Project Manual

For

Orange Grove High School
Transportation Office

300 Buena Vista Ave.
Corona, Ca 92882

Bidding and Contract Requirements
And
Specifications

for the

Corona Norco Unified School District
2820 Clark Ave.
Norco, Ca. 92860

Date: **8/31/23**

PBK Project No.: 230010

IDENTIFICATION STAMP
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APP: 04-122251 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 10/24/2023

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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: **Orange Grove High School – Transportation Office**
300 S. Buena Vista Ave.
Corona, CA 92882

B. Owner: **Corona-Norco Unified School District**
1. Owner's Representative: **John Vondriska**
Administrative Director Facilities
jvondriska@cnusd.k12.ca.us

C. Architect: **PBK**
8163 Rochester Ave #100
Rancho Cucamonga, CA 91730

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:
1. Relocate and refurbish one (1) 36’x40’ modular building
2. Site improvements including but not limited to walkways, utilities, and landscaping

B. Type of Contract: Project will be constructed under a Design-Bid-Build

1.5 WORK SEQUENCE

A. The Work shall be completed according to the Project schedule set forth by the District.

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.

D. Project Schedule:

The following schedule summarizes the major activity dates: TBD

Activity	Dates and Time (As Applicable)
Add Date #1	
Add Date #2	
Mandatory Pre-Bid Job Walk	
Bids RFI's Due to District	
Addendum Issued	
Bid Opening Date	
Board Award of Contract	
Construction to Begin	
Dry-in Substantial Completion	
Final Completion Date	

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.

B. Owner Furnished Products (OFCI):
1. The Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner furnished products and making building services connections when applicable:
   a. Owner Furnished Products: Coordinate with Owner.

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

3.1 CONSTRUCTION SCHEDULE

A. The Owner has a critical need for the Work to begin upon Notice to Proceed and shall be Substantially Complete by the date specified on the Project Schedule**. There will be No Extensions of Time due to weather.**

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
_____	_____	_____	_____

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.

____ Has the substituted manufacturer/product been installed on previous PBK projects?

If so, list project(s): (List projects within the last two years)

1. _____

   District: _____

   Contact:_____

2. _____

   District_____

   Contact:

   _____

Submitted by:

_____

Signature of Contractor Title

_____

Firm Telephone 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

By: _____

Date: _____

Remarks: _____

FOR USE BY OWNER:

____ Accepted ____ Not Accepted

By: _____

By: _____

Remarks: _____

END OF SECTION 01 25 00

SECTION 01 26 13 REQUEST FOR INFORMATION

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 provisions for preparation, submittal and response to Contractor's Request for Information (RFI's) during construction of project.

B. Related Sections:
   1. General Conditions of the Contract.

1.3 DEFINITIONS

A. PDF, Portable Document Format: An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

B. RFI, Request for Information: Request from Contractor seeking information required by or clarification of the Contract Documents.

1.4 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Submit RFI's via email as PDF electronic files. Architect will not act on any RFI's until 7 days following the submission of the Schedule of Values per Division 01 Section "Payment Procedures."
   1. RFI Form: Use RFI form included at end of this Section or form acceptable to Architect. Upon request from the Contractor, the form at the end of this section will be made available in WORD format from the Architect.
   2. Attachments: Attachments shall be in PDF electronic file format.

1.5 REQUESTS FOR INFORMATION (RFIS)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
   1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   1. Project name.
   2. Project number.
   3. Date.
   4. Name of Contractor.
   5. Name of Architect
   6. RFI number, numbered sequentially.
   7. RFI subject.

8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow 10 working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
4. Distribution: One electronic copy of each completed RFI review shall be distributed by the Architect to the Contractor and the Owner.

D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the sequential RFI number. Submit log weekly unless otherwise directed in writing by Architect. Include the following:
1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 7 days if Contractor disagrees with response.

F. Contractor's Expense for RFI's: Architect will review and respond to legitimate RFI's at no additional cost to the Contractor. RFI's determined by the Architect to be flagrant or unnecessary will have the expense for the Architect's time paid by the Owner with the amount being deducted from the Contract Sum. The expense will be based on an hourly rate in accordance with the Architect's standard hourly rate schedule in effect at the time the work is performed with a minimum of one hour for each flagrant or unnecessary RFI.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 26 13

CONTRACTOR'S REQUEST FOR INFORMATION

RFI #

From: _____ Project Number:_____ Date: __

To: Project: _____

Disciplines Impacted: Architectural [ ] Structural [ ] Mechanical [ ] Electrical [ ]
Civil [ ] Landscape [ ] Kitchen [ ]

Reference: _____ Drawing(s) _____ Spec. Section(s) _____

Other

Please clarify or provide the following information:

_____

Contractor's Suggestions: _____

_____

Possible Cost Impact: Unknown [ ] Increase [ ] Decrease [ ] No Change [ ]

Possible Time Impact: Unknown [ ] Increase [ ] Decrease [ ] No Change [ ]

This information is required as soon as possible, but no later than _____

[ ] PRIORITY ATTENTION REQUIRED

Contractor's Representative:

_____

Architect's Response: Date: _____

PBK Architects Copies____

_____

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

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 by 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.
   1. Reviewed: Indicates the Architect has reviewed the submittal and takes no exceptions as submitted.
   2. Furnish as Corrected: Submittal is approved, provided modifications noted are properly incorporated. Resubmission is not usually necessary.
   3. Revised and Resubmit: Modifications are required prior to approval. Work cannot proceed until the submittal is revised and resubmitted for further review.
   4. Rejected: Work covered by the submittal is not complete or does not conform the contract documents and cannot proceed. A new submittal needs to be made according to the notations and resubmitted for approval prior to fabrication or construction.

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 46 INDOOR AIR QUALITY 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. Construction procedures to promote adequate indoor air quality after construction.
2. Testing indoor air quality after completion of construction.

B. Related Sections:
1. Section 01 60 00: Product Requirements.
2. Section 23 05 93: Testing, Adjusting, and Balancing for HVAC.
3. Section 23 81 26: Split-System Air-Conditioners.

C. Reference Standards:
1. ASHRAE Std 52.2 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
2. ASHRAE Std 62.1 – Ventilation For Acceptable Indoor Air Quality.
3. ASHRAE Std 129 – Measuring Air-Change Effectiveness.
4. ASTM E779 – Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.
5. SMACNA (OCC) – IAQ Guideline for Occupied Buildings Under Construction.

D. Project Goals:
1. Dust and airborne particulates:
   a. Prevent deposition of dust and other particulates in HVAC ducts and equipment:
      1) Establish condition of existing ducts and equipment prior to start of alterations.
      2) Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
2. Airborne contaminants:
   a. Procedures and products have been specified to minimize indoor air pollutants:
      1) Furnish products meeting the Specifications.
      2) Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

E. Verification: HVAC system has been designed to achieve the minimum requirements for ventilation specified in ASHRAE 62.1, with verification provided by MEP Engineer of Record.

1.3 DEFINITIONS

A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics fibrous insulation, and other similar products.

B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

C. Particulates: Dust, dirt, and other airborne solid matter.

D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.4 SUBMITTALS

A. See Section 01 33 00: Submittal Procedures.

B. Submittals provided by Owner and/or the Commissioning Agent: To be reviewed by Contractor and submitted to Architect for processing.

C. Indoor Air Quality Management Plan:
1. Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA IAQ Guidelines for Occupied Buildings Under Construction as a guide (submit prior to pre-construction meeting):
   a. Submit not less than 60 days before enclosure of building.
   b. Identify potential sources of odor and dust.
   c. Identify construction activities likely to produce odor or dust.
   d. Identify areas of Project potentially affected, especially occupied areas.
   e. Evaluate potential problems by severity and describe methods of control.
   f. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters, and schedule for replacement of filters.
   g. Describe cleaning and dust control procedures.
   h. Describe measures to be taken for protection of absorptive materials.
   i. Outline requirement for filtration for air handling equipment used during construction to use media with a minimum of MERV 8 at each return grill if permanently installed air handlers are used during construction.

D. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors, or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.

E. Duct and Terminal Unit Inspection Report.

F. Air Contaminant Test Plan:
1. Identify:
   a. Testing agency qualifications.
   b. Locations and scheduling of air sampling.
   c. Test procedures, in detail.
   d. Test instruments and apparatus.
   e. Sampling methods.

G. Air Contaminant Test Reports:
1. Show:
   a. Location where each sample was taken, and time.
   b. Test values for each air sample; average the values of each set of three (3).
   c. HVAC operating conditions.
   d. Certification of test equipment calibration.
   e. Other conditions or discrepancies that might have influenced results.

H. Ventilation Effectiveness Test Plan:
1. Identify:
   a. Testing agency qualifications.

b. Description of test spaces, including locations or air sampling.
c. Test procedures, in detail; state whether tracer gas decay or step-up will be used.
d. Test instruments and apparatus; identify tracer gas to be used.
e. Sampling methods.

I. Ventilation Effectiveness Test Reports:
1. Include preliminary tests of instruments, apparatus, and test spaces.
2. Calculation of ventilation effectiveness, E.
3. Location where each sample was taken, and time.
4. Test values for each air sample.
5. HVAC operating conditions.
6. Other information specified in ASHRAE 129.
7. Other conditions or discrepancies that might have influenced results.

PART 2 PRODUCTS

2.1 MATERIALS

A. Low VOC Materials: See other Sections for specific requirements for materials with low VOC content.

B. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE 52.2.

PART 3 EXECUTION

3.1 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials:
1. Sequence the delivery of such materials so that they are not present in the building until wet work is completed and dry.
2. Deliver and store such materials in fully sealed moisture-impermeable packaging.
3. Provide sufficient ventilation for drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. If extremely dusty or dirty, work must be conducted inside the building:
1. Shut down HVAC systems for the duration.
2. Remove dust and dirt completely before restarting systems.

D. HVAC equipment and supply air ductwork may be used for ventilation during construction:
1. Operate HVAC system on 100 percent outside air, with 1.5 air changes per hour, minimum.
2. Ensure that air filters are correctly installed prior to starting use:
a. Replace filters when they lose efficiency (for corridor HVAC only).
3. Do not use return air ductwork for ventilation.
4. Seal return air inlets or otherwise positively isolate return air system to prevent recirculation of air:
a. Provide alternate return air pathways (for corridor HVAC only).

E. Do not store construction materials or waste in mechanical or electrical rooms.

F. Prior to use of return air ductwork without intake filters, clean up and remove dust and debris generated by construction activities:
1. Inspect duct intakes, return air grilles, and terminal units for dust.

2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes, and conduit.
3. Clean tops of doors and frames.
4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
5. Clean return plenums of air handling units.
6. Remove intake filters last after cleaning is complete.

G. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

H. Use other relevant recommendations of SMACNA IAQ Guideline for Occupied Buildings Under Construction for avoiding unnecessary contamination due to construction procedures.

