation from -40°F to 151°F . These speakers provide a broad frequency response range, low harmonic distortion and maintain a high sound pressure level at all tap settings to provide accurate and intelligible broadcast of evacuation messages.
 3. Field-selectable settings, including candela, speaker voltage and power settings, and automatic selection of 12- or 24-volt operation enable installers to easily adapt devices to meet requirements.
 4. Weatherproof audibles shall be System sensor models or approved equals. The speaker devices shall be able to produce a continuous output or a temporal code-3 output that can be synchronized.
 5. Speaker shall be listed to Underwriters Laboratories Standard S4048 for outdoor fire protective signaling systems. Speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature from -40°F to 150.8°F . Speaker shall have power taps and wattage settings that are selected by rotary switches. The speaker must be installed with its weatherproof back box in order to remain outdoor approved per UL listing S4048. The speaker shall be suitable for use in air handling spaces and wet environments.
- N. Knox Box 3200
1. Stores maximum 10 keys. Access cards and small entry items may also fit in interior compartment but will reduce max key quantity with Weather-resistant door gasket.
 2. Built Knox-Rugged and secure: UL 1037, UL 1610, UL 1332, UL 437.
 3. KnoxBox device must be mounted properly to ensure maximum security and resist physical attack.
 4. Suggested minimum mounting height, 6 feet above ground.
 5. KnoxBox surface/recessed mount with hinged door, with/without UL Listed Knox Tamper Alert. 1/4" plate steel housing, 1/2" thick steel door with interior gasket seal and stainless-steel door hinge. Box and lock UL Listed. Lock has 1/8" thick stainless-steel dust cover with tamper seal mounting capability.
- O. Battery
1. The battery shall have sufficient capacity to power the fire alarm system for no less than twenty-four hours plus 15 minutes of alarm upon a normal AC power failure.
 2. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.
 3. If necessary, to meet standby requirements, external battery and charger systems may be used.

PART 3 EXECUTION

3.1 COORDINATION

- A. Refer to the electrical and mechanical drawings and specifications to determine quantities and location of devices and required scope of work and coordinate work with mechanical and electrical installers. Provide function described under mechanical section Sequence of Control, for fire and/or emergency conditions. Submit proposed interconnection to elevator supplier. Submit conduit and pathing requirements to electrical installer. For self-contained door release, coordinate with door supplier.

3.2 GENERAL

- A. Comply with all applicable paragraphs in Section 26 05 00: Common Work Results for Electrical, apply as though repeated herein
- B. Install system(s) in accordance with manufacturer's instructions.
- C. Include services of certified technicians to supervise installation, provide adjustments, provide final connections, system testing and system training to Owner Representative

3.3 INSTALLATION

The complete system shall be installed by one (1) contractor and the installing contractor must be a certified dealer of the specified system. No subcontractors, to the awarded proposing contractor, will be allowed to install any portion of this system Including, but not limited to:

- 1. Wiring
 - 2. Field device installation
 - 3. System programming
 - 4. FACP installation
 - 5. Remote power supply installation
- A. The installing contractor shall install the network fire alarm system in as instructed by the manufacturer's instructions.
 - B. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
 - C. All conduit, junction boxes, conduit supports, and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
 - D. All fire detection and alarm system devices, control panels shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
 - E. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.
 - F. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold-water pipe or grounding rod. The control panel enclosure shall feature a quick removal chassis to facilitate rapid replacement of the FACP electronics.

3.4 GROUNDING

- A. All equipment to be grounded by means of green ground wire to "U" contact of duplex receptacles and bonded to ground provided under 26 05 26: Grounding and Bonding of Electrical Systems.

3.5 INSPECTION

- A. Systems to meet all the requirements of the CSFM and IOR and AHJ and shall be

approved thereby before installation and prior to final acceptance.

B. Closeouts:

1. It is the intent of these specifications and of the architect/engineer that a continued program of system maintenance be continued by the owner in compliance with NFPA Standard 72H. It is mandatory that the installing contractor provide such services and make available these services to the owner upon completion of the project.
2. As part of the closeout documents, fire alarm contractor will provide owner with AutoCAD as built drawings indicating locations of devices, routing of wiring, and panel information. All room numbers indicated on final close out documents and all panel settings shall be listed by actual building room numbers and not by room number indicated on construction documents. CAD files shall be AutoCAD 2004 or later. Provide the owner with one Mylar plot of each drawing and two blue line prints of each drawing. Provide the owner with electronic versions of the as-built CD's.
3. Locate next to building FACP and other fire alarm panels.
4. A building graphic shall be provided mounted in aluminum-extruded frame with plexi-glass front. Graphic shall locate all fire alarm devices, power supplies, and FACP.
5. State FML-005 certificate shall also be framed and mounted near the fire alarm panel. Fire alarm panel shall have white FM required installation sticker attached to it.
6. Graphic shall include actual room numbers posted as part of the building graphics package, include as part of substantial completion requirement.

3.6 LOCATION

- A. Before installation, verify exact location of control equipment and outlets. The Owner reserves the right to relocate system components within a radius of 10' at no increase in cost before rough-in work is started for the respective component.

3.7 WIRING

- A. Furnish all conductors, equipment, terminal strips, etc., and labor to install a complete and operable system. All cable conductors shall be color coded and numbered for identification at all terminals. Green shall be for grounding conductor only. Use red insulation and or red jacketing on all fire alarm cable.
- B. All wiring shall be in accordance with NFPA 72, the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
- C. All wire shall be U.L. Listed FPL for limited energy (300V) and fire alarm applications and shall be installed in conduit. Limited energy FPLP or MPP wire may be run open in return air ceiling plenums provided such wire is U.L. Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so, approved by the local authority having jurisdiction.
- D. No A.C. wiring or any other wiring shall be run in the same conduit as fire alarm wiring.
- E. Wiring used for the multiplex communication circuit (SLC) shall be twisted and support a minimum wiring distance of 10,000 feet when sized at 12 AWG. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit. Shielded wire shall not be required.

- F. The fire alarm control panel shall be capable of T-tapping NFPA Style 4 (Class B) Signaling Line Circuits (SLCs). Systems which do not allow or have restrictions in, for example, the number of T-taps, length of T-taps etc., is not acceptable.
- G. Contractor shall provide a service loop located above each device installed on the entire project. The service loop shall be a minimum of 5'.
- H. Contractor shall provide a service loop located above each type of panel installed. The service loop shall be a minimum of 10', but shall have enough length to allow for the panel to be relocated to any wall within the room that panel is located in.
- I. All service loops shall be installed in the accessible ceiling that is nearest to each device and panel. No service loops shall be installed in open spaces or non-accessible spaces

3.8 TERMINAL BOXES, JUNCTION BOXES AND CABINETS:

All boxes and cabinets shall be UL listed for their use and purpose.

3.9 CONDUIT / RACEWAY:

- A. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
- B. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC, local, and state requirements.
- C. Minimum conduit size shall be 3/4" (19.1 mm). Install conduit per engineered shop drawings.
- D. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
- E. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors traversing the respective box as well as the number of terminations required.
- F. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
- G. Wiring for 24-volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
- H. Conduit shall not enter the fire alarm control panel or any other remotely mounted control panel equipment or back boxes, except where conduit entry is specified by the FACP manufacturer.
- I. All wiring associated with smoke control system shall be installed in conduit per current adopted codes regardless of voltages or ratings.

3.10 TESTING

- A. After all equipment specified herein for each system has been installed and is in operating condition, conduct performance tests to determine if the installation and components comply with these specifications. Furnish competent personnel, all test material and approved test instruments and conduct the tests under supervision of factory personnel, in the presence of the Engineer, the building and fire inspecting agencies:
 - 1. The contractor's job foreman, in the presence of a representative of the manufacturer, a representative of the owner, and the fire department shall operate every installed device to verify proper operation at the control panel.
 - 2. At least on half of all tests shall be performed on battery standby power.
 - 3. Where application of heat would destroy any detector, it may be manually activated.
 - 4. The signaling line circuits and notification appliance circuits shall be opened in at least two (2) locations to verify the presence of supervision.
 - 5. When the testing has been completed to the satisfaction of the contractor representative IOR, representatives of the manufacturer and owner, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be forwarded to the owner and the authority having jurisdiction.
 - 6. The contractor shall leave the fire alarm system in proper working order, and, without additional expense to the owner, shall replace any defective materials or equipment provided by him under this contract within two years from the date of final acceptance by the awarding authority.
 - 7. The local responding fire department must be notified prior to the final test in accordance with local requirements and when requested, participate in system testing and evaluation.

3.11 WALK TEST

- A. Notify Owner, Architect and Engineer when system is 100 percent operational. Schedule walk-through of the entire facility and verify that each initiating and each indicating device is operating properly.
- B. Provide report at conclusion of walk through certifying all fire alarm devices are working.
- C. Walk test shall include a representative from owner maintenance department.
- D. Walk test to show in a printed report all AHU shutdown, strobes/horns, heat and smoke detectors. Report shall list all devices by approximate location to rooms, and device number.

3.12 SOFTWARE

- A. Installer shall provide a backup copy of the installed program database (on CD) upon completion of the project. They shall also provide the current version of system software, for the panel provided, on CD.

3.13 REPORT

- A. Prepare written report of final test results, signed by witnessing parties. Submit to the Engineer in triplicate for final approval.

END OF SECTION 28 31 00

SECTION 31 00 00 EARTHWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Furnishing all labor, materials and equipment necessary for all earthwork as indicated on drawings and specified here-in, or as required for completion of the Contract, as applicable. Includes items such as the following:
 - a. On-site utility verification.
 - b. Protection of work, people and existing site elements.
 - c. Seasonal limits.
 - d. Materials.
 - e. Execution of work.
- B. Related Sections:
 - 1. Section 01 50 00: Temporary Facilities and Controls.
 - 2. Section 31 23 00: Excavation and Fill
- C. Reference Standards:
 - 1. General: While the survey is deemed generally accurate, there exists discrepancies and variations due to elapsed time, weather, etc. Existing dirt grades may vary 0.2 ft. from that shown.
 - 2. Site Visitation: All bidders interfacing with existing conditions shall visit the site prior to bid to verify general conditions of improvements. Discrepancies must be reported prior to the bid for clarification.
 - 3. ASTM D1556: Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
 - 4. ASTM D1557: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft/lbf/ft³ (2,700 kN-m/m³)).
 - 5. ASTM D422: Standard Test Method for Particle-Size Analysis of Soils.
 - 6. ASTM D4318: Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - 7. CALTRANS Standard Specifications Section 17.
 - 8. CAL-OSHA, Title 8, Section 1590 (e).
 - 9. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.

1.3 SUBMITTALS

- A. Refer to Section 01 33 00: Submittal Procedures.
- B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

1.4 QUALITY ASSURANCE

- A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.
- B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- C. The representatives of the Owner's testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner's testing lab representatives nor the testing by the Owner's testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting of inadequate compaction or moisture content is the sole responsibility of the contractor.
- D. Tests: See Part 3 for Compaction Testing.
- E. Contractor shall be solely responsible for all subgrades built. Failures resulting from inadequate compaction or moisture content are the responsibility of the contractor. Contractor shall be solely responsible for any and all repairs.

1.5 WARRANTY

- A. Refer to General Conditions.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Transport, store and handle in strict accord with the local jurisdiction.
- B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Engineered Fill Materials: All fill shall be of approved local materials supplemented by imported fill if necessary. "Approved" local materials are defined as local soils tested and approved by Geotechnical Engineer free from debris, and concentrations of clay and organics; and contain rocks no larger than 3-inches in greatest dimension. The soil and rock should be thoroughly blended so that all rock is surrounded by soil. This may require mixing of the soil and rock with a dozer prior to placement and compaction.
- B. Imported Engineered Fill Material:
 - 1. Imported fill may be required to complete work. Proposed import fill material shall meet the above requirements; shall be similar to the native soils. Import fill shall meet the above requirements; shall have plasticity index of 12 or less; an Expansion Index of 20 or less; be free of particles greater than 3-inches in largest dimension; be free of contaminants and have corrosion characteristics within the acceptable limits. **All import fill material shall be tested and approved by Soils Engineer prior to transportation to the site.** Proposed fill material shall comply with DTSC guidelines to include Phase 1 environmental site assessment and related tests. Refer to the October 2001 DTSC Information Advisory for clean imported fill material:
 - a. DTSC Testing: Site work contractor is to coordinate testing with an analytical lab, hired by the owner, licensed by the State of California for the DTSC testing. The

costs associated with the testing will be paid by the contractor.