END OF SECTION 01 35 46

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 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 2022 California Administrative Code (Title 24, Part 2, Volume 2) describes the general administrative requirements for the Project under the jurisdiction of the Division of the State Architect (DSA). Included is a list of inspections coordinated with CBC Section listings. 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:
   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.
   c. Laboratory Evaluation and Acceptance program to evaluate laboratories acceptable to DSA.
   d. 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/ft^3 (600 kN-m/m^3).
         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 PIER DRILLING OPERATION

A. A representative of a qualified geotechnical laboratory shall provide services specified.

B. Laboratory representative shall make continuous inspections to determine that proper bearing stratum is obtained and utilized for bearing and that shafts are properly clean and dry before placing concrete.

C. Laboratory shall furnish complete pier log showing the diameter, top and bottom elevations of each pier, casing required or not required, actual penetration into bearing stratum, elevation of top of bearing stratum, volume of concrete used, and deviations from specified tolerances.

D. Laboratory representative shall make continuous inspections of drilled pier construction to check the following:
1. Verify soundness of bearing stratum and desired penetration.
2. Verify pier dimensions and reinforcing used.
3. Monitor condition of hole and removal of water and loose material from bottom.
4. Monitor placement of concrete and use of tremie or pumps.
5. Monitor the extraction of casing, if used.

E. Request probe holes when deemed necessary to confirm safe bearing capacity.

3.7 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.

3.8 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. Test Footings (Shafts; Piers; Caissons): Same diameter and type specified for footings, placed in same manner. Accepted test footings may be used in the Work.

X. 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.

Y. 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.

3.9 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.

3.10 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.

3.11 REINFORCING STEEL MECHANICAL SPLICES

A. Inspection and Observation Services:
   1. Visually inspect and report on completed condition of each mechanical splice of reinforcing steel.
   2. Visually inspect each mechanical splice to ensure compliance with the ICC-ES Reports and the manufacturer's published criteria for acceptable completed splices.
   3. Place special emphasis on the inspection of the end preparation of each bar to be spliced required by the ICC-ES Report.

B. Reports:
   1. Submit reports to Architect:
      a. Copies of manufacturer's published criteria for acceptable completed splices prior to observing mechanical splices.
      b. Reports on each mechanical splice shall indicate location of the splice, size of bars spliced, and acceptability or rejection of splice. Indicate reasons for rejection on each report.

3.12 OPEN WEB JOISTS AND JOIST GIRDERS

A. Inspect joists at jobsite for compliance with specified fabrication requirements. Verify welded connections between web and chord, splices, and straightness of members.

B. Inspect installation of joists at jobsite. Check connections to supporting members, chord extensions, number of rows of bridging, and bridging connections for compliance with Contract Documents and referenced standards.

C. Verify welder qualification certificates for both shop and field welding operators.

3.13 METAL FLOOR DECK

A. Field inspection shall consist of:
   1. Verifying types, gauges, and finishes for compliance with Contract Documents and shop drawings.
   2. Examine composite floor deck exposed to crawl space for damage to galvanizing due to welding or construction activities. Repair galvanized composite floor deck in accordance with the Specifications.
   3. Examine the erection of metal deck, fastenings, reinforcing of holes, deck reinforcing, miscellaneous deck supports, hanger tabs, shear studs, deck closures, painting, or other coating.
   4. Certification of welders.
   5. Inspect and test field welded shear studs used to fasten metal floor decking to supporting steel as specified for structural steel.

3.14 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.

3.15 SPRAYED FIREPROOFING

A. Verify that applied thickness, density, and bond strength of sprayed fireproofing meets fire rating requirements of approved design.

B. Verify that installation complies with fire rating requirements of approved design.

C. Inspect and test for thickness:
1. Test 25 percent of structural frame columns and beams in each building level.
2. Test ten percent (10%) of beams other than structural frame in each building level.
3. Test one (1) slab per 5,000 square feet of building area.

D. Inspect and test in accordance procedures of ASTM E605 and ASTM E736.

3.16 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.

3.17 LIGHTWEIGHT INSULATING CONCRETE FILL

A. Inspection and Observation Services (As Required):
1. Inspection of roof deck prior to start of Work.
2. Inspection during installation of insulation and lightweight insulating concrete fill Work to ascertain compliance with Contract Documents.
3. Observation of base ply fastener pull tests performed by Contractor to ascertain minimum withdrawal resistance of 40 pounds per fastener.

B. Testing Services (As Required):
1. References (as applicable for tests required):
   a. American Society for Testing and Materials (ASTM):
      1) C177 - Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties By Means of the Guarded Hot Plate Apparatus.
      2) C495 - Test Method for Compressive Strength of Lightweight Insulating Concrete.
      3) C578 - Specification for Rigid, Cellular Polystyrene Thermal Insulation.
2. Test EPS insulation board for thermal insulation value in accordance with ASTM C177.
3. Test lightweight insulating concrete fill in accordance with ASTM C495 for:
   a. Mix design compressive strength.
   b. Mix design wet and dry density range.
   c. Number of Tests:
      1) One (1) per 5,000 square feet.
      2) Not less than one (1) for each day's Work.
4. Test EPS insulation board for density in accordance with ASTM C578.

3.18 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.

3.19 MASONRY

A. Inspection and Observation Services:
1. Inspection of placement of reinforcement including condition, grade, size, location, spacing, and lap splices.
2. Review mortar design mixes.
3. Inspection of laying, mortaring, and grouting of concrete masonry units and elements.

B. Testing Services:
1. References (as applicable for tests required):
   a. ASTM International (ASTM):
      1) C140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units.
      2) C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
      3) C1019 - Standard Test Method for Sampling and Testing Grout.
2. Testing of Concrete Masonry Units (CMU):
   a. Pre-construction - Perform the following tests in accordance with ASTM C140:
      1) Compressive Strength.
      2) Absorption.
      3) Weight.
      4) Moisture Content.
      5) Dimensions.
3. Mortar Tests:
   a. Pre-construction - Perform the following tests in accordance with ASTM C780 on each type of mortar mix used on the Project:
      1) 28-day compressive strength.
      2) Water retention.
   b. Construction: Perform 28-day compressive strength test in accordance with ASTM C780 on each type of mortar mix used on the Project at the rate of one (1) test per 2,000 square feet of masonry.
4. Refer to and include Work for reinforcing steel specified.
5. Grout tests:
   a. Pre-construction - Perform the following tests in accordance with ASTM C1019 on each type of grout mix used on the Project:
      1) Slump test.
      2) 28-Day compressive strength.
   b. Construction: Perform 28-day compressive strength test in accordance with ASTM C1019 on each type of grout mix used on the Project at the rate of one (1) test per 2,000 square feet of masonry.
6. Prism test: Perform pre-construction 28-day compressive strength test on concrete masonry walls.

3.20 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 45 24 IMPORT MATERIALS TESTING

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 specifies the requirements for the sampling, testing, transportation, and certification of imported fill materials to school sites.

B. This Specification defines:
1. Contractor requirements for use of imported materials on Project sites.
2. Contractor requirements for stockpiling materials for use on Project sites.
3. Testing requirements for all materials imported, stockpiled, or generated for use on a Project site.
4. Contractor testing and reporting requirements.
5. Contractor submittal requirements.

C. Objectives:
1. Ensure that fill materials imported to Project sites are safe for students, staff, and visitors.
2. Ensure that representative data be collected so that analytical determinations can be made in regard to the first objective.
3. Require Contractor to contract with and pay for the services of a licensed environmental professional (licensed State of California Professional Engineer (PE Civil), Professional Geologist (PG) or Registered Environmental Assessor II (REA II) familiar with environmental site assessment and waste classification.
4. Require Contractor to contract with and pay for an independent, approved California Department of Health Services certified testing laboratory to perform sampling and testing of imported and site generated fill materials.
5. Require Contractor to pay all fees required by authorities having jurisdiction over area.
6. Require Contractor to post bonds required by authorities having jurisdiction over area.

1.3 SUBMITTALS

A. Contractor shall submit to Owner's Authorized Representative (OAR):
1. A qualifications statement for Contractor's independent California certified testing laboratory and required licensed environmental professional (California Professional Engineer (PE civil), Professional Geologist (PG), or Registered Environmental Assessor II (REA II) prior to the start of Work. Contractor's licensed environmental professional must possess recent demonstrated environmental experience in soil sampling and waste classification:
   a. Testing laboratory must be pre-approved by the Division of State Architect.
2. A draft import Sampling Strategy Plan (SSP) prepared by Contractor's licensed environmental professional for review and concurrence by the OAR. The objective of the SSP is to obtain representative sample data. The draft SSP must be submitted at least 72 hours prior to all proposed import sampling activities:
   a. At a minimum, the draft SSP shall include a site map which shows the location of the proposed import and the location and number of the proposed stockpile samples. The draft SSP shall also contain information pertaining to the total volume of the stockpile proposed for sampling and the rationale in support of the proposed sampling approach. Existing environmental documentation specific to the import site shall be utilized by Contractor's

environmental professional to support the proposed sampling approach and analytical method suite. For new Project sites, this information would include a DTSC approved site investigation report, e.g., Preliminary Environmental Assessment (PEA). It is the responsibility of Contractor to request this information in advance from the OAR if they do not already have access to a copy at the jobsite.

b. Lacking this information or rationale, samples shall be analyzed for all analytical methods described in this Section. Guidance for the minimum number of samples per stockpile volume is provided in Table 1 (supplemental samples may be required by the OAR if pothole stockpile sampling is utilized). In addition, the draft SSP shall contain all necessary contact information for the import site and a proposed schedule for the sampling activities.
c. To expedite the review process, the draft SSP shall be submitted electronically to the OAR in MS Word format.
d. Upon revision of the draft SSP by Contractor's licensed environmental professional and acceptance by the OAR, four (4) revised copies of the final SSP will be provided to the OAR for distribution to OEHS and the Project file.

3. A draft certification/sample data report prepared by Contractor's licensed environmental professional for review and concurrence. At a minimum, the draft certification/sample data report shall contain:
   a. A site map showing the location of the stockpile and stockpile sample locations.
   b. A detailed discussion and evaluation of the laboratory results.
   c. A summary of findings and recommendations that provide a determination on the waste classification of the subject materials, based on the representative sample results.
   d. Recommendations for additional steps, if any.
   e. Chain-of-custody forms and all laboratory data with respective QA/QC sheets.
   f. To expedite the review process, the draft SSP shall be submitted electronically to the OAR in MS Word format.
   g. Upon revision of the draft certification report by Contractor's licensed environmental professional and acceptance by the OAR, three (3) copies of the final report will be submitted to the OAR.
4. The environmental compliance manager shall confirm that the proposed waste classification for the proposed import material is appropriate.
5. Written documentation, in the form of a memo or e-mail from Contractor to OAR, prior to import, verifying that the hauling contract specifies "clean" trucks and that the actual haul trucks utilized for import activities will be clean of visible contamination or deleterious materials.
6. Written documentation that the trucks went directly from the source location to the recipient location with no detours or stops at other locations and that short loads were not augmented by other materials that were not tested as part of the final import SSP. It is Contractor's responsibility to document that no other trips or short-load augmentation occurred and submit to the documentation within five (5) business days of the completion of the import activities. All import transportation activities shall be conducted in accordance with all applicable (local, State, and Federal) rules and regulations.
7. The independent approved testing laboratory shall perform the required tests and report results of all tests noting if the tested material passed or failed such tests and shall furnish copies to the IOR, Architect, OAR, DSA, Contractor, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, Title 24, CCR, and DSA. Upon completion of the Work of this Section, the independent testing laboratory and geotechnical engineer shall submit a verified report to DSA as required by Title 24, CCR.
8. Certification, in the form of haul tickets or completed waste manifests, documenting the volume and recipient of all import materials and activities. This documentation shall be coordinated through the OAR environmental compliance manager:
   a. For approved import to new Project sites, unregulated facilities (landfill) or non-Project sites, haul tickets may be utilized, but shall contain the following minimum information:
      1) Date of haul activity.
      2) Address of source.
      3) Address of recipient.

4) Load volume.
5) Time of departure from source.
6) Time of arrival at recipient site.
7) Signature of recipient or recipient's agent.

1.4 QUALITY ASSURANCE

A. No import of earth or geotechnical grading or fill materials can occur at the Project site without prior approval by the OAR.

PART 2 PRODUCTS

2.1 MATERIALS

A. Imported:
1. Soils: Soils proposed for import shall be tested pursuant to the requirements of this Section.
2. Gravels: Clean gravel, consisting of native rock from a commercial source, shall be tested pursuant to the requirements of this Section.
3. Sands: Clean sand from a commercial source shall be tested pursuant to the requirements of this Section. Contractor shall provide written documentation, which identifies the source, volume, and proposed transport date(s) of the material for review.
4. Miscellaneous material: No miscellaneous material containing crushed concrete, asphalt, construction debris, or other potential deleterious materials may be utilized or imported to the Project site for use as fill or grading material.

B. Pre-Tested Sites:

Vulcan Materials Company
1709 Sherbon Street
Corona, CA 92879
Materials Tested: Sand, CAB, and 3/4 " Rock

LB Crushing Company
3100 Horseless Carriage Road
Norco, CA
Materials Tested: Sand

El Toro Materials
Rocky Road & Portola Parkway
Lake Forest, CA
Materials Tested: Sand

Hanson Aggregates North America-Inland Plant
12000 Banyan Street
Rancho Cucamonga CA 91730
Materials Tested: Sand

Hanson Aggregates North America-Irwindale
13550 Live Oak Avenue
Irwindale, CA 91706 Materials
Tested: Sand

Inland Empire Regional Composting Authority (IERCA)
12645 Sixth Street
Rancho Cucamonga, CA 91739 Materials
Tested: Top Soil and Mulch

C. Import of Fill Materials:
1. Fees: Contractor shall pay as required by authorities having jurisdiction over area.

2. Bonds: Contractor shall post as required by authorities having jurisdiction over area.

PART 3 EXECUTION

3.1 GRADING/EXCAVATION

A. If Contractor encounters an area(s) with discolored, stained, and/or odorous soils or any other evidence of contamination during excavation/grading work, Contractor must immediately notify District Representative, cease work in the aforementioned area(s), and secure the area(s) with fencing, tape, stakes, or other suitable means to prevent entry by personnel or equipment. In turn, the District Representative will initiate a construction response to address the contamination, in accordance with pertinent regulatory requirements.

3.2 SAMPLING AND TESTING

A. Contractor shall contract with, and pay for, the services of a licensed environmental professional (licensed State of California Professional Engineer (PE Civil), Professional Geologist (PG), or Registered Environmental Assessor II (REA II).

B. Contractor shall contract with, and pay for, an independent, approved California Department of Health Services certified testing laboratory to perform sampling and testing of imported, exported, and site generated fill materials:
   1. Note: Utilization of portable, onsite crushing equipment on the Project site also requires prior notification and approval by the OAR.

C. All imported fill/grading material, unless otherwise specified in writing by the OAR, must be tested at the site of origin. Import testing and certification process shall include the following steps:
   1. Stockpile all materials for sampling (standard stockpile or backhoe pothole stockpile). Crushed fill materials generated by Contractor at a Project site must be segregated by material (e.g., separate stockpiles for concrete, asphalt, etc.).
   2. Submit draft SSP for review and concurrence by OAR.
   3. Collect and analyze samples (see Table 1 for number of samples per volume) per SSP. Once fill materials for export have been stockpiled and tested, they may not be used onsite for any purpose without prior approval by OAR.
   4. Submit draft import sample data report for review and concurrence by OAR.
   5. Submit final import sample data report (certification report) to OAR's environmental compliance manager for concurrence of proposed waste classification.
   6. Submit required pre-import documentation/record to the OAR (e-mail).
   7. Submit post import certifications to the OAR.
   8. In addition to the preceding, requirements, certifications, and submittals as indicated in previous subsections above.

D. Owner retains the right to refuse any fill material proposed for use at a Project site.

E. Import fill materials shall be stockpiled by Contractor and are deemed acceptable for import or reuse only when it is demonstrated to the satisfaction of the OAR's environmental compliance manager that the subject materials meet the requirements of this Section.

F. As described in this Section, lacking site-specific data or sample rationale to support a more focused analytical approach, Contractor shall analyze all samples for the following substances according to the methods indicated below. Table 3 is a waste classification flowchart for use by Contractor's environmental professional. In all cases, detection levels and quality assurance/quality control methods shall be in accordance with standard Method reporting limits and best laboratory practices and the following USEPA (EPA) methods:
   1. Total Petroleum Hydrocarbons, utilizing EPA Method 8015M, for gasoline and diesel.
   2. Volatile Organic Compounds, utilizing EPA Method 8260B/5035.

3. Polychlorinated biphenyls, utilizing EPA Method 8082.
4. Semi-Volatile Compounds, utilizing EPA Method 8270C.
5. Organochlorine Pesticides, utilizing EPA Method 8081A.
6. Organophosphorous Pesticides, utilizing EPA Method 8141A.
7. Chlorinated Herbicides, utilizing EPA Method 8151A.
8. California Code of Regulations Title 22 (CAM 17) Metals, utilizing EPA Method 6010B/7470A.
9. Hexavalent Chromium, utilizing EPA Method 7199.
10. Arsenic/Thallium, utilizing EPA Method 6020.

G. Import fill material may be deemed defective for use by the OAR at the Project site if any of the following results are obtained:
1. Total petroleum hydrocarbons are present at concentrations exceeding 100 milligrams per kilogram (mg/kg) for gasoline and 1,000 mg/kg for oil/diesel and long chain hydrocarbons.
2. Solvents and other volatile organic compounds are present at concentrations exceeding the laboratory reporting limit.
3. Polychlorinated biphenyls are present at concentrations exceeding the laboratory reporting limit.
4. Semi-volatile compounds are present at concentrations exceeding the laboratory reporting limit.
5. Organochlorine pesticides are present at concentrations exceeding the laboratory reporting limit.
6. Organophosphorous pesticides are present at concentrations exceeding the laboratory reporting limit.
7. Chlorinated herbicides are present at concentrations exceeding the laboratory reporting limit.
8. California Code of Regulations Title 22 (CAM 17) Metals at concentrations exceeding site-specific background.
9. Hexavalent chromium is present at concentrations exceeding 15 mg/kg.

H. In addition to screening for hazardous materials, the imported soil must be tested and certified to be free of:
1. Organics and debris.
2. Infestation by vermin or insects, in particular fire ants.
3. Boron.

I. Imported materials must be suitable for engineered fill, even if used at landscaping, free from large rocks.

J. Imported materials shall not have a high clay content and must meet the permeability requirements of the Project's hardscape if there is such requirement.

K. Evaluate concentrations of metals in import fill by conducting the analysis set forth below:
1. Compare the maximum detected metal concentrations in import fill samples to the Threshold Criteria listed in Table 4. If any metal concentration exceeds its listed background value, the fill material fails and shall be deemed defective and unacceptable for use at the Project site unless supported by a site-specific health risk assessment.
2. In addition to otherwise specified in this Section, import fill shall be deemed environmentally defective and unacceptable for use if any of the following results are obtained:
   a. Arsenic concentrations exceed 12.0 mg/kg.
   b. Lead concentration exceeds 255 mg/kg or fails TTLC/STLC.
   c. Import materials at new Project sites with total chromium concentrations greater than or equal to 100 mg/kg shall be tested for hexavalent chromium.

L. All import fill material shall be characterized, handled, and documented in accordance with applicable US EPA and State of California hazardous waste and hazardous materials regulations. For the purpose of this Specification, "contaminated" shall mean any soil or geotechnical material at a concentration that would require disposal at a regulated facility (i.e., California hazardous or RCRA hazardous). OAR must be notified at least 72 hours prior to the disposal of any hazardous waste or hazardous material. No material disposal or reuse can take place without prior written approval of the OAR.

M. Specification test results and OAR approvals shall be valid for a period of 120 days from the date of the subject testing unless a variance is requested by Contractor and approved by OAR. Previously approved materials shall not be utilized or disposed off-site after the 120-day limit without prior review and approval by the OAR.

N. Requests for variances to this Specification shall be submitted in writing to the OAR a minimum of two (2) weeks in advance of need for review and approval. The request for variance must provide all available testing data, a rationale to support the request and have an active funding line (provided by OAR) to facilitate review by the OAR. OAR will review the request for variance and will provide its preliminary determination within two weeks. Certain requests may require final approval by the Department of Toxic Substances Control (DTSC).

O. Soils with concentrations above screening levels may, upon prior approval by the OAR, be reused at other Project sites if supported by a site-specific human health risk assessment.

P. Details of the samples and testing must be submitted to and approved by the OAR's environmental compliance manager before transportation.

Q. Haul Routes and Regulations/Restrictions: Contractor must comply with requirements of Project EIR (CEQA) and authorities having jurisdiction over the Project area and the proposed activities (e.g. Regional Water Quality Control Board, Department of Toxic Substances Control, etc.).

3.3 TRANSPORTATION

A. Contractor shall pay all fees required by authorities having jurisdiction over area.

B. Contractor shall pay all fees for disposal and/or processing of contaminated and/or hazardous fill materials at a regulated facility.