- b. DTSC testing shall include documentation as to the previous land use, location, and history. Soils shall be analyzed for all compounds of concern to ensure the imported soil is uncontaminated and acceptable. Testing shall be performed per the recommendations included in DTSC Imported Fill Advisory [http://www.dtsc.ca.gov/Schools/upload/SMP FS Cleanfill-Schools.pdf](http://www.dtsc.ca.gov/Schools/upload/SMP_FS_Cleanfill-Schools.pdf). Soils shall be tested prior to import to the project site.
- c. Lab shall determine geographically which tests and analysis comparison will be appropriate for the testing. (CAM 17 / Title 22); (RWQCB) Regional Water Quality Control Board; or (OEHHA) Office of Environmental Health Hazard Assessment.
- d. Frequency of testing shall be conducted in accordance with DTSC's Imported Fill Advisory as follows:

Fill Material Sampling Schedule

Area of Individual Borrow Area

Sampling Requirements

2 Acres or less
2 to 4 Acres
4 to 10 Acres
Greater than 10 Acres

Minimum of 4 samples
Minimum of 1 sample every ½ Acre
Minimum of 8 Samples
Minimum of 8 locations with 4 subsamples per location

Volume of Borrow Area Stockpile

Up to 1,000 Cubic Yards
1,000 to 5,000 Cubic Yards

Greater than 5,000 Cubic Yards

1 sample per 250 cubic yards
4 samples for the first 1000 cubic Yards + 1 sample per each additional 500 cubic yards
12 samples for the first 5,000 cubic yards + 1 sample per each additional 1,000 cubic yards

- e. Reports/ Documentation:
 - 1) Results of the testing analysis shall be sent to the Owner; Architect; Project Inspector, Project Civil Engineer, DTSC, and DSA. Letter shall reference DSA file and application numbers.

- C. Landscape Backfill Material:
 - 1. The top 12" of native topsoil stripped from the site may be used for landscape backfill material.
 - 2. Imported Topsoil may be required to complete work. Proposed Topsoil material shall comply with DTSC guidelines to include Phase 1 environmental site assessment and related tests. Refer to the October 2001 DTSC Information Advisory for clean imported fill material.
- D. Water: Furnish all required water for construction purposes, including compaction and dust control. Water shall be potable.
- E. Aggregate Base: Provide Class 2 3/4" Aggregate Base conforming to standard gradation as specified in Cal Trans Standard Specifications, Section 26,-1.02A.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Existing civil, mechanical and electrical improvements are shown on respective site plans to the extent known. Should the Contractor encounter any deviation between actual conditions

and those shown, he is to immediately notify the Architect before continuing work.

- B. Excavation dewatering may be necessary. Contractor shall provide any and all tools, equipment and labor necessary for excavation dewatering no matter what the source. Dewatering shall be continuous until all site utilities are installed and backfilled.

3.2 EXISTING SITE CONDITIONS

- A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

3.3 ON SITE UTILITY VERIFICATION AND REPAIR PROCEDURES

- A. Ground-breaking requirements:
 - 1. All underground work performed by a Contractor must be authorized by the District's Construction Manager or the Low Voltage Consultant prior to start of construction.
 - 2. The Contractor is to obtain and keep the original School's construction utility site plans on site during all excavation operations. Contractor can contact the District's Construction Manager, Facilities Manager, or the Low Voltage Consultant to procure the drawings.
- B. Underground Utility Locating:
 - 1. The contractor shall hire an Underground Utility Locating Service to locate existing underground utility pathways in areas affected by the scope of work for excavation.
 - 2. Contractor must use an underground utility locator service with a minimum of 3 years' experience. The equipment operator must have demonstrated experience. Contact Norcal Underground Locating (800/986-6722) or Precision Locating (800/577-7324)
 - 3. The Underground Utility Locator Service must have the use of equipment with the ability to locate by means of inductive clamping, induction, inductive metal detection, conductive coupling, or TransOnde (Radio detection) to generate signals, passive locating (free scoping) for "hot" electric, and metal detector.
 - 4. The Underground Utility Locator Service must be able to locate existing utilities at a depth of at least 72".
 - 5. The Underground Utility Locator Service must be able to locate but are not limited to locating the following types of utility pathways:
 - a. All conduit pathways containing 110 volt or greater 50-60Hz electrical wire.
 - b. All conduit pathways containing an active cable TV system.
 - c. All conduit pathways containing wire or conductor in which a signal can be attached and generated without damaging or triggering the existing systems.
 - d. All empty conduit pathways or pipe in which a signal probe or sonde (miniature transmitter) can be inserted.
 - e. All conduit pathways containing non-conductive cables or wires in which a signal probe or sonde (miniature transmitter) can be inserted.
 - f. All plastic and other nonconductive water lines in which a TransOnde
 - g. Radio detection) or other "transmitter" can be applied to create a low frequency pressure wave (signal) without damaging or triggering the existing systems.
 - h. All copper or steel waterlines and plastic or steel gas lines
 - 6. All markings made by the Underground Utility Locator Service or other shall be clear and visible.
 - 7. The contractor shall maintain all markings made by Underground Utility Locator Service or other throughout the entire length of the project.
 - 8. The Underground Utility Locator Service shall provide the contractor with two sets of maps showing the location of utilities and average depth. They will be referenced to permanent buildings. Contractor will deliver one copy to the district at no additional

- charge.
9. Contractor is responsible to contact Underground Service Alert (U.S.A. 800/227-2600) and receive clearance prior to any excavation operations.
 10. Contractor shall inform the (District's Construction Manager) (Architect) (Owner) no later than five (5) days prior to the date scheduled for the utility locator service to be on site.

3.4 PROTECTION

- A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.
- B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.
- C. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.
- D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gulying of sides of excavation.
- E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.
- F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.
- G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

3.5 SEASONAL LIMITS

- A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.
- B. Excessively wet fill material shall be bladed and aerated.

3.6 TESTING

- A. General: Refer to Section 01 40 00: Quality Requirements.
- B. Geotechnical Engineer:
 1. Owner is retaining a Geotechnical Engineer to determine compliance of fill with Specifications, and to direct adjustments in fill operations. Costs of Geotechnical Engineer will be borne by Owner; except those costs incurred for re-tests or re-inspection will be paid by Owner and back charged to Contractor:

- a. If Contractor elects to process or mine onsite materials for use as Suitable Fill, Aggregate Sub Base, Aggregate Base, Rock, Crushed Rock or sand the cost of all testing of this material shall be paid for by the Contractor.
- b. Testing of import fill for compliance with Department of Toxic Substance Control (DTSC) shall be paid for by the Contractor.

3.7 INSPECTION LAYOUT AND PREPARATION

- A. Prior to installation of the work of this Section, carefully inspect and verify by field measurements that installed work of all other trades is complete to the point where this installation may properly commence
- B. Layout all work, establish grades, locate existing underground utilities, set markers and stakes, setup and maintain barricades and protection facilities; all prior to beginning actual earthwork operations. Layout and staking shall be done by a licensed Land Surveyor or Professional Civil Engineer.
- C. Verify that specified items may be installed in accordance with the approved design.
- D. In event of discrepancy, immediately notify Owner and the Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.8 PERFORMANCE

- A. General: Do all grading, excavating and cutting necessary to conform finish grade and contours as shown. All cuts shall be made to true surface of subgrade.
- B. Archaeological Artifacts: Should any artifacts of possible historic interest be encountered during earthwork operations, halt all work in area of discovery and immediately contact the Architect for notification of appropriate authorities.
- C. Degree of Compaction: Percentage of maximum density, hereinafter specified as degree of compaction required, means density equivalent to that percentage of maximum dry density and such expressed percentage thereof will be minimum acceptable compaction for specified work.
- D. Moisture Content: Moisture content shall be as noted below and as called for on the plans. Moisture content shall be maintained until subgrade is covered by surfacing materials.

3.9 DEMOLITION, DISPOSAL, AND DISPOSITION OF UNDESIRABLE MAN-MADE FEATURES

- A. All other obstructions, such as abandoned utility lines, septic tanks, concrete foundations, and the like shall be removed from site. Excavations resulting from these removal activities shall be cleaned of all loose materials, dish shaped, and widened as necessary to permit access for compaction equipment. Areas exposed by any required over-excavation should be scarified to a depth of 12", moisture-conditioned to near optimum moisture content, and recompacted to at least 95% of the maximum dry density.

3.10 TESTING AND OBSERVATION

- A. All grading and earthwork operations shall be observed by the Geotechnical Engineer or his representative, serving as the representative of the Owner.
- B. Field compaction tests shall be made by the Geotechnical Engineer or his representative. If moisture content and/or compaction are not satisfactory, Contractor will be required to

change equipment or procedure or both, as required to obtain specified moisture or compaction. Notify Geotechnical Engineer at least 48 hours in advance of any filling operation.

- C. Earthwork shall not be performed without the notification or approval of the Geotechnical Engineer or his representative. The Contractor shall notify the Geotechnical Engineer at least two (2) working days prior to commencement of any aspect of the site earthwork.
- D. If the Contractor should fail to meet the compaction or design requirements embodied in this document and on the applicable plans, he shall make the necessary readjustments until all work is deemed satisfactory, as determined by the Geotechnical Engineer or Architect/Engineer.
- E. After each rain event Geotechnical Engineer shall test fill material for optimum moisture. Do not place any fill material until desired moisture is achieved.

3.11 CLEARING AND GRUBBING

- A. Prior to grading, remove all debris off-site. Remove trees and brush including the root systems. Holes resulting from tree and brush removal should be prepared and backfilled. This may require deepening and/or widening the holes to adequately remove disturbed soil and provide room for compaction equipment. Strip the surface of all organics.

3.12 CUTTING

- A. Building pads that are located within a cut/fill transition area will have to be overexcavated to provide a semi-uniform fill beneath the building pad. The portions of building pads located in cut areas shall be overexcavated to provide no more than 1 foot difference in fill placed in the same building pad.
- B. Do all cutting necessary to bring finish grade to elevations shown on Drawings.
- C. When excavation through roots is necessary, cut roots by hand.
- D. Carefully excavate around existing utilities to avoid unnecessary damage. The contractor shall anticipate and perform hand work near existing utilities as shown on the survey, without additional claims or cost.

3.13 SUBGRADE PREPARATION

- A. Grade compact and finish all subgrades within a tolerance of 0.10' of grades as indicated on Drawings and so as not to pool water. Subgrade within building pads and concrete walks shall be within 0.05' of grades indicated.
- B. After clearing, grubbing and cutting, subsurface shall be plowed or scarified to a depth of at least 12", until surface is free from ruts, hummocks or other uneven features and uniform and free from large clods. Moisture condition to optimum moisture content and recompact to at least 90% of the maximum dry density. If the existing soils are at a water content higher than specified, the contractor shall provide multiple daily aerations by ripping, blading, and/or disking to dry the soils to a moisture content where the specified degree of compaction can be achieved. After seven consecutive working days of daily aerations, and the moisture content of the soil remains higher than specified, the contractor shall notify the architect. If the existing soils have a moisture content lower than specified, the contractor shall scarify, rip, water and blade existing soil to achieve specified moisture content. The contractor shall make proper allowance in schedule and methods to complete this work.

- C. Subgrade in areas to receive landscaping shall be compacted to 90%.
- D. Where Contractor over-excavates building pads through error, resulting excavation shall be recompacted as engineered fill at Contractor's expense.

3.14 PLACING, SPREADING, AND COMPACTING FILL MATERIAL IN BUILDING PAD AND PAVEMENT AREAS

- A. Selected fill material shall be placed in layers which, when compacted, shall not exceed 6 inches in compacted thickness. Each layer shall be spread evenly and thoroughly mixed to insure uniformity in moisture content
- B. Selected fill material shall be moisture-conditioned to specified moisture content. Selected fill material shall be unfrozen. When moisture content of fill material is below that specified, add water until proper moisture content is achieved. When moisture content is above that specified, aerate by blading, or other methods noted in this Section, until moisture content is satisfactory.
- C. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to a minimum of 90% as determined by the ASTM D1557. Compact each layer over its entire area until desired density has been obtained.
- D. Recompaction of Fill in Trenches and Compaction of Fill Adjacent to Walls: Where trenches must be excavated, backfill with material excavated. Place in lifts that when compacted do not exceed 6", moisture conditioned to (optimum) (2% above optimum) moisture content, and compact to a minimum of 90% relative compaction in building pad and paved areas, and to 90% relative compaction in landscape areas.
- E. Jetting of fill materials will not be allowed.

3.15 FINAL SUBGRADE COMPACTION

- A. Building Pads: Upper 12" of all final building pad subgrades (including future buildings) shall be uniformly compacted at specified moisture content to at least 90% of maximum dry density, as determined by ASTM D1557, regardless of whether final subgrade elevation is attained by filling, excavation, or is left at existing grade. After acceptance of final compaction test, contractor shall maintain the required moisture content of subgrade until concrete flatwork is placed.
- B. Paved Areas: Upper 12" of all final subgrades supporting pavement sections and all other flatwork shall be brought to specified moisture content and shall be uniformly compacted to not less than 95% of maximum dry density, regardless of whether final subgrade elevation is attained by filling, excavation, or is left at existing grade. After acceptance of final compaction test, contractor shall maintain the required moisture content of subgrade until concrete flatwork is placed.
- C. Other Fill and Backfill: Upper 12 inches of all other final subgrades or finish grades shall be compacted to 95% of maximum dry density.
- D. Gravel Fill: Do not place compacted gravel fill until after underground work and foundations are in place. Compact gravel fill with vibratory plate or similar equipment to preclude settlement.

3.16 PLACING, SPREADING, AND COMPACTION OF LANDSCAPE BACKFILL MATERIALS

- A. All landscaped areas shall receive topsoil. After subgrade under landscape area has been scarified and brought to 90% maximum dry density, top soil shall be placed evenly to depth of 12 inches at 85% of maximum dry density.
- B. Project Inspector must verify that materials are uniformly spread to minimum depth specified.