C. Contractor shall post and pay for all bonds required by authorities having jurisdiction over area.

SECTION CONTINUES ON NEXT PAGE

TABLE 1: MINIMUM SAMPLING FREQUENCY	
Volume (Cubic Yards)	Sampling Frequency
0 – 1,000	1 per 250 CY
1,001 - 5,000	4 samples per first 1,000 CY and 1 sample per each additional 500 CY
Greater then 5,000	12 samples for first 5000 CY and 1 sample per each additional 1,000 CY

Chemicals of Potential Concern	TABLE 2 WASTE CHARACTERIZATION				
	Hazardous Waste if Exceed Criteria - TTLC Level* (mg/kg)	Additional WET Leaching Tests if Exceed Hazardous Waste Criteria - 10 times STLC Level** (mg/kg)	California-Regulated Hazardous Waste - Soluble Threshold Limit Concentration -STLC Level (mg/l)	Additional TCLP Leaching Tests if Exceed Hazardous Waste Criteria - 20 times TCLP Level** (mg/kg)	Federally-Regulated (RCRA) Hazardous Waste - Toxicity Characteristic Leaching Procedure - TCLP Level (mg/l)
CAM 17 Metals					
Antimony	500	150	15	NA	NA
Arsenic	500	50	5	100	5
Barium	10,000	1,000	100	2,000	100
Beryllium	75	7.5	0.75	NA	NA
Cadmium	100	10	1	20	1
Chromium	2,500	50	5	100	5
Cobalt	8,000	800	80	NA	NA
Copper	2,500	250	25	NA	NA
Lead	1,000	50	5	100	5
Mercury	20	2	0.2	4	0.2
Molybdenum	3,500	3,500	350	NA	NA
Nickel	2,000	200	20	NA	NA
Selenium	100	10	1	20	1
Silver	500	50	5	100	5
Thallium	700	70	7	NA	NA
Vanadium	2,400	240	24	NA	NA
Zinc	5,000	2,500	250	NA	NA
Chromium (VI)	500	50	5	NA	NA

TABLE 3 – WASTE CLASSIFICATION FLOWCHART

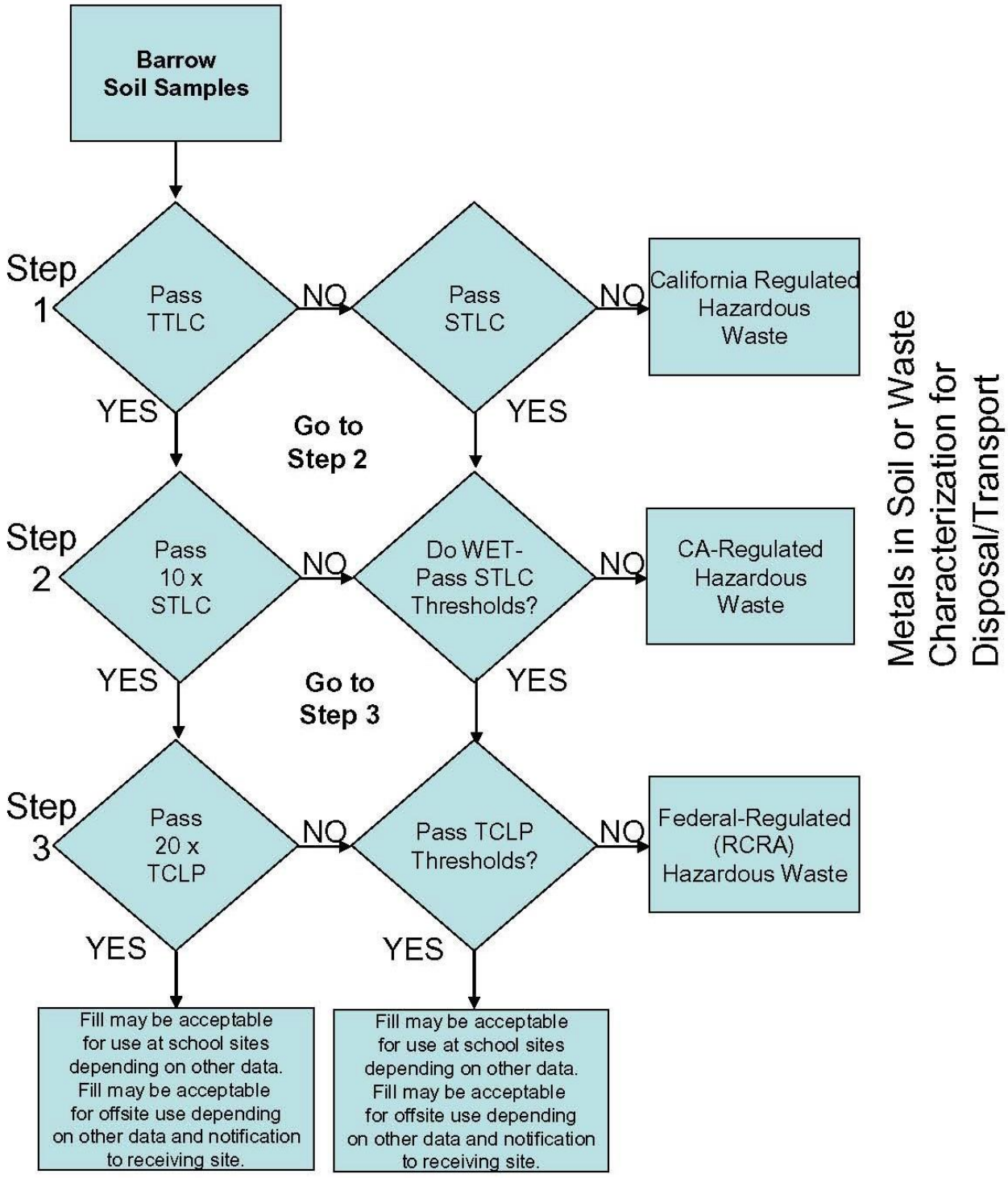

TABLE 4: THRESHOLD CRITERIA FOR METALS IN SOIL - LOOK UP VALUES

CAM 17 Metals	Soil Threshold Criteria (mg/kg)	Basis
Antimony	28	NC
Arsenic	11.3	BK
Barium	2330	NC
Beryllium	16	C
Cadmium	1.4	C
Chromium	106656	NC
Cobalt	4266	NC
Copper	2631	NC
Lead	255	PbB
Mercury	21	NC
Molybdenum	356	NC
Nickel	148	C
Selenium	356	NC
Silver	356	NC
Thallium	4.7	NC
Vanadium	498	NC
Zinc	21331	NC

NC = Non-Cancer Health Effects

BK = Background

C = Cancer Risk

PbB = Blood Lead Levels

END OF SECTION 01 45 24

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.
   21. Temporary signage.

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 2022 California Building Code (CBC) CCR Title 24, Part 2, (as adopted and amended by DSA).
b. Comply with applicable provisions in the U.S. Architectural and Transportation Barriers Compliance Board ADA-ABA Accessibility Guidelines (ADAAG), ICC/ANSI A117.1.

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 Sections 06 10 00: Rough Carpentry or 06 10 53: 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, proof rolling, 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: Not listed in 3.5 Below.
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 SIGNS

A. Furnish and install a project sign 6’-0” by 8’-0” in size. Image will be provided to the graphics printing company by the Architect after Award of Contract. Contractor will be responsible for the cost of printing the image, mounting the sign on an aluminum substrate and installing the sign at the site. The sign will include the name of the project, District, name and title of Board of Trustees, District Superintendent, Contractor, Architect, and each of the project consultants.

B. Other signs permitted at the site:

1. Warning signs.
2. Directional signs.
3. Identification signs at field offices.
4. Emergency medical services sign.
5. Signs required by Authorities Having Jurisdiction
6. Storm Water Pollution Prevention Plan sign (SWPPP)

C. Contractor shall allow no other signs to be displayed at the project site, unless authorized by the Owner/District.

3.6 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.

3.7 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.

3.8 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 13 STORM WATER POLLUTION PREVENTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Preparation, implementation and monitoring of Storm Water Pollution Prevention Plan (SWPPP) for the purpose of preventing the discharges of pollutants from the construction site into the receiving waters. This includes elimination of non-storm water pollution discharges such as improper dumping, spills or leakage from storage tanks or transfer areas.

B. Compliance with all local, state and federal regulations governing storm water discharges associated with construction activities such as, but not limited to clearing, excavating, grading, demolition and other land disturbances.

C. Payment of application and annual fees required by the State Water Resources Control Board (SWRCB) for the duration of the construction of the Project.

D. Submittal of all Permit Registration Documents (PRDs) through the SWRCB SMARTS online system.

E. Certification that the construction project has met all of the conditions of the General Construction Storm Water Permit (GCSWP).

1.02 REFERENCES

A. National Pollutant Discharge Elimination System (NPDES) General Permit No CAS000002.

B. State Water Resources Control Board (SWRCB) Water Quality Order 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-006-DWQ.

C. California Stormwater Quality Association, Stormwater Best Management Practice Handbook, Construction, latest edition.

1.03 RELATED DOCUMENTS

A. Project Contract, including General, Special and Supplementary Conditions and other General Requirements.

1.04 ACRONYMS AND DEFINITIONS

BMP	Best Management Practice.
CAN	Corrective Action Notice.
CASQA	California Stormwater Quality Association.
COI	Change of Information.
DWQ	Division of Water Quality.
CGP	NPDES General Permit for Storm Water Discharges Associated with Construction Activities.
ELAP	Environmental Laboratory Accreditation Program.

LRP	Legally Responsible Person (OWNER).
NOI	Notice of Intent.
NOT	Notice of Termination.
NPDES	National Pollutant Discharge Elimination System.
OEHS	LAUSD Office of Environmental Health and Safety.
PRDs	Permit Registration Documents, including NOI, Risk Assessment, Site Map, SWPPP, Annual Fee, Signed Certification Statements.
REAP	Rain Event Action Plan.
RISK LEVEL	As defined by CGP.
QSD	Qualified SWPPP Developer.
QSP	Qualified SWPPP Practitioner.
QRE	Qualifying Rain Event, is an event that produces 0.5 inches of precipitation with a 48 hour or more period between rain events.
SMARTS	Storm Water Multiple Application and Report Tracking System (smarts.waterboard.ca.gov).
SWPPP	Storm Water Pollution Prevention Plan.
SWRCB	State Water Resources Control Board.
WPCD	Water Pollution Control Drawings.
WDID	Waste Discharge Identification Number.

1.05 SUBMITTALS

A. The Owner's QSD shall submit the Notice of Intent and all Permit Registration Documents and the Notice of Intent fee required by SWRCB.

B. The Owner's QSD shall prepare and submit the Storm Water Pollution Prevention Plan for this project to the State Water Resources Control Board (SWRCB) via SMARTS.

C. The Owner's QSD shall prepare the SWPPP, including the WPCD, Risk Level Determination, and Post Construction Water Balance Calculation. Copies of these documents shall be provided to the Contractor. Contractor at his discretion may accept SWPPP as is, modify it, or develop his own.

D. Contractor shall submit qualifications and experience of the QSP for Owner's review and acceptance.

E. Contractor shall submit electronic copies of weekly and quarterly inspections, annual reports, compliance certifications, and test results.

F. Contractor shall submit the annual report. The General Permit requires all projects that are enrolled for more than one continuous three-month period to submit information and

annually certify that their site is in compliance with these requirements. All dischargers must prepare and electronically submit an annual report no later than September 1 of each year using the Storm water Multi-Application Reporting and Tracking System (SMARTS). The Annual Report must include a summary and evaluation of all sampling and analysis results, original laboratory reports, chain of custody forms, a summary of all corrective actions taken during the compliance year, and identification of any compliance activities or corrective actions that were not implemented.