3.17 SLOPE CONSTRUCTION

- A. Cut slopes shall be constructed to no steeper than 3:1 (horizontal:vertical). Fill slopes shall be constructed to no steeper than 3:1 (horizontal:vertical). Prior to placement of fill on an existing slope the existing slope shall be benched. The benches shall be in a ratio of 1 horizontal to 5 vertical. The face of the fill slopes shall be compacted as the fill is placed, or the slope may be overbuilt and then cut back to the design grade. Compaction by track walking will not be allowed.

3.18 FINISH GRADING

- A. At completion of project, site shall be finished graded, as indicated on Drawings. Finish grades shall be "flat graded" to grades shown on the drawing. Mounding of finish grades will not be allowed unless otherwise directed on the landscape drawings. Tolerances for finish grades in drainage swales shall be $\pm 0.05'$. Tie in new and existing finish grades. Leave all landscaped areas in finish condition for lawn seeding. Landscaped planters shall be graded uniformly from edge of planter to inlets. If sod is used for turf areas the finish grade on which it is placed shall be lowered to allow for sod thickness.
- B. All landscape areas shall be left free of rock or foreign material.
- C. All landscape areas shall be approved by Architect prior to any planting.

3.19 SURPLUS MATERIAL

- A. Excavated material not required for grading or backfill shall be removed from site at contractor's expense.

3.20 CLEANING

- A. Refer to Section 01 74 19: Construction Waste Management and Disposal.
- B. Remove from fill all vegetation, wood, form lumber, casual lumber, and shavings, in contact with ground; buried wood will not be permitted in any fill.

END OF SECTION 31 00 00

SECTION 31 10 00 SITE CLEARING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Necessary for the completion of all site clearing work as required and as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.
- B. Removal of surface debris; removal of paving and curbs; removal of trees, shrubs, and other plant life; topsoil excavation; and repair of damaged vegetation and/or irrigation systems/system components
- C. Removal of concrete and bituminous surfacing.
- D. Related Sections:
 - 1. Section 01 71 23: Field Engineering.
 - 2. Section 01 57 23: Temporary Storm Water Pollution Control.
- E. Reference Standards:
 - 1. The work provided herein shall conform to and be in accordance the Standard Specifications for Public Works Construction (GREENBOOK), current edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the "Standard Specifications."

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. The Contractor shall obtain all necessary permits, licenses, or agreements required by any legally constituted agency, pay for all fees and give all necessary notices required for the construction of the work. The School District shall reimburse the contractor for all necessary permits or inspection fees by any legally constituted agency.
 - 2. Perform all work of this Section in strict accordance with applicable Government Codes and Regulations especially meeting all safety standards and requirements of CAL/OSHA. Provide additional measures, added materials and devices as may be needed as directed by the District Representative at no added cost to the District
 - 3. Comply strictly to Rule 1404, South Coast Air Quality Management District.
 - 4. Coordinate clearing Work with utility companies

PART 2 PRODUCTS

- 2.1** Satisfactory soil materials: Requirements for satisfactory soil materials are specified

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Traffic - Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations:
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.
- D. Do not direct vehicle or equipment exhaust towards protection zones.
- E. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
- F. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

3.2 PREPARATION

- A. Verify that existing plant life designated to remain is tagged or identified.
- B. Protect and maintain benchmarks and survey control points from disturbance during construction.
- C. Identify a waste area for placing removed materials.

3.3 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Retain first paragraph below if tree- or plant-protection zones are required.
- C. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- D. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- E. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.4 PROTECTION

- A. Protect existing structures and site improvements indicated to remain from damage by approved methods and/or as authorized by the District Representative. Removal of all protections shall be when work of this Section is completed or when so authorized by the District Representative.

- B. Protect Existing Utilities indicated or made known to remain traversing the job-site and serving existing adjacent facilities.
- C. Protect Existing Trees and Shrubs indicated to remain by providing temporary surrounding fencing so located a sufficient distance away so that trees and shrubs will not be damaged by site-clearing operations:
 - 1. Protection Barrier: A protection barrier shall be installed around the shrubs or trees to be preserved. The barrier shall be constructed of a durable fencing material, such as plastic construction fencing, snow fence, or chain link. The barrier shall be placed at or beyond the drip line. "Drip line" as referred to herein means a line which may be drawn on the ground around the tree directly under its outermost branch tips and which identifies that location where rainwater tends to drip from the tree. Placement of barrier to be approved by District Representative (Grounds Supervisor). If barrier is placed inside the drip line, then 3/4 inch plywood must be placed over the root zone up to the drip line. The fencing shall be maintained in good repair throughout the duration of the project, and shall not be removed, relocated, or encroached upon without permission of the District Representative (Grounds Supervisor).
 - 2. Storage of Materials: There shall be NO storage of materials or supplies of any kind within the area of the protection barriers. Concrete, cement, asphalt materials, block, stone, sand and soil shall not be placed within the drip line of the tree(s).
 - 3. Fuel Storage: Fuel storage shall NOT be permitted within 150 feet of any tree to be preserved. Refueling, servicing and maintenance of equipment and machinery shall NOT be permitted within 150 feet of protected trees.
 - 4. Vehicles/equipment: NO parking or driving of vehicles or storage of equipment shall be permitted within the drip line of any tree to be preserved.
 - 5. Debris and Waste Materials: Debris and waste from construction or other activities shall NOT be permitted within protected areas. Wash down of Concrete, cement or asphalt handling equipment, in particular shall NOT be permitted within 150 feet of protected areas.
 - 6. Grade Changes: Grade changes can be particularly damaging to trees. Any grade changes should be approved by the District Representative (Grounds Supervisor) before construction begins and precautions taken to mitigate potential injuries.
 - 7. Damages: Any damages or injuries to the preserved trees (including pruning or cutting of such trees not in conformity with the International Society of Arboricultural Pruning Guidelines shall be reported immediately to the District Representative (Grounds Supervisor). Severed roots shall be pruned cleanly to healthy tissue, using proper pruning tools. Broken branches/limbs shall be pruned according to International Society of Arboricultural Pruning Guidelines. In the event that any damage, injury, improper pruning or cutting of a protected tree is deemed to be so substantial as to require its replacement (such determination to be made in the sole discretion of the District Representative), Contractor shall replace such tree with the same species and variety of tree, up to a box size of 48 inches, or if no such replacement is available, with a substitute species or variety as determined in the sole discretion of the District Representative. Any replacement tree shall be approved in advance by the District Representative. The value of the tree to be replaced shall be determined by a Certified Arborist selected by Contractor from the District's approved list of Registered Consulting Arborists. To the extent that the value of the replaced tree as determined by the Certified Arborist exceeds the cost of the replacement tree, Contractor shall be liable to District for such difference in value in addition to all costs associated with replacement of the damaged tree.
 - 8. Removal of Existing Tree or Shrub: Prior to removing or cutting any trees designated for removal, the contractor shall coordinate with the District's Ground Supervisor. In the event that Contractor, a Subcontractor, Sub-Subcontractor, material supplier or anyone else performing the Work of the Contract willfully, negligently or mistakenly removes any tree or shrub not designated for removal, Contractor shall immediately report such removal to the District Representative (Grounds Supervisor). Contractor

shall replace such tree with the same species and variety of tree, up to a box size of 48 inches, or if no such replacement is available, with a substitute species or variety as determined in the sole discretion of the District Representative. Any replacement tree shall be approved in advance by the District Representative. The value of the tree to be replaced shall be determined by a Certified Arborist selected by Contractor from the District's approved list of Registered Consulting Arborists. To the extent that the value of the replaced tree as determined by the Certified Arborist exceeds the cost of the replacement tree, Contractor shall be liable to District for such difference in value in addition to all costs associated with replacement of the damaged tree.

9. Unauthorized Tree Removal or Injury: Criminal Penalties: Reference is made to California Penal Code §384a which provides that any person who willfully or negligently cuts, destroys, mutilates or removes any tree or shrub or portion thereof growing on public land without a written permit from the owner of said public land is guilty of a misdemeanor, subject to a fine of up to \$1,000, imprisonment in county jail for up to 6 months, or both. Contractor is advised that, in addition to all remedies provided herein and in the Contract Documents, the District shall cooperate with appropriate authorities in prosecuting and enforcing Penal Code §384a and other criminal sanctions as appropriate concerning trees and shrubs located on District property.
 10. Preventive Measures: Before construction begins fertilization of the affected areas to be applied at a rate to be determined by the District Representative (Grounds Supervisor).
- D. Protect bench marks, survey control points, and existing structures from damage or displacement.
 - E. Protection of Persons and Property (existing structures and site improvements):
 1. Provide barricades, warning signs at open depressions and holes on adjacent property and public accesses.
 2. Provide operating warning lights during hours from dusk to dawn each day or as otherwise required.
 3. Protect existing remaining structures, utilities, sidewalks, pavements other facilities from damage as caused by settlement, undermining, washout or other hazards created by site- clearing operations of this Section.
 - F. Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors and to others performing work on or near the job-site.
 - G. Maintain access to the job-site at all times.

3.5 CLEARING AND GRUBBING

- A. Clear areas required for access to site and execution of Work.
- B. Remove all rubbish and debris existing and resulting from work operations of this Section as soon as possible, do not allow to pile up. Do not burn rubbish and debris on the job-site.
- C. Where active utility lines need to be capped or plugged, perform such work in accordance with requirements of the Utility Company.

3.6 REMOVAL

- A. Remove debris, rock, and extracted plant life from site.
- B. Excavate and remove associated plumbing piping.

- C. Prior to demolition work, the Contractor shall notify the District Representative to identify the existing items for salvage purposes. The materials identified for salvage shall be returned to the District in a timely manner agreed upon by the District Representative.

3.7 CONCRETE AND BITUMINOUS SURFACE REMOVAL

- A. Where noted on the construction drawings, break up and completely remove all existing concrete surfacing, curbs, gutters, walks and bituminous surfacing to limits indicated to be removed. All cutting shall be done to a neat and even line with proper tools or a concrete cutting saw. Minimum depth of cut shall be 1-1/2", unless otherwise specified. Remove any concrete broken beyond the indicated limits to the nearest joint or score line and replace with new concrete to match the existing.
- B. Removed concrete and bituminous materials shall be disposed of off-site unless otherwise noted on the construction drawings. All such items to be removed shall be disposed of off the property in a legal manner.
- C. Removal of concrete curb / curb & gutter covered by this section shall include saw-cutting and removal of a twelve (12") inch wide section of the adjacent bituminous pavement.
- D. When saw cutting concrete curb / curb & gutter, the cuttings shall be continuously wet vacuumed to prevent the materials from entering catch basins, storm water conveyances, or waters of the State. Vacuumed cuttings shall be disposed of according to applicable regulations.
- E. Concrete curb and concrete curb and gutter shall be removed to the lines, grades and locations shown on the plans in accordance with Section 300-1.3.2 of the Standard Specifications.
- F. Concrete removal in sidewalk and driveway areas shall extend to existing score lines unless specifically indicated otherwise on the Plans or in the Project Special Provisions, or unless otherwise approved by the Engineer.
- G. Reinforcing or other steel may be encountered in portions of concrete to be removed. No additional compensation will be allowed for the removal of concrete containing reinforcing or other steel.
- H. In those areas where existing bituminous surfacing is removed to make way for new planting or lawn areas, remove soil 6" below existing exposed soil surface. Removed soil may be used only as fill under buildings or other areas to be paved, only if approved by the District Inspector. Legally dispose of offsite, if material is not approved as fill material.

3.8 REPAIRS

- A. During demolition and construction, ensure that trees, shrubs and other plant material and vegetation are protected inside and outside of the work zone and that the vegetation is being watered, maintaining the proper moisture content according to the season. Failed vegetation, including sod, due to lack of water, and/or plant material destroyed during construction period are to be replaced to equal or better size and condition at no additional cost to the District.
- B. If the irrigation system is damaged or modified during construction, it shall be repaired to the District's standards, and shall be in equal or better condition than prior to damage or modification. All repairs shall be inspected and approved by the District Representative (Grounds Supervisor) prior to backfilling or covering of said repairs. The District

representative requires forty-eight hours prior notice, when contractor requests inspection of completed repairs. All repairs shall be made so as to ensure proper operation prior to the close of the contract at no additional cost to the District.

- C. Controller Wires: If damaged, cut or removed, repair by splicing, soldering and silicone sealing. To ensure proper operation, reconnect the wires to the valve to correspond with the map on the controller to the correct station.
- D. Hydraulic Tubes: If damaged/cut or removed, repair by replacing the tubing using equal or better material.
- E. Valves: If damaged, repair/replace with equal or better material. All valves are to be flushed/cleaned thoroughly.
- F. Mainlines: If damaged, repair/replace with equal or better material. All lines are to be flushed/cleaned thoroughly.
- G. Lateral Lines: If damaged, repair/replace with equal or better material. All lines are to be flushed/cleaned thoroughly.
- H. Irrigation Heads: If damaged, repair/replace with equal or better material. All heads are to be flushed and filters cleaned thoroughly.
- I. Controllers: If damaged repair/replace with equal or better material.
- J. Backflow Prevention Devices: If damaged, repair/replace with equal or better material.
- K. Gate/Ball/Quick Coupler Valves: If damaged repair/replace with equal or better material.
- L. Valve Boxes: If damaged, repair/replace with equal or better material. Concrete boxes and concrete lids with the appropriate markings for identification shall be used. The top of the box shall be buried below finish grade, equal to existing depth or deeper. The top of the valve stems shall be 6" below the underside of the top of the box.
- M. Construction in grass areas: Sod shall be removed by sod cutting at a soil depth of 2", stored on site, and watered on a daily basis. Upon completion of work, stored sod shall be reinstalled over the areas disrupted due to construction. An option may be to bypass cutting the sod, however at the completion of the project, finish grading and installation of new Hybrid Bermuda GN -1 sod over the areas disrupted by construction shall be required.