G. Within 90 days of when construction is complete or ownership has been transferred, the Contractor shall electronically file a Notice of Termination (NOT), a final site map, and photos through the State Water Boards SMARTS system. Filing a NOT certifies that all General Permit requirements have been met.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Storm Water Pollution Prevention Plan: The Contractor's QSD shall provide the quality, grade and type of materials as specified in Stormwater Best Management Practice Handbook, Construction, latest edition, and State Water Resources Control Board (SWRCB) Water Quality Order 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-006-DWQ.

B. The Contractor shall have available on-site during construction activities a non-stormwater sampling kit suitable for obtaining storm water and non-stormwater quality grab samples. Kit shall include containers and preservatives appropriate for the pollutants known or expected to be in the stormwater. Required sampling equipment shall be adequate to capture and transport samples to a local ELAP State certified water testing lab.

C. Provide a rain gauge on site to record readings during site inspections.

PART 3 - EXECUTION

3.01 SWPPP IMPLEMENTATION

A. The Contractor shall hire a Qualified SWPPP Practitioner (QSP), as defined by the Construction General Permit, to implement the Storm Water Pollution Prevention Plan to be consistent with the requirements of SWRCB Water Quality Order 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-006-DWQ, and as follows:

1) Install perimeter controls and sediment control BMPs prior to starting construction work at the site.

2) Install effective erosion control BMPs at the jobsite.

3) Protect exposed dirt, such as stockpiles, landscaping areas, and hillsides.

4) Properly manage non-storm water discharges such as ground water, broken utility lines and fire hydrant testing per CGP requirements.

5) Contain on-site storm water at the jobsite. Do not drain on-site water directly into the storm drains.

6) QSP to train personnel for the proper implementation of the SWPPP.

7) Revise the SWPPP to suit changing site conditions and also when properly installed systems are ineffective.

8) Adjust BMP's locations and layouts in accordance to construction progress to assure compliance to regulations.

9) Conduct inspections of pollution prevention controls and provide Site Monitoring Report to OAR immediately if pollutants are discharged into the site runoffs. CONTRACTOR shall sample and remediate contaminated water.

10) QSP to develop and implement Rain Event Action Plans (REAPs).

11) QSP to perform and oversee all monitoring consistent with the identified Risk Level for the site.

12) Notification and Report: If pollution occurs in the work area for any reason or when the 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 Project Civil 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, the Contractor shall also explain in the written report why the Work was inadequately monitored.

13) Revise SWPPP to suit changing site conditions and also when properly installed systems are ineffective.

14) Upon Substantial Completion: Maintain and leave post-construction storm water pollution prevention controls in place and remove those that are not needed as determined by the QSD and OAR.

15) QSP shall submit the annual report. All dischargers must prepare and electronically submit an annual report no later than September 1 of each year using the Storm water Multi-Application Reporting and Tracking System (SMARTS). The Annual Report must include a summary and evaluation of all sampling and analysis results, original laboratory reports, chain of custody forms, a summary of all corrective actions taken during the compliance year, and identification of any compliance activities or corrective actions that were not implemented.

3.02 MONITORING

A. The Contractor shall conduct examination of storm water pollution prevention controls according to the monitoring requirements identified for the projects risk level as defined by the Construction General Permit.

B. The Contractor shall prepare and maintain, at the jobsite, a log of each inspection using Site Monitoring Report forms.

C. The Contractor shall distribute copies of the Owner provided Storm Water Pollution Prevention Plan to their superintendent and subcontractors. At least one (1) copy of the SWPPP shall be available on site at all times.

3.03 SWPPP LIABILITIES AND PENALTIES

A. Review of the inspection logs by the Owner shall not relieve the Contractor from liabilities arising from non-compliance with storm water pollution regulations.

B. Payment of Penalties for non-compliance by the Contractor shall be the sole responsibility of the Contractor and will not be reimbursed by the Owner.

C. Compliance with the Clean Water Act and the State Water Resources Control Board (SWRCB) Water Quality Order 2009-0009-DWQ pertaining to construction activities is the sole responsibility of the Contractor. For any fine(s) levied against the Owner due to non-compliance by the Contractor, the Owner will have the option to either require payment by Contractor of, or deduct from any payments due the Contractor, the total amount of the fine(s) levied on the Owner and associated costs.

3.04 SWPPP CLOSEOUT

A. Verify the following prior to Substantial Completion of SWPPP:

1) Elements of the SWPPP have been completed.

2) Final stabilization of site, as defined by the GCP, has been demonstrated.

3) There is no potential for construction related storm water pollutants to be discharged into site runoff.

4) Construction related equipment and temporary BMPs have been removed from site.

5) Rubbish, debris, and waste materials have been removed and legally disposed of off the Project site.

6) Post-Construction BMP Maintenance Plan has been established.

END OF SECTION 01 57 13

SECTION 01 71 23 FIELD ENGINEERING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surveying requirements for the Work.

1.02 RELATED SECTIONS

A. Section 31 20 00: Earthwork

B. Section 32 12 16: Asphalt Paving

C. Section 33 00 00: Sanitary Utilities

D. Section 33 40 00: Storm Drainage

1.03 SURVEY SERVICE

A. Unless otherwise stated by the Architect or noted in the Special Provisions, the CONTRACTOR shall provide all surveying services.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.01 SUBMITTALS

A. CONTRACTOR shall submit the name and address of the State of California licensed surveyor to Construction Management Representative (CMR), ARCHITECT and OWNER including any changes as they may occur.

B. CONTRACTOR shall submit to OWNER copies of cut sheets, coordinate plots, data collector printouts, and other documentation as available to verify completeness and/or accuracy of field surveying work.

C. Statement of Compliance: CONTRACTOR shall submit a statement of certification signed and sealed by Surveyor, counter-signed by CONTRACTOR indicating compliance with grade elevations, slopes and tolerances.

3.02 LAYOUT OF THE WORK

A. CONTRACTOR shall employ a State of California licensed surveyor to lay out the entire Work, set grades, lines, levels, control points, vertical and horizontal control, elevations, grids and positions. Before the commencement of Work, surveyor shall, in conjunction with OWNER and Construction Management Representative (CMR) provided engineering survey of the Project site, locate all reference points and benchmarks, then lay out all lines, elevations, and measurements for the entire Work including but not limited to, buildings, grading, paving and utilities.

B. All work under this contract shall be built in accordance with the lines and grades shown on the plans. Field survey for establishing these, and for the control of construction, shall be the responsibility of the Contractor. All such survey work including construction staking shall be done under the supervision of a California Licensed Land Surveyor or authorized

Civil Engineer. Staking shall be done on all items ordinarily requiring grade and alignment, at intervals normally accepted by the agencies and trade involved.

C. The CONTRACTOR shall be responsible for any errors in the finished work, and shall notify the Engineer, in writing, within 24 hours, of any discrepancies, or design errors during the construction staking.

D. Contractor shall immediately remediate any areas found not to meet specification requirements.

3.03 SURVEY REQUIREMENTS

A. Establish a minimum of two permanent horizontal and vertical control points on the Project site, remote from the work area, referenced to data established by the survey control points.

B. Indicate the reference points on the project record drawings with the basis of elevation being the established benchmarks.

C. Establish lines, grades, locations and dimensions by instrumentation. From time to time, verify the layout of all Work by the same methods.

D. 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.

E. Calculate and layout proposed finished elevations and intermediate control as required to provide smooth transitions between the spot elevations indicated in the Contract Documents.

F. Provide stakes and elevations for grading, fill, and topsoil placement.

G. Provide adequate horizontal and vertical control to locate utility lines, including but not limited to, storm, sewers, water mains, gas, 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 AC surfaces at key locations such as BC's, EC's, grade breaks, corners or angle points in sufficient number to demonstrate the Work complies with the intent of the Contract Documents.

H. Provide horizontal and vertical control for batter boards for drainage, utility, and other on-site structures as required.

I. 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.

J. 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'. Building pad tolerance will be +- 0.10'.

3.04 ESTABLISHMENT OF GRADES IN HARDSCAPE AREAS

A. All work shall conform to the lines, elevations, and grades shown on the Grading Plans. Three consecutive points set on the same slope shall be used together so that any variation

from a straight grade can be detected. Any such variation shall be reported to the Engineer. In the absence of such report, the Contractor shall be responsible for any error in the grade of the finished work.

B. Areas having drainage gradients of 2 percent or more shall have elevation stakes, set with instrument, at grid intervals of 25 feet. Intermediate stakes may be set by using a tightly-drawn string line over the tops of adjacent stakes. Grade stakes must be set at all grade breaks, grade changes, etc.

C. Areas having drainage gradients of less than 2 percent shall have elevation stakes, set with instrument, at 10 foot intervals. Grade stakes must be set at all grade breaks, grade changes, etc.

D. Protect and maintain stakes in place until their removal is approved by the Owner. Grade or location stakes lost or disturbed by Contractor, shall be reset by the Surveyor at the expense of Contractor.

3.05 STORM DRAIN & SEWER PIPE INSTALLATION

A. All storm drain & sewer pipelines, cleanouts, catch basins and drain inlets shall be staked by a licensed surveyor if slope of grade is less than 2% and a complete set of cut sheets shall be supplied to the Inspector. All construction staking shall be installed and verified for grade and alignment prior to the start of construction.

3.06 RECORD DRAWINGS

A. Upon Substantial Completion, CONTRACTOR shall obtain and pay for reproducible transparencies of the as built survey drawings. Deliver to ARCHITECT, final “record” drawings of the original drawings and completed Work within specified tolerances.

B. Record drawings shall indicate locations by coordinate of 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 manholes.

C. Completed record drawing transparencies shall be signed and certified as correct and within specified tolerances by the licensed surveyor.

D. Attention is called to other sections of the Contract Documents requiring verification or measurements of installed Work by survey. Surveyor shall perform and certify all such surveys or verification are completed in accordance with the Contract Documents.

END OF SECTION 01 71 23

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 50 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 reproducibles 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 reproducibles and two (2) sets of bluelines of approved reproducibles.
   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 00 00 49: Certificate of Substantial Completion.
2. 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. Pest Control:
   1. Comply with pest control requirements in Section 01 57 15: Integrated Pest Management. Prepare written report.

C. 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. Schedule for annual inspection and reports.
   f. 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 fata, 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 02 21 00 SURVEYS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. Section relates to execution of survey construction staking and addresses the following:
   1. Personnel and applicable responsibilities for surveying and staking.
   2. Procedures and time limitations.
   3. Consideration of monuments and damage.

B. Contractor shall furnish and set construction stakes and marks to establish the lines and grades required for completion of the Work as shown on the Plans and specified in the Project Specifications.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

A. Construction staking shall be performed under the direction of a licensed land surveyor or registered professional Engineer familiar with construction surveying and staking.

B. Construction staking shall be performed as necessary to control the Work. Construction stakes and marks shall be furnished and set with accuracy adequate to assure that the completed Work conforms to the lines, grades, and sections shown on the Plans.

C. Contractor shall provide a construction staking request in writing to Owner and the Engineer no less than 72 hours prior to the desired time for construction staking to be performed.

D. Construction stakes shall be removed from the site by Contractor when no longer needed. Removal and disposal of construction staking materials is the sole responsibility of Contractor.

E. In the event Contractor’s operations destroy any of the survey control points, Contractor shall replace such control points at his expense, subject to verification by the Engineer. The cost of any such verification or replacement of the control surveys will be the sole responsibility of Contractor with no additional cost to Owner. Contractor will not be allowed any adjustment in Contract Time for such verification or replacement of survey control points.

F. Contractor must preserve all Geographic Reference Stations, section corners, and all other legal property monuments of any kind during all construction and related activities. It is Contractor's responsibility to become familiar with the survey control and documentation of the site and surrounding property prior to conducting activities on the site that may potentially jeopardize such facilities.

G. Contractor shall give written notice to Owner and the Engineer at least five (5) working days in advance of any need to disturb or destroy any of the monuments of the site. Contractor

must receive approval for such destruction or disturbance from Owner and Engineer prior to conducting the work.

H. Only a professional land surveyor registered in the State of California will be permitted to perform surveying to reset or replace destroyed monuments. The professional land surveyor shall follow all rules, regulations, provisions, and laws of the State of California, as applicable for such work.

I. The cost of replacement of monuments destroyed or disturbed by Contractor will be the sole responsibility of Contractor and be at no additional cost to Owner.

END OF SECTION

SECTION 02 41 16 STRUCTURE DEMOLITION

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. Demolition and removal of existing buildings including existing site features or elements associated as indicated on Drawings.
2. Removing below-grade under existing buildings all electrical, plumbing, and landscape irrigation elements outwards to a minimum of five feet (5') in any direction.
3. Disconnect, cap or seal, and abandoning in-place all site utilities to an area designated on Drawings.
4. Remove all utilities, power, and water and provide new utilities to new location.
5. Salvaging items for reuse by Owner.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse or store. Include fasteners or brackets needed for reattachment elsewhere.

1.4 SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures:
1. Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control, and for noise control. Indicate proposed locations and construction of barriers:
a. Adjacent buildings: Detail special measures proposed to protect adjacent buildings to remain including means of egress from those buildings.

C. Schedule of Building Demolition Activities:
1. Indicate the following:
a. Detailed sequence of demolition work, with starting and ending dates for each activity.
b. Temporary interruption of utility services.
c. Shutoff and capping or re-routing of utility services.

D. Pre-Demolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, which might be misconstrued as damage caused by demolition operations before the Work begins.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all 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.

F. Inventory: Submit a list of items that have been removed and salvaged.

1.5 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

B. Pre-demolition conference to be conducted at Project site:
1. Inspect and discuss condition of construction to be demolished.
2. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review and finalize protection requirements.
4. Review procedures for noise control and dust control.
5. Review procedures for protection of adjacent buildings.
6. Review items to be salvaged and returned to Owner.

C. Arrange demolition schedule so as not to interfere with Owner's onsite operations or operations of adjacent occupied buildings.

D. Arrange demolition schedule so as not to interfere with work performed by other contractors onsite. Coordinate work for equipment used to not deter or stop work by others.

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 their 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:
1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

C. Onsite storage or sale of removed items or materials is not permitted.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Division 31.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted:
   1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings:
      a. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings:
         1) Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.

C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical:
   1. Before building demolition, Owner will remove the following items:
      a. Furniture

3.2 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Review Project record documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project record documents.

C. 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.

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. Salvaged Items:
   1. Clean salvaged items of dirt and demolition debris.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to storage area.
   5. Protect items from damage during transport and storage.

3.4 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Utilities to be Disconnected:
   1. Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished:
      a. Owner will arrange to shut off utilities when requested by Contractor.
      b. Arrange to shut off utilities with utility companies.
      c. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
      d. Cut off pipe or conduit a minimum of 24 inches (610 mm) below grade. Cap, valve,

or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.

e. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.5 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Temporary Shoring:
1. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished:
   a. Strengthen or add new supports when required during progress of demolition.

C. Existing Utilities to Remain:
1. Maintain utility services to remain and protect from damage during demolition operations:
   a. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
   b. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction:
      1) Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.

D. Temporary Protection:
1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated.
   a. Protect adjacent buildings and facilities from damage due to demolition activities.
   b. Protect existing site improvements, appurtenances, and landscaping to remain.
   c. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
   d. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   e. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
   f. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
   g. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.6 DEMOLITION, GENERAL

A. Demolish indicated buildings and site elements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least two (2) hours after flame-cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Site Access and Temporary Controls:
   1. Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities:
      a. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
      b. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

3.7 DEMOLITION BY EXPLOSIVES

A. **No explosives** are to be used on this Project.

3.8 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent:
   1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Salvage:
   1. Items to be removed and salvaged are indicated below:
      a. Doors and door hardware.
      b. Windows.
      c. Cabinets.
      d. Mirrors.
      e. Chalkboards.
      f. Tackboards.
      g. Marker boards.
      h. Plumbing fixtures.

D. Below-Grade Construction: Abandon foundation walls and other below-grade construction. Cut below-grade construction flush with grade.

E. Existing Utilities:
   1. Demolish existing utilities and below-grade utility structures that are within five feet (5’) outside footprint indicated for new construction. Abandon utilities outside this area.
      a. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in Division 31.

F. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.

3.9 SITE RESTORATION

A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.10 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

B. Promptly repair damaged sidewalks, roadways, fencing, or retaining walls to nearest expansion joint. Replace in-kind or as designated by Architect.

3.11 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
   1. Do not allow demolished materials to accumulate onsite.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.12 CLEANING

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

END OF SECTION

SECTION 02 41 19 SELECTIVE DEMOLITION

PART 1 - GENERAL

A. Removal of designated building equipment and fixtures.
B. Removal of designated construction.
C. Disposal of materials.
D. Storage of salvaged materials.
E. Cap and identify utilities.
F. Temporary partitions to allow building occupancy.
G. Temporary fire protection.
H. Schedule of materials and equipment.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.

B. Disposal: Removal off-site of demolition waste and subsequently deposit in landfill acceptable to authorities having jurisdiction.

C. Existing to Remain: Items of construction that are not to be removed and that are not indicated to be removed.

1.3 MATERIALS OWNERSHIP

A. Historic items, relics, cornerstones, commemorative plaques, tablets and similar objects encountered during demolition are to remain the Owner's property.

B. Carefully remove each item in a manner to prevent damage and deliver to Owner.

1.4 SUBMITTALS

A. Predemolition Photographs: Show conditions of exiting adjacent construction and site improvements that might be misconstrued as damaged by demolition operations. Submit before work begins.

B. Record Documents: Submit under provisions of Section 01 77 00. Accurately record locations of utilities and subsurface obstructions.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable codes for demolition work, safety of structure, electrical disconnection and reconnection dust control and disposal of materials.

B. Comply with California Fire Code (CFC), California Code of Regulations, (CCR) Title 24, Part 9, Chapter 14 - Fire Safety During Construction and Demolition.

C. Obtain required permits from authorities.

D. Notify affected utility companies before starting work and comply with their requirements.

E. Do not close or obstruct egress width to exits.

F. Do not disable or disrupt building fire or life safety systems without 3 day prior written notice to the Owner.

1.6 PROJECT CONDITIONS

A. Areas of buildings to be demolished will be evacuated and their use discontinued before start of work.

B. Owner will occupy building(s) adjacent to demolition area. Conduct demolition so owner's operation will not be disrupted.

C. Provide at least 72 hour notice to Owner of activities that will affect Owner's

operation.

D. Maintain access to existing walkways, exits and other adjacent occupied

facilities.

E. Owner assumes no responsibility for areas of buildings to be demolished.

F. Hazardous Materials: It is not anticipated that hazardous materials will be encountered in the work.

1. Hazardous materials will be removed by Owner before start of work.

2. Hazardous materials will be removed by Owner under separate contract.

3. If materials suspected of containing hazardous materials are encountered, do not disturb. Notify Architect.

4. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.

1.7 SEQUENCING

A. Sequence work under the provisions of Section 01 11 00.

B. Owner will conduct salvage operations before demolition begins to remove materials and equipment that the Owner chooses to retain.

D. Notify Owner in writing 5 days in advance of any required work to be performed on a

weekend or holiday.

E. Coordinate utility and building service interruptions with Owner.

F. Schedule tie-ins to existing systems to minimize disruption.

G. Coordinate Work to ensure fire sprinklers, fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas.

1.9 PROJECT CONDITIONS

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Cease operations immediately if structure appears to be in danger and notify Architect. Do not resume operations until directed.

3. PART 3 - EXECUTION

3.1 EXAMINATION

A. Correlate existing conditions with requirements indicated.

B. Inventory and record condition of items to be removed and

salvaged. Execute predemolition photographs.

D. Verify that hazardous waste remediation is complete.

3.2 PREPARATION

A. Existing Utilities: Locate, identify, disconnect and seal or cap off indicated utilities serving areas to be demolished.

B. Salvaged Items: Clean, pack and identify items for delivery to Owner.

C. Protect existing items which are not indicated to be salvaged, removed, or

altered.

D. Erect and maintain weatherproof closures for exterior openings.

E. Erect and maintain temporary partitions to prevent spread of dust, fumes, noise, and smoke to provide for Owner occupancy as specified in Section 01 11 00.

3.3 DEMOLITION

A. Conduct demolition to minimize interference with adjacent [and occupied] building areas.

B. Cease operations immediately if structure appears to be in danger. Notify Architect. Do not resume operations until directed.

C. Maintain protected egress and access to the Work.

D. Maintain fire safety during demolition in accordance with CFC, Chapter 14.

E. Demolish in an orderly and careful manner. Protect existing supporting structural members.

3.4 SALVAGING OF DEMOLITION

MATERIALS

A. Clean salvaged items.

B. Pack or crate items after cleaning. Identify

contents.

C. Store items in secure area until delivery to

Owner.

D. Protect items from damage.

E. Install salvaged items to comply with requirements for new materials and equipment.

3.5 RECYCLING OF DEMOLITION MATERIALS

A. Separate recycled demolition materials from other demolished materials.

B. Stockpile processed materials on-site without intermixing with other materials.

C. Do not store materials within drip line of trees

D. Transport recyclable materials that are not indicated to be reused off Owner's property to recycling receiver or processor.

E. Recycled incentives received for building demolition materials shall be equally shared between Contractor and Owner.

F. Wood Materials: Sort and stack members according to size, type and length. Separate dimensional and engineered lumber, panel products, and treated wood materials.

G. Metals: Separate by metal type. Remove nuts, bolts and rough hardware. Sort structural steel by type and size.

H. Roofing: Separate organic and fiberglass shingles and felts. Remove nails, staples and accessories.

I. Doors and Hardware: Brace open end of door frames. Leave hardware attached to doors.

J. Carpet and Pad: Store clean dry carpet and pad in a closed container or trailer.

K. Gypsum Board: Stack large clean pieces on pallets. Remove edge trim and sort with metals. Remove and dispose of fasteners.

L. Acoustical Ceiling Materials: Stack panels and tiles on pallets. Separate suspension system and sort with metals.

M. Equipment: Drain tanks, piping and fixtures. Seal openings with caps or plugs.

N. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves and other components.