3.9 EXCESS MATERIALS DISPOSAL

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.
- B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

3.10 SITE CLEANUP

- A. Cleanup of branches, limbs, logs, or any other debris resulting from any operations shall be promptly and properly accomplished. The work area shall be kept safe at all times until all operations are completed. Under no circumstances shall the accumulation of brush, limbs, logs, or other debris be allowed in such a manner as to result in a hazard to the public. All

debris shall be cleaned up each day before the work crew leaves the site, unless permission is given by the Owner to do otherwise. All lawn areas shall be raked, all streets and sidewalks shall be swept, and all brush, branches, rocks or other debris shall be removed from the site. Areas are to be left in a condition equal to or better than that which existed prior to the commencement of operations.

END OF SECTION 31 10 00

SECTION 31 23 00 EXCAVATION AND FILL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes requirements for excavation, backfilling, compaction, quality control, and restoration.
- B. Measurement:
 - 1. Excavation and Fill: Includes all labor material and equipment necessary for the excavation and fill to the lines and grades shown on the project plans for construction. Fill shall be compacted per this section. Measurement shall be made by weight tickets or performing field surveys after initial site grading and after fill is complete, and shall be measured by the in-place volume or by other methods agreed upon between the Contractor and the Engineer. No allowance will be made for shrink/swell of fill material during excavation or transport. No separate payment will be made for fill materials utilizing onsite soils.
 - 2. Trenching & Backfilling: Cost to be included in other items. Includes excavating trenches and backfilling for all pipe and utilities in the project area.
- C. Reference Standards:
 - 1. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.5 Kg) Rammer and 12 inch (300 mm) Drop.
 - 2. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
 - 3. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.5 Kg) Rammer and 18 inch (450 mm) Drop.
 - 4. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
 - 5. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- D. Submittal Requirements:
 - 1. In accordance with the requirements of Section 6705 of the Labor Code of the State of California, submit a detailed plan to the Engineer before excavation, showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of any trench or trenches 5 feet or more in depth.
 - 2. Submit the plan to the Engineer prior to start of excavation.

1.3 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, or cable.
- B. Structure: Foundation, manhole, septic tank, cleanout, catch basin, vault, or culvert.
- C. Solid Rock: Large continuous masses of igneous, metamorphic, or sedimentary rock, which in the opinion of the Engineer cannot be excavated without drilling and blasting. Soil that is capable of being excavated with rippers is not considered solid rock.

- D. Loose Rock: Boulders and other detached stones, with a minimum volume of 1 cubic yard.

PART 2 PRODUCTS

2.1 IMPORTED PIPE EMBEDMENT

- A. Use crushed stone or gravel that is free of shale, clay, friable material, and debris. Grade in accordance with ASTM C136, within the following limits:

| Sieve Size | Percent Passing |
|------------|-----------------|
| 1 in | 100 |
| 3/4 in | 90 to 100 |
| 3/8 in | 20 to 55 |
| No. 4 | 0 to 10 |
| No. 8 | 0 to 5 |

2.2 IMPORTED STRUCTURAL FILL

- A. Use imported soil (if required) that has angular fragments and a low expansion index (less than 30 per ASTM D4829). Use imported fill that complies with the requirements of Caltrans Class 2 Aggregate Sub-base:

| Sieve Size | Percent Passing (Contract Compliance) |
|------------------|---------------------------------------|
| 3 in (75mm) | 100 |
| 1½ in (63mm) | 87 to 100 |
| No. 4 (4.75mm) | 45 to 100 |
| No. 200 (.075mm) | 0 to 34 |

PART 3 EXECUTION

3.1 FIELD MEASUREMENTS

- A. Verify that survey benchmarks, control points, and intended elevations are as shown on drawings.

3.2 PROTECTION

- A. Barricade open excavations.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- C. Provide safe conditions for workers and passers-by.

3.3 PREPARATION

- A. **Notify Underground Service Alert** prior to excavation. Comply with their notice requirements.
- B. Identify required lines, levels, contours, and datum locations.

- C. Protect plant life, lawns, rock outcropping, and other features remaining as final landscaping.
- D. Protect benchmarks, existing structures, fences, and paving from excavating equipment and vehicular traffic.
- E. Maintain and protect utilities and structures to remain.

3.4 EXCAVATION

- A. Use open cut method on all excavation unless otherwise shown on the drawings, required by permit, or approved in writing by the Engineer.
- B. Stockpile excavated material on site. Any material not utilized for construction purposes may be spread onsite or removed from the site as designated by the Engineer.

3.5 CLASSIFICATION OF EXCAVATION

- A. All excavation with equipment commonly used in the industry is classified as common excavation (except for drilling and blasting).

3.6 TRENCH EXCAVATION

- A. Cut trenches sufficiently wide to enable installation and inspection. Remove water or materials that interfere with work. When groundwater is encountered the Contractor must submit a dewatering plan to the Engineer for approval.
- B. Maintain trench sides as vertical as possible--between 12 inches and 24 inches wider than the outside diameter of the pipe barrel--below pipe level.
- C. Excavate trench width above the pipe as wide as necessary for shoring, sheeting, and installation.
- D. Center trench excavation on pipe alignment for a minimum clearance of 6 inches on each side of the pipe.
- E. Hand trim for bell and spigot pipe joints. Remove loose matter.
- F. Restore over-excavated areas. If the trench bottom is over-excavated below the intended grade, fill over-excavation with imported pipe embedment and compact to density equivalent to the in situ material.
- G. Remove lumped subsoil, boulders, and rock up to $\frac{1}{2}$ yd³ (measured by volume).
- H. Excavate for additional trench depth when soil prevents adequate pipe support. Refill addition with imported pipe embedment. Remove large rock, boulders, and large stones to provide 3 inches of soil cushion on all sides of the pipe and pipe accessories.
- I. Length of trench that may be left open at any one time is 100 yards. Do not leave trench open overnight.
- J. Stockpile excavated material in designated area on site, and remove excess material from site.

3.7 STRUCTURE EXCAVATION

- A. Excavate for structures down to the levels indicated on the drawings or as directed by the Engineer. Excavate as large as necessary to accommodate the work forms. When necessary over-excavate to remove unsuitable soil and replace with engineered fill. Comply with all safety regulations.
- B. Excavate a sufficient distance from walls and footings to provide forming except where concrete for walls or footings is directly against excavated surfaces.
- C. Do not excavate below depths indicated in the drawings. Restore over-excavated areas to proper elevation by filling with imported structural fill. Do not interfere with 45 degree bearing splay of foundations.
- D. Hand-trim the bottom of the excavation to prevent disturbing the soil below the required depth.

3.8 BACKFILLING

- A. Use care to prevent disturbance or damage to utilities or structures in trench.
- B. Maintain optimum moisture content to attain required compaction density.
- C. Remove surplus fill materials from site.
- D. Leave fill material stockpile areas free of excess fill materials.

3.9 TRENCH BACKFILLING

- A. Use excavated soil as embedment unless Engineer determines it unsuitable. Unsuitable material is defined as incapable of being compacted to specified density with optimum moisture content, solid or loose rock, lump material larger than 1 inch, organic matter, or debris.
- B. Use excavated soil as final backfill unless the Engineer determines it unsuitable. Unsuitable final backfill material is solid or loose rock larger than 6 inches or lumps larger than 3 inches. Do not use organic matter or debris.
- C. Backfill pipe embedment material in uniform layers on all sides of the pipe in lifts not to exceed 6 inches.
- D. Use the following methods when placing final backfill material unless otherwise required by permits or authority.

| <u>Compact</u> | <u>Not to Exceed (In loose measure)</u> |
|-----------------------------------|---|
| Roadways | 6 inches thick |
| Rights-of-way and outside roadway | 12 inches thick |
| Unimproved surfaces | 24 inches thick |

3.10 STRUCTURE BACKFILLING

- A. Place structure fill material in uniform layers on all sides of the structure 6 inches thick.
- B. Do not fill structure material until the structure footing or other portions of the structure have been inspected Use excavated soil as final backfill material unless Engineer determines it unsuitable. Unsuitable final backfill material is solid or loose rock larger than 6 inches or lumps larger than 3 inches. Do not use organic matter or debris.

3.11 COMPACTION

- A. Compact final backfill to the percentage of maximum density determined by Cal 216 unless otherwise specified by the Owner.

| Percent of Maximum Density | | | | |
|--|----------------|------------------|-----------------------------|-----------------------|
| Location | Bedding | Haunching | Initial Backfill | Final Backfill |
| Roadways, Improved Surfaces | 95 | 95 | 95 | 95 |
| Roadway Rights-of-Way Outside of Roadway Prism | 90 | 90 | 90 | 90 |
| Unimproved Surfaces, Fields, Etc. | 90 | 90 | 80 | 80 |
| Backfill Around Structures | 95 | 95 | 95 | 95 |

3.12 FIELD QUALITY CONTROL

- A. The Owner, at its discretion, may acquire the services of a certified soils testing laboratory to perform baseline Modified Proctor density tests in accordance with Cal 216 or latest revision:
 - 1. Tests may be performed at locations approved by the Engineer.
 - 2. Test results from tests prior to construction will be made available to the contractor.
 - 3. Testing is at the Owner's expense.
- B. Compaction testing will be determined at the Engineer's discretion.
- C. If work does not meet specified requirements, remove, replace, and retest. All re-testing is at the contractor's expense. Compaction tests shall be used as the basis for determination of acceptability of work performed under this contract.

3.13 PROTECTION OF FINISHED WORK

- A. If vehicular traffic has altered finished work, reshape and re-compact

END OF SECTION 31 23 00

SECTION 32 30 01 SITE CONCRETE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Related Sections:
 - 1. Section 01 45 23: Testing and Inspecting Services.
 - 2. Division 31: Earthwork.
- B. Reference Standards:
 - 1. California Building Code, latest edition.
 - 2. ACI Standards, ACI 211.1, ACI 318, ACI 301, ACI 305R, ACI 306R.
 - 3. ASTM – American Society for Testing and Materials:
 - a. ASTM C94, Specification for Ready-Mixed Concrete.
 - 4. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice (latest edition).

1.3 SUBMITTALS

- A. Refer to Section 01 33 00: Submittal Procedures.
- B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.
- C. Materials list: Submit to the Architect a complete list of all materials proposed to be used in this portion of the work. Submitted items should include but are not limited to sand, gravel, admixtures, surface treatments, coloring agents, sealers, fibers, cast-in-place accessories, forming and curing products and concrete mix designs.
- D. With concrete submittal, provide documented history of mix design performance.

1.4 QUALITY ASSURANCE

- A. Use only new materials and products.
- B. Use materials and products of one manufacturer whenever possible.
- C. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- D. Sieve analysis from testing laboratories identifying rock/sand percentages within the concrete mix; or class 2 aggregate base shall have the current project name and project location identified on the report. Outdated analytical reports greater than 90 days old will not be accepted
- E. Testing:

1. General: Refer to Section 01 40 00: Quality Requirements.
 2. Cement and Reinforcing shall be tested in accordance with CBC Section 1910A. Testing of reinforcing may be waived in accordance with Section 1910A.2 when approved by the Structural Engineer and DSA.
- F. Adequacy And Inspection:
1. Design, erect, support, brace and maintain formwork and shoring to safely support all vertical and lateral loads that might be applied until such loads can be carried by concrete.
 2. Notify Inspector, Architect and DSA at least 48 hours prior to placing of concrete.
- G. Protection:
1. Finish surfaces shall be protected at all times from concrete pour. Inspect forming against such work and establish tight leak-proof seal before concrete is poured. Finish work damaged, defaced or vandalized during the course of construction shall be replaced by contractor at contractor expense.
- H. Field Measurements:
1. Make and be responsible for all field dimensions necessary for proper fitting, slopes and completion of work. Report discrepancies to Architect before proceeding.

1.5 WARRANTY

- A. Refer to General Conditions and Section 01 78 39: Project Record Documents.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver undamaged products to job in manufacturer's sealed containers and/or original bundles with tags and labels intact.
- B. Store materials in protected, dry conditions off of ground and in areas so as to not interfere with the progress of the work.
- C. Transport, store and handle in strict accord with the manufacturer's written recommendations.
- D. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.
- E. Store cement in weather tight building, permitting easy inspection and identification. Protect from dampness. Lumpy or stale cement will be rejected.
- F. Aggregates: Prevent excessive segregation, or contamination with other materials or other sizes of aggregate. Use only one supply source for each aggregate stock pile.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Cement: Portland cement, ASTM C150, Type II, per ACI 318 Section 26.4.
- B. Concrete Aggregates: Normal weight aggregates shall conform to ASTM C33, except as modified by this section. Combined grading shall meet limits of ASTM C33. Lightweight aggregate shall conform to ASTM C330, suitably processed, washed and screened, and

shall consist of durable particles without adherent coatings.