O. Lighting Fixtures: Remove lamps and separate by type.

P. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

Q. Conduit: Reduce conduit to straight lengths and store by type and size.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Except for items to be salvaged, reinstalled, or otherwise indicated to remain, remove demolished materials from Project site and legally dispose of them in an EPA – approved landfill.

B. Do not burn or bury materials on site.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt and debris caused by demolition.

B. Remove temporary construction.

C. Return adjacent areas to condition existing before demolition operations began.

D. Leave site in a clean condition.

END OF SECTION 02 41 19

SECTION 03 10 00 CONCRETE FORMING AND ACCESSORIES

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 concrete forming and accessories and includes:
   1. Formwork for cast-in-place concrete, with shoring, bracing, and anchorage.
   2. Installation of items to be embedded in concrete, such as anchor bolts, inserts, embeds, and sleeves.
   3. Openings for other work.
   4. Form accessories.
   5. Form stripping.

B. Reference Standards:
   1. ACI 117 Standard Specifications for Tolerances for Concrete Construction and Materials.
   2. ACI 301 Specifications for Structural Concrete.
   3. ACI 318-14 Building Code Requirements for Structural Concrete and Commentary.
   4. ACI 347 Guide to Formwork for Concrete.
   5. National Institute of Standards and Technology - PS 1 Structural Plywood.
   6. 2022 California Building Code, Chapter 19A.
   7. APA American Plywood Association Design and Construction Guide.
   8. Local AQMD - Air Quality Management District.

1.3 SUBMITTALS

A. Product Data: Provide data on void form materials and installation requirements.

B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties. Review and approval will not include form strength and adequacy.

C. Keep an accurate record of the dates of removal of forms, form shores and reshores, and furnish copies to the Architect and LOR.

1.4 QUALITY ASSURANCE

A. Construct forms according to ACI 347, "Guide to Formwork for Concrete," and conforming to tolerances of ACI 117, "Standard Specifications for Tolerances for Concrete Construction and Materials."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in a timely manner to ensure uninterrupted progress.

B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 PRODUCTS

2.1 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.

C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

D. Comply with relevant portions of ACI 347, ACI 301, and ACI 318.

2.2 WOOD FORM MATERIALS

A. Softwood Plywood: PS 1, B-B Medium or High Density Concrete Form Overlay, Class I, grade marked, not mill oiled.

B. Lumber: DF species; WCLIB Construction grade or better, WWPA No. 1 grade or better; with grade stamp clearly visible.

2.3 REMOVABLE PREFABRICATED FORMS

A. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; two inches (2”) thick.

2.4 FORMWORK ACCESSORIES

A. Form Ties: Prefabricated rod, flat band, wire, internally threaded disconnecting type, or equal, not leaving metal within 1-1/2 inches of concrete surface.

B. Form Release Agent:
   1. Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bug holes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied:
      a. Composition: Colorless reactive, mineral oil-based, soy-based, or vegetable oil-based compound.
      b. Do not use materials containing diesel oil or petroleum-based compounds.
      c. VOC content: In compliance with applicable local, state, and federal regulations.

C. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 12 00: Structural Steel Framing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.

3.2 EARTH FORMS

A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete. Sides of all footings and grade beams shall be formed, unless the member detail provides at

least three inches (3") clear cover to reinforcement and indicates the member is cast against earth. Remove formwork prior to backfilling operations.

3.3 ERECTION - FORMWORK

A. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Rigidly construct forms to prevent mortar leakage, sagging, displacement, or bulging between studs. Use clean, sound, approved form material, coated with specified materials only, not oil. Provide backing on all plywood joints.

C. Coat forms with the specified resin coating, not form oil. Construct forms to exact shapes, sizes, lines, and dimensions required to obtain level, plumb, and straight surfaces. Provide openings, offsets, keys, reglets, anchorages, recesses, moldings, chamfers, blocking, screeds, drips, bulkheads, and all other required features. Make forms easily removable without hammering or prying against concrete. Space forms apart with metal spreaders. Construct forms to accurate alignment, locations, and grades, and provide against sagging, leakage of concrete mortar, or displacement occurring during and after placing of concrete. Coordinate installation of inserts and anchors in forms according to shop drawings and requirements for Work of other Sections.

D. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

E. Corners and angles: Provide 1/2-inch by 1/2-inch beveled chamfer strips for all exposed concrete corners and angles square unless indicated otherwise.

F. Reglets and Rebates: Form required reglets and rebates to receive frames, flashing, and other equipment. Obtain required dimensions, details, and precise positions for Work to be installed under other Sections and form concrete accordingly.

G. Form Joints: Align joints and make watertight. Keep form joints to a minimum. Fill joints to produce smooth surfaces, intersections, and arises. Use polymer foam or equivalent fillers at joints and where forms abut or overlap existing concrete to prevent leakage of mortar.

H. Recesses, Drips, and Profiles: Provide smooth milled wood or pre-formed rubber or plastic shapes of types shown and required.

I. Cleanouts and Cleaning: Provide temporary openings in all wall forms and other vertical forms for cleaning and inspection. Clean forms and surfaces to receive concrete prior to placing.

J. Re-Use: Clean and recondition form material before re-use.

3.4 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. All necessary pipe sleeves, anchors, or other required inserts shall be accurately installed as part of the work of other Sections, according to Section 03 30 00: Cast-In-Place Concrete, for submittal requirements related to this scope.

B. Obtain approval before framing openings in structural members that are not indicated on Drawings.

C. Provide formed openings where required for items to be embedded in passing through concrete work.

D. Locate and set in place items that will be cast directly into concrete.

E. Conduits or Pipes:
1. Locate so as not to reduce strength of the concrete.
2. Do not place pipes, other than conduits, in a slab 4-1/2 inches thick or less in any case. Conduit buried in a concrete slab shall not have an outside dimension greater than 1/3 the slab thickness nor be placed below the bottom reinforcing or over the top reinforcing.
3. Sleeves: Pipe sleeves may pass through the slab or walls if not exposed to rusting or other deterioration and are of uncounted or galvanized iron or steel. Provide sleeves of diameter large enough to pass any hub or coupling on pipe, including any insulation.
4. Conduits may be embedded in walls only if the outside diameter does not exceed 1/3 the wall thickness, are spaced no closer than three (3) diameters on centers, and not impair the strength of the structure.

F. Coordinate with work of other Sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

G. Install accessories in accordance with manufacturer's instructions so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

H. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Heat seal joints so they are watertight.

I. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

J. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fit so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

A. Clean forms as erection proceeds to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

3.7 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

B. Deflection: Limit deflection of forming surfaces from concrete pressure to L/240.

C. Finish Lines:

1. Position formwork to maintain hardened concrete finish lines within following permissible deviations:
   a. Variation from plumb:

In 10'-0"	1/4 inch
In any story or 20'-0"	3/8 inch
In 40'-0" or more	3/4 inch

   b. Variation from level or grades indicated:

In 10'-0"	1/4 inch
In any story or 20'-0"	3/8 inch
In 40'-0" or more	3/4 inch

   c. Cross-sectional dimensions:

Minus	1/4 inch
Plus	1/2 inch

3.8 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

3.9 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and all superimposed loads as determined by testing field cured cylinders, but not sooner than specified in ACI 347. Load supporting forms may be removed when concrete has attained 75 percent of required 28-day compressive strength, but no sooner than three (3) days, provided construction is reshored. Vertical formwork for cast-in-place concrete walls may be removed no sooner than one (1) day following concrete placement, provided that Contractor can demonstrate that no sloughing or sagging of concrete will occur:
   1. Reshore structural members as specified per ACI 347.
   2. Remove formwork progressively so unbalanced loads are not imposed on the structure.
   3. Avoid damage to concrete surfaces during removal.
   4. Remove formwork in same sequence as concrete placement to achieve similar concrete surface coloration.

END OF SECTION

SECTION 03 20 00 CONCRETE REINFORCING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section is related to concrete reinforcement and includes:
   1. Reinforcing steel for cast-in-place concrete foundations.
   2. Reinforcing steel for cast-in-place concrete slabs-on-grade.
   3. Supports and accessories for steel reinforcement.

B. Reference Standards:
   1. ACI 301 Specifications for Structural Concrete.
   2. ACI 318 Building Code Requirements for Structural Concrete and Commentary.
   3. ACI SP-066 ACI Detailing Manual.
   4. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   5. ASTM A706/A706M Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
   6. ASTM A775/A775M Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
   7. ASTM D3963/D3963M Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
   8. AWS D1.4 Structural Welding Code - Reinforcing Steel.
   9. CRSI Concrete Reinforcing Steel Institute Manual of Standard Practice.
   10. CRSI Concrete Reinforcing Steel Institute Placing Reinforcing Bars.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Comply with requirements of ACI SP-066. Include the following:
      a. Complete bar layout.
      b. Representative sections.
      c. Details for congested conditions.
      d. Proposed layout where vertical and horizontal bars intersect.
      e. Bar schedules.
      f. Typical bending diagrams and offsets.
      g. Shapes of bent bars.
      h. Spacing of bars.
      i. Splice lengths and locations.

B. Where welding is proposed:
   1. Detail welding to conform to AWS D1.4.
   2. Submit copies of welding operator's certificate.
   3. Where reinforcement complying with ASTM A615 is to be welded, chemical tests shall be performed to determine the weldability in accordance with ACI 318.
   4. Weld procedure specifications (WPS):
      a. All WPS's shall be submitted to the Lab of Record (LOR) and Architect for review and approval prior to use.
      b. For WPS's that have been qualified by test, the supporting Procedure Qualification

Record (PQR) shall be submitted to the LOR for review and approval and to the Architect for records.

c. Included shall be WPS for repair welds.

C. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

A. Perform work of this Section in accordance with ACI 301.

B. Welders' Certificates: Submit certifications for welders employed on the Project, verifying AWS qualification within the previous 12 months.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in a timely manner to ensure uninterrupted progress.

B. Bundle bars, tag with identification, and transport and store so as not to damage any material. Use metal tags indicating size, length, and other marking shown on placement drawings. Maintain tags after bundles are broken.

C. Avoid exposure to dirt, moisture, or conditions harmful to reinforcement.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel:
1. ASTM A615/A615M, Grade 60 (60,000 psi):
   a. Deformed billet-steel bars.
   b. Unfinished.
   c. Only to be used for conditions where bars will not be welded.

B. Reinforcing Steel:
1. ASTM A706/A706M, Grade 60 (60,000 psi) deformed low-alloy steel bars:
   a. Unfinished.
   b. Used in all cases where welding of bars is required.

C. Reinforcement Accessories:
1. Tie wire: ASTM A1064, annealed copper bearing steel, minimum 16 gage, 0.0508 inch.
2. Chairs, bolsters, bar supports, spacers:
   a. Sized and shaped for adequate support of reinforcement during concrete placement. Standard manufactured products shall conform to the Concrete Reinforcing Institute Manual of Standard Practice, latest edition.
3. Use dense precast concrete supports with embedded wire ties for reinforcement placed on grade. Elsewhere, use wire bar supports.