- C. Water: Clean and free from deleterious amounts of acids, alkalis, scale, or organic materials and per ACI 318 Section 26.4.1.3.1.
- D. Fly Ash: Western Fly Ash, conforming to ASTM C618 for Class N or Class F materials (Class C is not permitted). Not more than 15% (by mass) may be substituted for portland cement.
- E. Water Reducing Admixture: Admixture to improve placing, reduce water cement ratio, and ultimate shrinkage may be used. Provide WRDA 64 by Grace Construction Products or approved equal. Admixture shall conform to ASTM C494 and ACI 318 Section 26.4.1.4.19(a). Such admixture must receive prior approval by the Architect, Structural Engineer, and the Testing Lab, and shall be included in original design mix.
- F. Air-entraining Admixture: Daravair 1000 by Grace Construction Products or approved equal. Admixture must conform to ASTM C260 and ACI 318, section 26.4.1.4.
- G. Exterior Flatwork Expansion Joint Sealant: 1-part polyurethane sealant, Sikaflex -1c SL or approved equal.
- H. Surface Retarder (for exposed aggregate finishes): Rugasol-S by Sika Corporation or approved equal.
- I. Form Coating: Material which will leave no residue on concrete surface that will interfere with surface coating, as approved by the Architect.
- J. Expansion Joint Material: Preformed 3/8" fiber material, full depth of concrete section, with bituminous binder manufactured for use as concrete expansion joint material, as accepted by the Architect.
- K. Reinforcement Bars: New billet steel deformed bars conforming to requirements of ASTM A615 or ASTM A706; Grade 60. Dowels for installation through expansion joints or construction joints to existing sidewalks or concrete features shall be smooth or shall be sleeved on one end for slippage.
- L. Reinforcing supports: Galvanized metal chairs or spacers or metal hangers, accurately placed 3'-0" O.C.E.W. Staggered and each support securely fastened to steel reinforcement in place. Bottom bars in footings may be supported with 3" concrete blocks with embedded wire ties. Concrete supports without wire ties will not be allowed.
- M. Curing Compound (for exterior slabs only): Burke Aqua Resin Cure by Burke by Edoco, 1100 Clear by W.R. Meadows or accepted equal. Water based membrane-forming concrete curing compound meeting ASTM C309 and C1315.
- N. Concrete Bonding Agent: Weld-Crete by Larson Products Corp., Daraweld C by Grace Construction Products or accepted equal.
- O. Patching Mortar: Meadow-Crete GPS, one-component, trowel applied, polymer enhanced, shrinkage-compensated, fiber reinforced, cementitious repair mortar for horizontal, vertical and overhead applications as manufactured by W.R. Meadows or accepted equal.
- P. Non-shrink Grout: Masterflow 713 Plus by Master Builders or approved equal. Premixed, non-metallic, no chlorides, non-staining and non-shrinking per CRD-C621, Corps of Engineers Specification and ASTM C1107, Grades B and C.

- Q. Aggregate Base: Class 2 AB per Caltrans specification section 26-1.02A.
- R. Joint sealant for expansion joints: Single component silicone sealant, Type S, ASTM D5893
- S. Pre- Formed plastic Expansion Joint; W.R. Meadows 3/8" "Snap Cap", Tex-Trude expansion joint cap, or an approved equal.
- T. Adhesive Anchoring (Epoxy): Hilty HIT-HY 200 Safe Set, or approved equal.

2.2 CONCRETE DESIGN AND CLASS

- A. Class "B": Concrete shall have 1" max. size aggregate, shall have 3000 psi min. at 28-day strength with a maximum water to cementitious ratio no greater than 0.50. Use for exterior slabs, including walks, vehicular paved surfaces, manhole bases, poured-in-place drop inlets, curbs, valley gutters, curb & gutter and other concrete of like nature.
- B. Slump Limits: Provide concrete, at point of final discharge, of proper consistency determined by Test Method ASTM C143 with a slumps of 4" plus or minus 1".
- C. Mix Design: All concrete used in this work will be designed for strength in accordance with provisions of ACI 318 Section 26.4. Should the Contractor desire to pump concrete, a modified mix design will need to be submitted for review. Fly ash may be used in concrete to improve workability in amounts up to 15% of the total cementitious weight.
- D. Air Entrainment; Per the Local Jurisdiction minimum requirements, or 3% minimum.

2.3 MIXING OF CONCRETE

- A. Conform to requirements of CBC, Chapter 19A.
- B. All concrete shall be mixed until there is uniform distribution of material and mass is uniform and homogenous; mixer must be discharged completely before the mixer is recharged.
- C. Concrete shall be Ready-mixed Concrete:
 - 1. Mix and deliver in accordance with the requirements set forth in ASTM C94 and ACI 301. Batch Plant inspection may be waived in accordance with CBC Section 1705A.3.3.1, when approved by Structural Engineer and DSA:
 - a. Approved Testing Laboratory shall check the first batching at the start of the work and furnish mix proportions to the Licensed Weighmaster.
 - b. Licensed Weighmaster to positively identify materials as to quantity and to certify to each load by ticket.
 - c. Ticket shall be transmitted to Project Inspector by truck driver with load identified thereon. Project Inspector will not accept load without load ticket identifying mix and will keep daily record of pours, identifying each truck, its load and time of receipt and will transmit two copies of record to DSA.
 - d. At end of project, Weighmaster shall furnish affidavit to DSA on form satisfactory to DSA, certifying that all concrete furnished conforms in every particular and to proportions established by mix designs.
 - e. Placement of concrete shall occur as rapidly as possible after batching and in a manner which will assure that the required quality of the concrete is maintained. In no case may concrete be placed more than 90 minutes from batch time.
 - f. Water may be added to the mix only if neither the maximum permissible water-cement ratio nor the maximum slump is exceeded. In no case shall more than 10 gallons of water shall be added to a full 9 yard load, or 1 gal. per yard on remaining concrete within the drum providing load tag indicates at time of mixing at plant will

allow for additional water.

2.4 MATERIALS TESTING

- A. Materials testing of concrete and continuous batch plant inspection may be waived in accordance CBC Section 1705A.3.3 when approved by Structural Engineer and DSA.
- B. Testing of concrete shall be performed per article 3.12 of this specification.

2.5 EQUIPMENT

- A. Handling and mixing of concrete: Project Inspector may order removal of any equipment which in his opinion is insufficient or in any way unsuitable.

PART 3 EXECUTION

3.1 APPROVAL OF FORMS AND REINFORCEMENTS

- A. Forms and reinforcements are subject to approval by the Project Inspector, and notice of readiness to place first pour shall be given to DSA, Architect and Structural Engineer 48 hours prior to placement of concrete. Before placing concrete, clean tools, equipment and remove all debris from areas to receive concrete. Clean all reinforcing and other embedded items off all coatings oil, and mud that may impair bond with concrete.
- B. All reinforcing steel and or W.W.F. shall be adequately supported by approved devices on centers close enough to prevent any sagging.
- C. All reinforcing bar lap splices shall be staggered a minimum of 5 ft.
- D. Additional reinforcing steel shall be placed around all utility boxes, valve boxes, manhole frames and covers that are located within the concrete placements.
 - 1. The bars shall be placed so that there will be a minimum of 1 ½" clearance and a maximum of 3" clearance. The reinforcing steel shall be placed mid-depth of concrete slab.
- E. At all right angles or intersections of concrete walks, additional 2'x2' #5, 90 degree bars shall be added at all inside corners for additional crack control. The bars shall be placed 2" from concrete forms and supports at mid-depth of slab.

3.2 PROTECTION

- A. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.
- B. In the event of damage, make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.
- C. Sub-Grade in vehicular concrete paved areas: Subgrade shall be clean, shaped and compact to hard surface free from elevations or depressions exceeding 0.05' in 10' from true plan. Compact per Division 31: Earthwork. Compaction and moisture content shall be verified immediately prior to placement of concrete. Proof roll subbase in presence of geotechnical engineer prior to placement of aggregate base.

3.3 CLEANING

- A. Reinforcement and all other embedded items at time of placing concrete to be free of rust, dirt oil or any other coatings that would impair bond to concrete.
- B. Remove all wood chips, sawdust, dirt, loose concrete and other debris just before concrete is to be poured. Use compressed air for inaccessible areas. Remove all standing water from excavations.

3.4 FORMING

- A. Form material shall be straight, true, sound and able to withstand deformation due to loading and effects of moist curing. Materials which have warped or delaminated, or require more than minor patching of contact surfaces, shall not be reused.
- B. Build forms to shapes, lines, grades and dimensions indicated. Construct form work to maintain tolerances required by ACI 301. Forms shall be substantial, tight to prevent leakage of concrete, and properly braced and tied together to maintain position and shape. Butt joints tightly and locate on solid backing. Chamfer corners where indicated. Form bevels, grooves and recesses to neat, straight lines. Construct forms for easy removal without hammering, wedging or prying against concrete.
- C. Space clamps, ties, hangers and other form accessories so that working capacities are not exceeded by loads imposed from concrete or concreting operations.
- D. Build openings into vertical forms at regular intervals if necessary to facilitate concrete placement, and at bottoms of forms to permit cleaning and inspection.
- E. Build in securely braced temporary bulkheads, keyed as required, at planned locations of construction joints.
- F. Slope tie-wires downward to outside of wall.
- G. Brace, anchor and support all cast-in items to prevent displacement or distortion.
- H. During and immediately after concrete placing, tighten forms, posts and shores. Readjust to maintain grades, levels and camber.
- I. Concrete paving, Curbs, Curb and Gutters, Ramps:
 - 1. Expansion Joints: Install at locations indicated, and so that maximum distance between joints is 20' for exterior concrete unless otherwise shown. Expansion joint material shall be full depth of concrete section. Recess for backer rod and sealant where required. Expansion joints shall not exceed ¼ inch depth measured from finish surface to top of felt or sealant, and ½ inch width.
 - 2. Curbs, Valley Gutter, and Curb & Gutter: Install expansion joints at 60' on center, except when placing adjacent to concrete walks, the expansion joints shall align with the expansion joints shown for the concrete walks. Expansion joint material shall be full depth of concrete section. Recess for backer rod and sealant will be required.
 - 3. Isolation Joints: 3/8" felt between walls and exterior slabs or walks so that paved areas are isolated from all vertical features, unless specifically noted otherwise on plans.
 - 4. Exterior Concrete Paving: Install expansion joints at 20' on center maximum, both directions, unless shown otherwise on plans.
 - 5. Ramps, whether shown or not all ramps shall have control joints and expansion joints:
 - a. Control joints on ramps shall be aligned and be placed in between with the vertical posts for the handrails. The curbs, if required shall have control joints that align with the handrail posts.
 - b. Expansion joints shall be placed at the upper, intermediate, and bottom landings.

3.5 FORM COATING

- A. Before placement of reinforcing steel, coat faces of all forms to prevent absorption of moisture from concrete and to facilitate removal of forms. Apply specified material in conformance with manufacturer's written directions.
- B. Before re-using form material, inspect, clean thoroughly and recoat.
- C. Seal all cut edges.

3.6 INSTALLATION

- A. General: Reinforcement shall be accurately placed at locations indicated on the drawings within required tolerances and providing required clearances. Reinforcement shall be secured prior to placement of concrete such that tolerances and clearances are maintained. Coverage shall be in accordance with Section 1904A.1 of the CBC. Keep a person on the job to maintain position of reinforcing as concrete is placed. Reinforcement must be in place before concreting is begun. Install dowels as shown on drawings. Give notice whenever pipes, conduits, sleeves, and other construction interferes with placement; obtain method of procedure to resolve interferences. All expansion and construction joints in concrete shall have dowels of size and spacing as shown, or as approved by Architect.
- B. Placing Tolerances:
 - 1. Per ACI 301 or CRSI/WCRSI Recommended Practice for Placing Reinforcing Bars, unless otherwise shown.
 - 2. Clear distance between parallel bars in a layer shall be no less than 1", the maximum bar diameter not 1 ½ times the maximum size of coarse aggregate.
- C. Splices:
 - 1. General:
 - a. Unless otherwise shown on drawings, splice top reinforcing at midspan between supports, splice bottom reinforcing at supports and stagger splices at adjacent splices 5 foot minimum. Bar laps shall be wired together. Reinforcing steel laps shall be as follows:
 - 1) Lap splices in concrete: Lap splice lengths shall not be less than 62 bar diameter for No. 5 bar, 56" minimum for No. 6 bars. No. 4 bar shall have a minimum of 24" splice. 93 bar diameters for No. 7 bars and larger.
 - 2) All splices shall be staggered at 5 feet minimum.

3.7 INSPECTION

- A. Approval of reinforcing steel, after installation, must be received from Inspector. Architect, Structural Engineer and DSA must be notified 48 hrs. in advance of beginning of concrete placement operations.
- B. Slope of concrete forms and finish condition shall be checked with a two foot (2') digital level.

3.8 PLACING OF CONCRETE

- A. Adjacent finish surfaces shall be protected at all times during the concrete pour and finishing. Verify that all formwork is tight and leak-proof before concrete is poured. Finish work defaced during the concrete pour and finishing shall be replaced at no extra cost to the owner.

- B. Transport concrete from mixer to place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients. Deposit as close as practicable in final position to avoid re-handling or flowing. Partially hardened concrete must not be deposited in work. Concrete shall not be wheeled directly on top of reinforcing steel.
- C. Placing: Once started, continue concrete pour continuously until section is complete between predetermined construction joints. Prevent splashing of concrete onto adjacent forms or reinforcement and remove such accumulation of hardened or partially hardened concrete from forms or reinforcement before work proceeds in that area. Free fall of concrete shall not to exceed 4'-0" in height. If necessary, provide lower openings in forms to inject concrete and to reduce fall height.
- D. Remove form spreaders as placing of concrete progresses.
- E. Place footings as monolithic and in one continuous pour.
- F. Keep excavations free of standing water, but moisture condition sub-grade before concrete placement.
- G. Compacting: All concrete shall be compacted by mechanical vibrators. Concrete shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms. Vibrating shall not be applied to concrete which has already begun to initially set nor shall it be continued so long as to cause segregation of materials.
- H. Grout under column bearing plates: Dry pack with specified Non-shrink Grout, as recommended by manufacturer. Use as little water as practicable. Ram grout solid into place.
- I. Concrete Flatwork:
 - 1. All flatwork shall be formed and finished to required line and grades. Flatwork shall be true and flat with a maximum tolerance of 1/8" in 10' for flatness. Flatwork which is not flat and are outside of the maximum specified tolerances shall be made level by the Contractor at no additional expense to the Owner.
 - 2. Thoroughly water and soak the flatwork subgrade as required to achieve required moisture content prior to the concrete pour. Provide damming as required to keep water within the formed area and to allow for proper saturation of the subgrade.
 - 3. Concrete vibrator shall be used to assist concrete placement. Contractor shall have spare concrete vibrator on site during concrete placement.
 - 4. Thoroughly water and soak the exterior slabs, curbs, curb and gutters, footing subgrades with multiple daily waterings for at least three (3) days or as required to achieve required moisture content prior to the concrete pour in order to place the subgrade soils in full expansion. Provide damming as required to keep standing water within the formed area and to allow for proper saturation and full expansion of the subgrade soils. Remove any standing water before concrete placement.
- J. Placing in hot weather: Comply with ACI 305R. Concrete shall not exceed 85 degrees F at time of placement. Concrete shall be delivered, placed and finished in a sufficiently short period of time to avoid surface dry checking. Concrete shall be kept wet continuously after tempering until implementation of curing compound procedure in accordance with this specification.
- K. Placing in cold weather: Comply with ACI 306R. Protect from frost or freezing. No antifreeze admixtures are permitted. When deposited concrete during freezing or near-freezing weather, mix shall have temperature of at least 50 degrees F but not more than 90 degrees F. Concrete shall be maintained at temperature of at least 50 degrees F for not

less than 72 hours after placing or until it has thoroughly hardened. Provide necessary thermal coverings for any flat work exposed to freezing temperatures.

- L. Horizontal construction joint: Keep exposed concrete face of construction joints continuously moist from time of initial set until placing of concrete; thoroughly clean contact surface by chipping entire surface not earlier than 5 days after initial pour to expose clean hard aggregate solidly embedded, or by approved method that will assure equal bond, such as green cutting. If contact surface becomes contaminated with soil, sawdust or other foreign matter, clean entire surface and re-chip entire surface to assure proper adhesion.

3.9 CONCRETE FINISHES

- A. Concrete Slab Finishing:
 - 1. Finish slab as required by ACI 302.1R. Use manual screeds, vibrating screeds to place concrete level and smooth. Use "jitterbugs" or other special tools designed for the purpose of forcing the coarse aggregate below the surface leaving a thick layer of mortar 1 inch in thickness. Surface shall be free from trowel marks, depressions, ridges or other blemishes. Tolerance for flatness shall be 1/8" in 10'. Provide final finish as follows:
 - a. Flatwork, medium broom finish: Typical finish to be used at all exterior walks and stairs.
 - b. Ramps, heavy broom finish: Concrete surfaces with slope greater than 5% including all ramps. Brooming direction shall run perpendicular to slope to form non-slip surface
 - c. Under no circumstances can water be added to the top surface of freshly placed concrete.
- B. Curb Finishing: Steel trowel.
- C. Joints and Edges:
 - 1. Mark-off exposed joints, where indicated, with 1/4" radius x 1" deep jointer or edging tool. Joints to be clean, cut straight, parallel or square with respect to concrete walk edge. Tool all edges of exposed expansion and contraction joints, walk edges, and wherever concrete walk adjoins other material or vertical surfaces:
 - a. The expansion joints shall be full depth as shown in the plan details. Failure to do so will result in non-compliance and shall be immediately machine cut by the contractor at his expense.
- D. Exposed Concrete Surface Finishing (not including top surface of flatwork): Remove fins and rough spots immediately following removal of forms from concrete which is to be left exposed. Damaged and irregular surfaces and holes left by form clamps and sleeves shall be patched with grout. Tie wires are to be removed to below exposed surface and holes pointed up with neat cement paste similar to procedure noted under "Patching" below. Removal of tie wires shall extend to distance of 2" below established grade lines. Ends of tie wires shall be cut off flush at all other, unexposed locations. Care shall be taken to match adjacent finishes of exposed concrete surface. After patching, all concrete that is to remain exposed, shall be sacked with a grout mixture of 1-part cement, 1 1/2- parts fine sand and sufficient water to produce a consistency of thick paint. After first wetting the concrete surface, apply mixture with a brush and immediately float entire surface vigorously using a wood float. Keep damp during periods of hot weather. When set, excess grout shall be scraped from wall with edge of steel trowel, allowed to set for a time, then wiped or rubbed with dry burlap. Entire finishing operation of any area shall be completed on the same day. This treatment shall be carried to 4" below grade, and all patching and sacking shall be done immediately upon removal of the forms.

3.10 CURING

- A. Cured Concrete in Forms: Keep forms and top on concrete between forms continuously wet until removal of forms, 7 days minimum. Maintain exposed concrete in a continuous wet condition for 14 days following removal of forms.
- B. Flatwork/Variable Height Curbs, Curb and gutter, Valley Gutter:
 - 1. Cure utilizing Curing Compound. If applicable, the Contractor shall verify that the approved Curing Compound is compatible with the approved colorant system. Upon completion of job, wash clean per manufacturer's recommendations:
 - a. Curing compound shall be applied in a wet puddling application. Spotty applications shall be reason for rejection and possibly concrete removal and replacement at the contractor's expense with no compensation from the owner.
- C. No Curing Compound shall be applied to areas scheduled to receive resilient track surface including, curbs, ramps, run ways, etc.

3.11 DEFECTIVE CONCRETE

- A. Determination of defective concrete shall be made by the Architect or Engineer. His opinion shall be final in identifying areas to be replaced, repaired or patched.
- B. The Owner reserves the right to survey the flatwork, if it is determined to be outside of the maximum tolerance for flatness. If the flatwork is found to be out of tolerance, then the Contractor will be required to replace concrete. The Contractor will be responsible for reimbursing the Owner for any surveying costs incurred. Determination of flatwork flatness, surveying and any remedial work must be completed far enough in advance so that the project schedule is maintained, delays are avoided and the new flatwork or flatwork repairs are properly cured.
- C. As directed by Architect, cut out and replace defective concrete. All defective concrete shall be removed from the site. No patching is to be done until surfaces have been examined by Architect and permission to begin patching has been provided.
- D. Permission to patch any area shall not be considered waiver of right, by the Owner, to require removal of defective work, if patching does not, in opinion of Architect, satisfactorily restore quality and appearance of surface.
- E. Defective concrete is:
 - 1. Concrete that does not match the approved mix design for the given installation type.
 - 2. Concrete not meeting specified 28-day strength.
 - 3. Concrete which contains rock pockets, voids, spalls, transverse cracks, exposed reinforcing, or other such defects which adversely affect strength, durability or appearance.
 - 4. Concrete which is incorrectly formed, out of alignment or not plumb or level.
 - 5. Concrete containing embedded wood or debris.
 - 6. Concrete having large or excessive patched voids which were not completed under Architect's direction.
 - 7. Concrete not containing required embedded items.
 - 8. Excessive Shrinkage, Traverse cracking, Cracking, Curling; or Defective Finish. Remove and replace if repair to an acceptable condition is not feasible.
 - 9. Concrete that is unsuitable for placement or has set in truck drum for longer than 90 minutes from the time it was batched.
 - 10. Expansion joint felt that is not isolating the full depth of the concrete section, and recessed as required for backer rod and sealant where required.
 - 11. Concrete that is excessively wet or excessively dry and will not meet the minimum or maximum slump required per mix design.
 - 12. Finished concrete with oil stains from equipment use, and or rust spots that cannot be

removed.

13. Control joints (weakened planed joints) that do not meet the required minimum depth shown on the drawings.

- F. Patching: Install specified Patching Mortar per manufacturer's recommendations. **Repairs to defective concrete which affect the strength of any structural concrete member or component are subject to approval by the architect and dsa.**

3.12 CONCRETE TESTING

- A. Comply with CBC Section 1903A, 1905A.1.15 1910A and 1705A.3 and as specified in B. below. Costs of tests will be borne by the Owner.
- B. Four identical cylinder samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards of concrete, or not less than once for each 2,000 square feet of surface area for slabs or walls. In addition, samples for strength tests for each class of concrete shall be taken for seven-day tests at the beginning of the concrete work or whenever the mix or aggregate is changed.
- C. Strength tests will be conducted by the Testing Lab on one cylinder at seven (7) days and two cylinders at twenty-eight (28) days. The fourth remaining cylinder will be available for testing at fifty-six (56) days if the 28-day cylinder test results do not meet the required design strength.
- D. On a given project, if the total volume of concrete is such that the frequency of testing required by paragraph B. above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.
- E. Cost of retests and coring due to low strength or defective concrete will be paid by Owner and back-charged to the Contractor.
- F. Each truck shall be tested for slump before concrete is placed.

3.13 REMOVAL OF FORMS

- A. Remove without damage to concrete surfaces.
- B. Sequence and timing of form removal shall insure complete safety of concrete structure.
- C. Forms shall remain in place for not less than the following periods of time. These periods represent cumulative number of days during which temperature of air in contact with concrete is 60 degrees F and above:
 1. Vertical forms of foundations, walls and all other forms not covered below: 5 days.
 2. Slab edge screeds or forms: 7 days.
 3. Concrete columns and beam soffits: 28 days.
- D. Concrete shall not be subjected to superimposed loads (structure or construction equipment) until it has attained its full design strength and not for a period of at least 21 days after placing. Concrete systems shall not be subjected to construction loads in excess of design loads.

3.14 CLEANING

- A. Refer to Section 01 74 19: Construction Waste Management and Disposal.
- B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.
- C. Clean excess material from surface of all concrete walks and utility structures.
- D. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION 32 30 01

SECTION 32 31 13 CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. All Chain link fences, new or modernized shall comply with all local codes and zoning, where located on property and in route of travel all hardware to meet specified requirements listed here-in. Refer to Drawings and Details.
- B. Related Section:
 - 1. Section 03 30 00: Cast-In-Place Concrete.
- C. Reference Standards:
 - 1. ASTM International (ASTM):
 - a. A392, Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
 - b. F567, Standard Practice for Installation of Chain Link Fence.
 - c. F626, Standard Specification for Fence Fittings.
 - d. F900, Standard Specification for Industrial and Commercial Swing Gates.
 - e. F1083, Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded for Fence Structures.
 - f. F2611, Standard Guide for Design and Construction of Chain Link Security Fencing.
- D. Accessibility Requirements - Comply with applicable requirements:
 - 1. Americans with Disability Act of 1990, as amended.
 - 2. CBC 2019 California Building Code:
 - a. CBC Chapter 11B - California Building Code - Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing; 2019.
 - b. Door and Gate closures shall comply with 11B-404.2.8.1.
 - c. Door and Gate opening force shall comply with 11B-404.2.9.
 - d. Door and Gate operation shall comply with 11B-309.4.
 - 3. California Referenced Standards Code:
 - a. CCR Title 24, Part 2, as adopted and amended by DSA.
 - b. Title 24, Part 12, Section 12-10-202, Item (F).

1.4 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's schedules, charts, literature, and illustrations indicating the performance, fabrication procedures, product variations and accessories indicating material compliance and specified options.
 - 2. Manufacturer's installation instructions.
- B. Shop Drawings: Indicate materials, dimensions, details, and finish, show locations and installation procedures. Include details of fence and gate joints, attachments, accessories, footings, and clearances.

1.3 QUALITY ASSURANCE

- A. Accessibility Requirements for Fences, Gates, and Hardware:
 - 1. Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with CNC Section 11B-404.
 - 2. The levers of lever actuated latches or locks for accessible gates shall be curved with a return to within ½ inch of the gate surfaces to prevent catching on the clothing or persons. See California Referenced Standards Code T-24, Part 12, Section 12-10-202, Item (F).
 - 3. Swing doors and gate surfaces within 10 inches of the finish floor or ground shall have a smooth surface on the push side extending the full width of the door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within 1/16 inch of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped. See CBC Section 11B-404.2.10.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Specifications are based on products of Anchor Fence by Master Halco Inc., Baltimore, MD, Phone (800) 229-5615.
- B. Other manufacturers must have a minimum of five (5) years' experience manufacturing chain link fencing and gates meeting or exceeding the following specifications for design, size, gauge, finish of metal parts and fabrication and comply with Division 01 requirements for substitutions in order to be considered:
 - 1. Golden State Fence, Co Inc, Rancho Cordova, CA (916) 468-0975
 - 2. S & S Fence Co, Sacramento, CA (916) 682-1100

2.2 CHAIN LINK FENCE MATERIALS

- A. General:
 - 1. Selvage: Knuckled finish top and bottom.
 - 2. Steel Fabric: Comply with Chain Link Fence Manufacturers Institute (CLFMI) Product Manual. Furnish one-piece fabric widths for fencing up to 16 feet high. Wire sizes includes zinc coating.
 - 3. Galvanized Wire: Zinc coated wire-ASTM A392, Class 1, with not less than 1.2 oz. zinc. per sq. ft.
- B. Fence Fabrics:
 - 1. Type A - Privacy Slatted Fabric: Industrial grade. 3-1/2 inch x 5" diamond mesh interwoven wire with factory install 2.310" wide PDS "IDS" slats full height or approved equal. Secure slats with monel-clinch-lock staples. 9 gauge zinc coated steel wire, top selvage twisted tight, bottom selvage knuckled end closed. Color as selected by Owner from Manufacturer's Standard range of colors. Slats to be fabricated of extruded high density virgin polyethylene, containing color pigmentation and U.V. inhibitors. Height shall be 6'-0" unless otherwise noted.
- C. Fence Framing:
- D. Framing:
 - 1. Strength requirements for posts and rails shall conform to ASTM F1043.
 - 2. Pipe shall be straight, true to section, material, and sizes specified, and shall conform to the following weights per foot:

| NPS in inches | Outside Diameter (OD) in inches | Type I Steel | Type II Steel |
|---------------|---------------------------------|--------------|---------------|
| 1 | 1.315 | 1.68 | 1.35 |
| 1.25 | 1.660 (1-5/8") | 2.27 | 1.84 |
| 1.5 | 1.900 (2") | 2.72 | 2.28 |
| 2 | 2.375 (2-1/2") | 3.65 | 3.12 |
| 2.5 | 2.875 (3") | 5.79 | 4.64 |
| 3 | 3.500 | 7.58 | 5.71 |
| 3.5 | 4.000 | 9.11 | 6.56 |
| 4 | 4.500 | 10.79 | --- |

3. Posts, Rails, Braces, and Gate Frames - Steel pipe - Type I - ASTM F1083, standard weight Schedule 40; minimum yield strength of 25,000 psi; sizes as indicated below. Hot-dipped galvanized with minimum average 1.8 oz/ft² of coated surface area:
 - a. Line posts: 2 inch o.d, weighing 2.72 lb/ft.
 - b. Terminal, End, Corner, and Pull Posts: 2-1/2 inch o.d., weighing 3.65 lb/ft.
 - c. Rails and Braces: 1-5/8 inch o.d., weighing 2.27 lb/ft.
 4. Line or intermediate posts for following fabric heights:
 - a. End, corner, and pull posts for following fabric
 - a. 6 feet to 10 feet: 2.875" OD (3" OD)
 4. Line or intermediate posts for following fabric heights:
 - b. 6 feet to 8 feet: 2.375" OD (2-1/2" OD) (with privacy slats provide 3" OD)
 - c. Top, bottom and horizontal intermediate rails (as applicable) shall be 1.66" OD (1-5/8"OD)
 5. Gate Posts: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:
 - a. 6 feet to 10 feet: 3.5" OD
 6. Gate Frames: Furnish frames (single or double gate), for nominal gate widths as follows:
 - a. 6 feet to 10 feet: 1.90" OD (2" OD)
- E. Concrete: ASTM C94/C94M-19a; Portland Cement, 2,500 p.s.i. strength at 28 days, 3 inch slump; one inch maximum sized coarse aggregate.
- F. Fence Accessories:
1. Chain Link Fence Accessories: Provide items required to complete fence system. Galvanize each ferrous metal item and finish to match framing.
 2. Post Caps: Formed steel, cast malleable iron, or aluminum alloy weathertight closure cap for tubular posts. Provide one (1) cap for each post (where top rail is used, provide tops to permit passage of top rail).
 3. Top Rail and Brace Rail Ends: Formed steel, malleable or cast iron, for connection of rail and brace to terminal posts.
 4. Top Rail Sleeves: 6 inch sleeve allowing for expansion and contraction of top rail.
 5. Wire Ties: 9 gauge galvanized steel wire for attachment of fabric to line posts. Double wrap 13 gauge for rails and braces. Hog ring ties of 12-1/2 gauge for attachment of fabric to tension wire.
 6. Brace and Tension (Stretcher Bar) Bands: Pressed steel.
 7. Tension (Stretcher) Bars: One piece lengths equal to 2 inches less than full height of fabric with a minimum cross-section of 3/16 inch x 3/4 inch or equivalent fiber glass rod. Provide tension (stretcher) bars where chain link fabric meets terminal posts.
 8. Tension Wire: 7 gauge, diameter core wire with tensile strength of 75,000 psi.
 9. Truss Rods: Steel rods with minimum diameter of 5/16 inch.
 10. Fasteners: Galvanized nuts and bolts.

2.3 CHAIN LINK SWING GATES

- A. Gate Frames: Fabricate chain link swing gates in accordance with ASTM F900 using galvanized steel tubular members, 2 inches square, weighing 2.60 lb/ft. Fusion or stainless

steel welded connections forming rigid one-piece unit.

- B. Chain Link Fence Fabric: Same as specified above for fence. Install fabric with hook bolts and tension bars at all four (4) sides. Attach to gate frame at not more than 15 inches on center.
- C. Hardware Materials - Hot dipped galvanized steel or malleable iron shapes to suit gate size.
 - 1. Hinges: Structurally capable of supporting gate leaf and allow opening and closing without binding. Non-lift-off type hinge design shall permit gate to swing 180 degrees inward.
 - 2. Latch: Non-accessible; Forked type capable of retaining gate in closed position and have provision for padlock. Latch shall permit operation from either side of gate.
 - 3. Gate Hardware: Shall conform to 1.2.D this section and as listed in part 4 below.
 - 4. Keeper: Provide keeper for each gate leaf over five (5) feet wide. Gate keeper shall consist of mechanical device for securing free end of gate when in full open position.
 - 5. Drop Rod: Provide at double gates to hold inactive leaf. Provide gate stop pipe to engage center drop rod. Provide locking device and padlock eyes as an integral part of latch, requiring one (1) padlock for locking both gate leaves.
- D. Gate Posts - Steel pipe, ASTM F1083, standard weight Schedule 40; minimum yield strength of 25,000 psi. Hot-dipped galvanized with minimum 1.8 oz/ft² of zinc. Sizes as follows:
 - 1. Width for single gate or one gate leaf of double gates:
 - b. Over 6 feet to 12 feet: 4.00 inches in diameter, weighing 9.11 lb/ft.

2.4 SETTING MATERIALS

- A. Concrete: Minimum 28 day compressive strength of 2,500 PSI

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify areas to receive fencing are completed to final grades and elevations.
- B. Ensure property lines and legal boundaries of work are clearly established.

3.2 CHAIN LINK FENCE FRAMING INSTALLATION

- A. Install chain link fence in accordance with ASTM F567 and manufacturer's instructions.
- B. Locate terminal post at each fence termination and change in horizontal or vertical direction of 30 degrees or more.
- C. Space line posts uniformly at 10 feet on center.
- D. Concrete fence post footings:
 - 1. Drill holes in firm, undisturbed or compacted soil. Excavate deeper than specified below as required for adequate support in soft and loose soils, and for posts with heavy lateral loads.
 - 2. Line posts shall be set in 9 inch minimum diameter concrete piers, with a minimum of 36 inches of post embedment in concrete with an additional 3 inch concrete cover at bottom.
 - 3. All end, corner, and pull posts shall be set in minimum 12 inch minimum diameter concrete piers, with a minimum of 36 inches of post embedment in concrete with an additional 3 inch concrete cover at bottom.

4. Place concrete around posts in a continuous pour.
 5. Trowel finish around post. Slope to direct water away from posts.
- E. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.
- F. Bracing: Install horizontal pipe brace at mid-height for fences six (6) and over, on each side of terminal posts. Firmly attach with fittings. Install diagonal truss rods at these points. Adjust truss rod, ensuring posts remain plumb.
- G. Tension Wire: Provide tension wire at bottom of fabric. Install tension wire before stretching fabric and attach to each post with ties. Secure tension wire to fabric with 12-1/2 gauge hog rings 24 inches on center.
- H. Top Rail: Install lengths, 21 feet. Connect joints with sleeves for rigid connections for expansion/contraction.
- I. Bottom Rails: Install bottom rails between posts with fittings and accessories.

3.3 CHAIN LINK FABRIC INSTALLATION

- A. Fabric: Install fabric on security side and attach so that fabric remains in tension after pulling force is released. Leave approximately 2 inches between finish grade and bottom selvage. Attach fabric with wire ties to line posts at 15 inches on center and to rails, braces, and tension wire at 24 inches on center.
- B. Tension (stretcher) bars: Pull fabric taut; thread tension bar through fabric and attach to terminal posts with bands or clips spaced maximum of 15 inches on center.
1. Install to the guideline of ASTM F2611.

3.4 ACCESSORIES

- A. Tie Wires: Bend ends of wire to minimize hazard to persons and clothing.
- B. Fasteners: Install nuts on side of fence opposite fabric side for added security.

3.5 CHAIN LINK SWING GATE POST INSTALLATION

- A. Install gate posts in accordance with manufacturer's instructions.
- B. Concrete gate post footings:
1. Drill holes in firm, undisturbed or compacted soil. Excavate deeper than specified below as required for adequate support in soft and loose soils, and for posts with heavy lateral loads.
 2. All gate posts shall be set in minimum 12 inch diameter concrete piers, with a minimum of 36 inches of post embedment in concrete with an additional 3 inch concrete cover at bottom.
 3. Place concrete around posts in a continuous pour.
 4. Trowel finish around post. Slope to direct water away from posts.
- C. Gate posts and hardware: Set keeper, stops, sleeves into concrete. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.

3.6 GATE INSTALLATION

- A. Install gates plumb, level, and secure for full opening without interference.
- B. Attach hardware by means which will prevent unauthorized removal.
- C. Adjust hardware for smooth operation.

3.7 CLEANING

- A. Clean up debris and unused material, and remove from the site.

END OF SECTION 32 31 13

SECTION 32 80 00 IRRIGATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes information relating to the provisions of all material, labor, equipment transportation, and services necessary for the furnishing and installation of the complete automatic sprinkler irrigation system as shown on the drawings and as specified herein. The work includes, but is not limited to:
 - 1. Pipe and fittings and accessories.
 - 2. Automatic valves.
 - 3. Manual valves.
 - 4. Control system.
 - 5. Trenching, stockpiling excavation materials and refilling trenches.
 - 6. Providing a complete system including piping, valves, fittings, rotors, sprinklers, automatic controls, dripline, and emitters and final adjustment of heads to ensure complete coverage.
 - 7. Line voltage connections to all irrigation controllers; low voltage control wiring from controller to remote control valves.
 - 8. Electrical service and hookup to automatic controller
 - 9. Automatic controller assembly and installation.
 - 10. Thrust Blocking.
 - 11. Submittals, tests, as-built and record drawings.
 - 12. Erosion control and repair of damage due to over watering and erosion.
 - 13. Warranty replacement.
 - 14. Cleanup, inspection and approval.
- B. Related Sections:
 - 1. Section 31 23 00: Excavation and Fill.
- C. Reference Standards:
 - 1. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
 - 2. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 - 3. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
 - 4. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 SUBMITTALS

- A. See Section 01 33 00: Submittal Procedures.
- B. Dimension from two permanent points of reference, building corners, sidewalk, or road intersections, etc., the location of the following items:
 - 1. Connection to existing water lines.
 - 2. Connection to existing electrical power.
 - 3. Gate valves.

4. Routing and/or directional turns of sprinkler pressure lines (dimension max. 100' along routing).
 5. Remote control valves.
 6. Routing of control wiring.
 7. Quick coupling valves.
 8. Other related equipment as directed by the Architect.
- C. Detail Drawings: Submit detailed drawings for Owner approval, for all assemblies not detailed on the drawings.
- D. Controller Charts:
1. Contractor shall provide a new controller chart indicating the updated project area the controller irrigates. The chart shall indicate existing valves and new valves with corresponding zones for each.
- E. Operation and Maintenance Data:
1. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.
 2. Provide schedule indicating length of time each valve is required to be open to provide a determined amount of water.
- F. Maintenance Materials - Provide the following for District's use in maintenance of project:
1. Prepare and deliver to the Architect, within 10 calendar days prior to completion of construction, two hardcover binders with three rings containing the following information:
 - a. Index sheet stating Contractor's address and telephone number, list of equipment with name and addresses of local manufacturer's representative.
 - b. Catalog and part sheets on every material and equipment installed under this contract.
 - c. Contractor's Guarantee statement that all equipment has been installed per plans and specifications.
 - d. Complete operating and maintenance instruction on all major equipment.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. Requirements of Regulatory Agencies: All work and materials shall be in full conformance with the latest rules and regulations of the California Plumbing and Electric codes.
 2. Manufacturer's Directions: Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturers of articles used in this contract furnish directions covering points not shown in the drawings and specifications.
 3. Underwriters Laboratories: Electrical wiring, controls, motors, and devices shall be UL listed, and so labeled.
- B. Installation Meetings:
1. Contractor shall be responsible for notifying the Architect or Designated Representative in advance for the following observation meetings, according to the time indicated (certain meetings may be grouped if prior approval is granted):
 - a. Coordinate one week prior to commencing work of this Section.
 - b. Pressure supply line installation and testing: 48 hours.
 - c. Coverage test: 48 hours.
 - d. Final site review: 7 days.
 2. When observations have been conducted by other than the Architect or Designated Representative, show evidence in writing of when and by whom these observations were made:

- a. Final Observation:
 - 1) The Contractor shall operate each system in its entirety for the Architect or Designated Representative at time of final observation. Any items deemed not acceptable by the Architect or Designated Representative, or not in compliance with these specifications and drawings, shall be reworked to the complete satisfaction of the Architect or Designated Representative.
 - 2) The Contractor shall show evidence to the Architect or Designated Representative that the District has received all accessories, charts, record drawings, and equipment as required before final observation can occur.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Handling of PVC Pipe and Fittings: The Contractor is cautioned to exercise care in handling, loading, unloading, storing and installation of PVC pipe and fittings. All PVC pipe shall be transported in a vehicle that allows the length of pipe to lie flat so as not to subject it to undue bending or concentrated external load at any point. Any section of pipe that has been dented or damaged will be discarded and, if installed, shall be replaced with new piping.

1.6 WARRANTY

- A. The warranty for the sprinkler irrigation system shall be made in accordance with the following form.
- B. A copy of the warranty form shall be included in the operations and maintenance manual.
- C. The warranty form shall be retyped onto the Contractor's letterhead and contain the following information:

WARRANTY FOR SPRINKLER IRRIGATION SYSTEM

We hereby warrant that the sprinkler irrigation system we have furnished and installed is free from defects in materials and work quality, and the work has been completed in accordance with the drawings and specification. We agree to repair or replace any defects in material or work quality that may develop during the period of one year from the date of acceptance, except those that may be caused by ordinary wear and tear, unusual abuse or neglect. We also agree to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the District. We shall make such repairs or replacements within a reasonable time, as determined by the District, after receipt of written notice. In the event of our failure to make such repairs or replacements within a reasonable time after receipt of written notice from District, we authorize the District to proceed to have said repairs or replacements made at our expense, and we will pay the costs and charges therefore upon demand.

PROJECT: _____
CONTRACTOR: _____ PHONE NO.: _____
ADDRESS: _____ BY: _____
DATE OF ACCEPTANCE: _____ BY: _____

PART 2 PRODUCTS

2.1 IRRIGATION SYSTEM

- A. Manufacturers:
 - 1. As shown on plans.
- B. Substitutions: See Section 01 60 00: Product Requirements.

2.2 PIPE MATERIALS

- A. PVC Pipe (Sizes up through 3"): ASTM D2241; 200 psi pressure rated upstream from controls, 160 psi downstream; solvent welded sockets.
- B. Pressure and Non-Pressure Main Line Piping and Fittings: Sizes 2 1/2 inches and smaller shall be Schedule 80 PVC.
- C. Non-pressure lines (buried): Shall be PVC Schedule 40.
- D. Fittings: Type and style of connection to match pipe and shall meet the requirements for service at an operating pressure of 150 pounds per square inch, unless otherwise specified.
- E. Pipe Risers at Valves: 160 psi PVC pipe.
- F. Solvent Cement: ASTM D2564 for PVC pipe and fittings.
- G. Sleeve Material: Schedule 40 PVC.
- H. PVC nipples: Schedule 80 with molded threads.
- I. All PVC pipe must bear the following markings:
 - 1. Manufacturer's name.
 - 2. Nominal pipe size.
 - 3. Schedule or class.
 - 4. Pressure rating in AST (not required on drip tubing).
 - 5. NSF (National Sanitation Foundation) approval (not required on drip tubing).
 - 6. Date of extrusion.

2.3 OUTLETS

- A. Manufacturer:
 - 1. As indicated on the drawings.
- B. Emitter: Non-clogging, self-cleaning per the model numbers shown on the drawings.
- C. Tree Bubbler: Fixed outlet capable of watering deep root systems directly.

2.4 VALVES

- A. Manufacturers:
 - 1. As indicated on the drawings.
- B. Gate Valves: Bronze construction non-rising stem.
- C. Ball Valves: PVC Type II construction 150 PSI working pressure.
- D. Quick Coupling Valves - Two-piece brass body construction, 150-pound class, with 1-inch female threads opening at base permitting operation with a special connecting device (coupler) designed for this purpose:
 - 1. Coupler threads: Lug type.
 - 2. Hinge cover: Provide with rubber-like locking N/A vinyl cover.
- E. Remote Control Valves:
 - 1. Valve Type: Spring loaded, packless diaphragm activated, normally closed type with

brass body, equipped with flow control and pressure regulation capabilities where noted.

2. Valve Solenoid: 24 volt AC, 4.5 watt maximum, 500 milli-amp maximum surge, corrosion-proof, stainless steel construction, epoxy encapsulated to form a single integral unit unless otherwise noted on plans.
3. Provide bleeder valve to permit operation in the field without power at the controller.

F. Valve Boxes:

1. Remote control Valves: 14" x 19" of concrete material with locking cover.
2. Gate valves, ball valves and quick couplers: 10" round of concrete material with locking cover.
3. Valve box extensions shall be by the same manufacturer as the valve box.
4. Emboss, letters on valve boxes to indicate contents of valve box. (ie. GV = Gate Valve, QC = Quick Coupler, RC = Remote Control Valve, MV = Master Valve, BV = Ball Valve).

2.5 CONTROLS

A. Manufacturers:

1. As indicated on the drawings.

B. Controller: As indicated on the drawings. Shall meet district standard. Controller shall be capable of reading soil moisture sensory input data.

2.6 ELECTRICAL (LOW VOLTAGE)

A. Connections between controller and remote control valves shall be made with direct burial AWG-UH, 600-volt wire, insulation thickness 3/64 inch, utilizing low-density high molecular weight polyethylene insulation.

B. Splices, where permitted, shall be waterproofed using Rain Bird, Pen-Tite Connectors or fusible heat shrinking tubing, and housed in a box. Boxes for other irrigation use may be utilized for this purpose.

C. Wire sizing shall be minimum of #14 "UF" 600 volt underground wiring, unless a shielded cable is used in which case #16 wire may be used. Common wires to be #12 and white in color. Each "hot" valve wire shall have a distinct and unique color other than white with no repetition of colors.

PART 3 EXECUTION

3.1 COORDINATION

A. Coordinate the work with site backfilling, landscape grading and delivery of plant life.

3.2 JOB CONDITIONS

A. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the Architect. In the event this notification is not performed, the irrigation Contractor shall assume full responsibility for any revision necessary.

3.3 SUBSTITUTIONS

- A. Procedure: Submit information in conformance with the substitution requirements of Division 01.
- B. Provide descriptive catalog literature, performance charts and flow charts for each item to be substituted.

3.4 EXAMINATION

- A. Verify location of existing utilities.
- B. Verify that required utilities are available, in proper location, and ready for use.

3.5 PREPARATION

- A. Drawings are generally diagrammatic and indicative of the work to be installed. Due to the scale of drawings, it is not possible to indicate all offsets, fittings, sleeves, etc., which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of his work and plan accordingly, furnishing such fittings, etc., as may be required.
- B. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions and receive Architect or Designated Representative's approval prior to proceeding with work under this section.
- C. Coordinate installation of irrigation system, including pipe, so there will be NO interference with utilities or other construction or difficulty in planting trees, shrubs, and ground covers. The Contractor shall carefully check all grades to satisfy him/her that he may safely proceed before starting work on the irrigation system.
- D. All piping or equipment shown diagrammatically on drawings outside planting areas shall be installed inside planting areas whenever possible.
- E. Layout and stake locations of system components.
- F. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system.

3.6 TRENCHING

- A. Trench and backfill in accordance with Section 31 23 00: Excavation and Fill.
- B. Excavate trenches to required depths. Follow approved layout for each system.
- C. Trench bottom shall be flat to ensure piping is supported continuously on an even grade.
- D. Where lines occur under paved areas, consider dimension to be below the subgrade.
- E. Trench Size:
 - 1. As indicated on the drawings.
- F. Trench to accommodate grade changes and slope to drains.
- G. Maintain trenches free of debris, material, or obstructions that may damage pipe.

3.7 INSTALLATION

- A. Assemblies:
1. Install pipe, valves, controls, and outlets in accordance with manufacturer's instructions.
 2. Line Clearance: All lines shall have a minimum clearance of 6 inches from each other and from lines of other trades. Parallel lines shall not be installed directly over one another.
 3. Connect to utilities.
 4. Install all assemblies specified herein in accordance with respective detail. In absence of detail drawings or specification pertaining to specific items required to complete work, perform such work in accordance with best standard practice, with prior approval from Architect or Designated Representative.
 5. PVC pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before installation. Installation and solvent welding methods shall be as recommended by the pipe and fitting manufacturer.
 6. On PVC to metal connections, the Contractor shall work the metal connections first. Teflon tape or approved equal shall be used on all threaded PVC to PVC, and on all threaded PVC to metal joints. Light wrench pressure is all that is required. Where threaded PVC connections are required, use threaded PVC adapters into which the pipe may be welded.
 7. Quick Coupling Valves: Unless otherwise indicated, locate valves within 12 inches of hardscape.
 8. Set outlets and box covers 2 inches above finish grade in shrub planters.
 9. Provide for thermal movement of components in system.
 10. Use threaded nipples for risers to each outlet.
- B. Electrical Supply:
1. Low voltage wiring shall be placed in the same ditch and taped on bottom side of main lines unless otherwise approved.
 2. Wire is to be taped a maximum 12 feet on center.
 3. Provide a 12-inch expansion loop at each connection and directional change.
 4. Use a continuous wire between controller and remote control valves. Except as otherwise approved, do not splice wire at any point. All approved splices shall be enclosed in an acceptable box.
 5. Each controller shall be provided with separate ground wire.
- C. Automatic Controller:
1. Install as per manufacturer's instructions. Remote control valves shall be connected to controller in numerical sequence as shown on the drawings.
 2. Controller shall be mounted in same location as existing controller was.
- D. System Flush: After piping is installed, but before outlets are installed and backfilling commences, open valves and flush system with full head of water.
- E. Valve Boxes:
1. All buried valves and equipment shall be installed with a proper box as specified in part 2- products.
 2. Fill area under box with a minimum of 1 cubic feet of pea gravel before box is installed:
 - a. Identification tags shall be attached to each remote control valve, showing number that corresponds with controller sequence. Tags shall be manufactured of polyurethane Behr Desopaid, yellow in color with black letters 2-3/4 inches by 2-1/4 inches.
 - b. All boxes shall be permanently marked on top, designating type of equipment installed as noted in drawing.

3.8 FIELD QUALITY CONTROL

- A. Prior to backfilling, test system for leakage at main piping to maintain 100 psi pressure for two hours.
- B. System is acceptable if no leakage or loss of pressure occurs and system self-drains during test period.
- C. Testing of pressure main lines shall occur prior to installation of electrical control valves, quick couplers or any other equipment that might prevent a proper test from being performed.
- D. All piping under paved areas shall be tested under hydrostatic pressure of 150 pounds per square inch, and proved watertight, prior to paving.
- E. If leaks develop, replace joints and repeat test until entire system is proven watertight.
- F. All hydrostatic tests shall be made only in the presence of the Architect or Designated Representative of the District. No pipe shall be completely backfilled until it has been inspected, tested and approved in writing.
- G. Furnish necessary force pump and all other test equipment.
- H. Upon completion of each phase of work, entire system shall be tested and adjusted to meet site requirements.
- I. Low voltage wire under paving shall be tested for continuity, prior to paving.

3.9 BACKFILLING

- A. Backfill trench and compact to specified subgrade elevation. Protect piping from displacement.
- B. Buried pipe in trenches shall be center loaded only until all required tests are performed. Trenches shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand or other approved materials, free from large clods of earth or stones. Backfill shall be mechanically compacted in landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill will conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.
- C. A fine granular material backfill will be initially placed on all lines. No foreign matter larger than 1/2 inch in size will be permitted in the initial backfill.
- D. Flooding of trenches will be permitted only with approval of the Architect or Designated Representative.
- E. If settlement occurs and subsequent adjustments in pipe, valves, sprinkler heads, lawn or planting, or other construction are necessary, the Contractor shall make all required adjustments without cost to the District.

3.10 TEMPORARY REPAIRS

- A. The District reserves the right to make temporary repairs as necessary to keep the sprinkler system equipment in operating condition. The exercise of this right by the District shall not relieve the Contractor of his responsibilities under the terms of the warranty as herein specified.

3.11 SYSTEM STARTUP

- A. Prepare and start system in accordance with manufacturer's instructions.
- B. Adjust control system to achieve time cycles required.

3.12 MAINTENANCE

- A. The entire sprinkler irrigation system shall be under full automatic operation for a period of seven days prior to any planting.
- B. The Architect or Designated Representative reserves the right to waive or shorten the operation period.

3.13 CLEANUP

- A. Cleanup shall be performed as each portion of the work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed or washed down, and any damage sustained to the work of others shall be repaired and work returned to its original condition.

3.14 OPERATING INSTRUCTIONS

- A. The Contractor shall be required to train District's maintenance personnel in proper operation of all major equipment. Provide written evidence of the person or persons so trained to the Architect or Designated Representative.

3.15 CLOSEOUT ACTIVITIES

- A. Instruct District's personnel in operation and maintenance of system. Use operation and maintenance material as basis for demonstration.

END OF SECTION 32 80 00