D. Welding electrodes: AWS D1.4, Table 5.1 and 5.3, low hydrogen electrodes, E8018 for Grade 60 steel.

2.2 REBAR SPLICING

A. Coupler Systems: Mechanical devices for splicing reinforcing bars conforming to the requirements of ACI 318; capable of developing 1.25fy of the steel reinforcing yield strength in tension and compression.

B. For reinforcement, all mechanical splices in Special Structural Walls, Special Moment Frames, and Concrete Diaphragms shall be Type 2, conforming to the requirements of ACI 318, capable of developing 1.25fy of the steel reinforcing yield strength in tension and compression, and develop the specified tensile strength of the spliced bar:
   1. Products:
      a. Dayton Superior Corporation; Bar Lock Coupler System: www.daytonsuperior.com (ICC-ESR 2481).
      b. Lenton Lock Couplers (IAPMO-ES 129).

C. Dowel Bar Splicer with Dowel-Ins:
   1. Mechanical devices for connecting dowels; capable of developing full steel reinforcing design strength in tension and compression.
      a. Products:
         1) Dayton Superior Corporation; Dowel Bar Splicer D101A with Straight Dowel-In: www.daytonsuperior.com.
         2) Lenton Form Savers (IAPMO-ES 129).

2.3 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI - Manual of Standard Practice.

B. Bending and Forming:
   1. Fabricate bars of the indicated sizes and bend and form to required shapes and lengths by methods not injurious to materials.
   2. Do not heat reinforcement for bending.
   3. Bend bars No. 6 size and larger in the shop only.
   4. Bars with unscheduled kinks or bends are subject to rejection.
   5. Use only tested and approved bar materials.

C. Welding:
   1. Use only ASTM A706 steel where welding is proposed:
      a. Perform welding where shown or approved, by the direct electric arc process in accordance with AWS D1.4 using specified low hydrogen electrodes.
      b. Preheat six inches (6") each side of joint.
      c. Protect joints from drafts during the cooling process; accelerated cooling is prohibited.
      d. Do not tack weld bars.
      e. Welding shall not be done on or within two (2) bar diameters of any bent portion of a bar that has been bent cold.
      f. Welding of crossing bars shall not be permitted for assembly reinforcement unless authorized by the Architect and DSA approved.
      g. Clean metal surfaces to be welded of all loose scale and foreign material.
      h. Clean welds each time electrode is changed and chip burned edges before placing welds.
      i. When wire brushed, the completed welds must exhibit uniform section, smooth welded metal, feather edges without undercuts or overlays, freedom from porosity and clinkers, and good fusion and penetration to the base metal.
      j. Cut out welds or parts of welds found defective with chisel and replace with proper welding.
      k. Fillet welds may be considered prequalified per AWS D1.4.
      l. Other welds are to be qualified per AWS D1.4.

D. Where ASTM A615 steel is to be used or occurs in existing elements and is to be welded:
   1. Complete chemical analyses shall be performed to determine chemical composition and, for a new bar, provided in the mill certifications to determine weldability in accordance with ACI 318 with modifications per AWS D1.4.

2. The carbon equivalency (CE) shall be clearly defined and bars with a CE above 0.75 shall not be welded.
3. Welding Procedure Specifications and supporting PQRs with required testing per AWS D1.4 shall be provided for review and approval prior to welding.
4. These WPS and PQRs shall be specific to the CE as determined above, and shall, in addition to the other AWS requirement, include minimum and maximum preheat and interpass temperatures that are specified to the CE. This preheat and interpass temperature shall be strictly enforced in the field.
5. If separate shipments of bars vary the weldability, the process listed in the above requirements shall be repeated for these new bars.

E. Locate reinforcing splices not indicated on Drawings at point of minimum stress. Review locations of splices with SEOR.

PART 3 EXECUTION

3.1 PLACEMENT

A. Before placing bars, and again before concrete is placed, clean bars of loose rust and/or mill scale, dirt, oil, or any other coating that may be deleterious or could reduce bond with the concrete.

B. Securing in place:
1. Accurately place bars and wire tie in precise position where bars cross.
2. Bend ends of wire ties away from the forms.
3. Wire tie bars to the corners of ties and stirrups.
4. Support bars according to the Concrete Reinforcing Steel Institute (CRSI) "Placing Reinforcing Bars," using approved accessories and chairs.
5. Place precast concrete cubes with embedded wire ties to supporting reinforcing steel bars in concrete placed on grade and in footings.
6. Take adequate precautions to ensure that reinforcing bar position and spacing is maintained during concrete placement.

C. Do not displace or damage vapor barrier.

D. Maintain concrete cover around reinforcing per requirements on Drawings.

E. Splices:
1. Do not splice reinforcing bars at the points of maximum stress except where indicated.
2. Lap splices as shown or required to develop the full strength or stress of the bars.
3. Stagger splices in horizontal wall bars at least 48 inches longitudinally in alternate bars and opposite faces.

F. Field Welding: As specified for fabrication.

3.2 FIELD QUALITY CONTROL

A. Supervision: Perform Work to this Section under supervision of a capable superintendent.

B. An independent testing agency, as specified in Section 01 40 00: Quality Requirements, shall inspect installed reinforcement for conformance to Contract Documents before concrete placement.

C. Where welding is done in the shop or at the site, perform welding of reinforcing bars under inspection of the testing laboratory welding inspector in accordance with Chapter 17A of the

CBC. The welding inspector shall make a systematic record of all welds:

1. Identification marks of welders.
2. List of defective welds.
3. Manner of correction of defects:
    a. The welding inspector shall check the material, equipment details of construction and procedures, as well as the welds. The inspector shall check the ability of the welder. The welding inspector shall furnish the structural Engineer and the enforcement agency with a verified report that the welding required to be inspected is proper and has been done in conformity with the approved Plans and Specifications. The welding inspector shall use all means necessary to determine the quality of the weld. The inspector may use gamma ray, magnaflux, trepanning, sonics, or any other aid to visual inspection, which the inspector may deem necessary to assure the adequacy of the welding.

END OF SECTION

SECTION 03 30 00 – CAST-IN-PLACE CONRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Retaining and Freestanding Walls.
4. Slabs-on-grade.
5. Slab substrate.

B. Related Sections include the following:

1. Division 03 Section "Architectural Concrete" for general building applications of specially finished formed concrete.
2. Division 07 Section "Reinforced Vapor Retarder for under slabs".
3. Division 09 Section “Tiling for finish of concrete floor tiling.
4. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.
5. Division 32 Section "Concrete Paving" for concrete pavement and walks.
6. Division 32 Section "Decorative Concrete Paving" for decorative concrete pavement and walks.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments. Design mixtures shall be prepared by and signed and sealed by a Registered Civil Engineer.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Samples: For vapor retarder.

E. Qualification Data: For Installer.

F. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

    a) Material Certificates: For each of the following, signed by manufacturers:

2. Cementitious materials.
3. Admixtures.
4. Form materials and form-release agents.
5. Steel reinforcement and accessories.
6. Granular fill.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Semirigid joint filler.
12. Joint-filler strips.
13. Repair materials.

G. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

H. Field quality-control test and inspection reports. (By I.O.R. and Testing Agency).

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5 and Section 7, "Lightweight Concrete."

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

H. Mockups: Cast concrete slab-on-grade and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.

1. Build panel approximately 200 sq. ft. (18.6 sq. m) for slab-on-grade and 100 sq. ft. (9.3 sq. m) for formed surface in the location indicated or, if not indicated, as directed by Architect.

2. Approved panels may become part of the completed Work if undisturbed at time of Substantial Completion.

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.

b. Independent testing agency responsible for concrete design mixtures.

c. Ready-mix concrete manufacturer.

d. Concrete subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2. Products: Subject to compliance with requirements, provide one of the products specified.

3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

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

2.02 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints. Refer to Section 03 35 00 for form facing materials for colored architectural concrete.

1. Plywood, metal, or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1 or better.

b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

c. Structural 1, B-B or better; mill oiled and edge sealed.

d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.

2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.

3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.03 STEEL REINFORCEMENT

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

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Plain-Steel Wire: ASTM A 82, as drawn.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.04 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.05 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type II, gray Supplement with the following:

a. Fly Ash: ASTM C 618, Class F.

b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials. Use ASTM C227 to determine alkali reactivity of the aggregates as specified therein. The alkali reactivity shall be “innocuous” as determined by ASTM C289.

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

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

D. Water: ASTM C 94/C 94M and potable.

2.06 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

2. Retarding Admixture: ASTM C 494/C 494M, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

C. Color Pigment: Refer to Section 03 35 00 Colored Architectural Concrete. Add other admixtures, such as integral waterproofing admixtures, if required.

2.07 GRANUALAR FILL

A. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, with 90 to 100 percent passing a ¾ sieve: 0 to 10 percent passing a No. 4 sieve; and 0 to 3 percent passing a No. 100 sieve.

B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve,

10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.08 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 C 171, polyethylene film or white burlap-polyethylene sheet. USE FOR ALL FLATWORK, SLABS AND TOPPINGS.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Products:

a. Anti-Hydro International, Inc.; AH Clear Cure WB.

b. Burke by Edoco; Spartan Cote WB II.

c. ChemMasters; Safe-Cure & Seal 20.

d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Cure and Seal WB.

e. Dayton Superior Corporation; Safe Cure and Seal (J-18).

f. Euclid Chemical Company (The); Aqua Cure VOX.

g. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.

h. Lambert Corporation; Glazecote Sealer-20.

i. L&M Construction Chemicals, Inc.; Dress & Seal WB.

j. Meadows, W. R., Inc.; Vocomp-20.

k. Metalcrete Industries; Metcure.

l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 150E.

m. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.

n. Tamms Industries, Inc.; Clearseal WB 150.

o. Unitex; Hydro Seal.

p. US Mix Products Company; US Spec Hydrasheen 15 percent

2.09 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Reglets: Fabricate reglets of not less than 0.0217-inch- (0.55-mm-) thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

2.010 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.

4. Compressive Strength: Not less than 4500 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.

4. Compressive Strength: Not less than 4500 psi at 28 days when tested according to ASTM C 109/C 109M.

2.011 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 15 percent.

2. Combined Fly Ash and Pozzolan: 15 percent.

3. Comply with CBC Section 1903A.5.

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

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing 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, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup. See Section 03 35 00 for other details.

2.012 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As indicated on the Drawings.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).

B. Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As indicated on the Drawings.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 5 inches (125 mm), plus or minus 1 inch (25 mm).

C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As indicated on the Drawings.
2. Minimum Cementitious Materials Content: 610 lb/cu. yd. (320 kg/cu. m).
3. Maximum Water-Cementitious Materials Ratio: 0.45.
4. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
5. Build (3) 4-foot square mock-up panels for Architect’s approval.

D. Concrete Toppings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As indicated on the Drawings.
2. Minimum Cementitious Materials Content: 610 lb/cu. yd. (320 kg/cu. m).
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).

E. Retaining and Freestanding Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As indicated on the Drawings.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 5 inches (125 mm), plus or minus 1 inch (25 mm).

2.013 FABRICATING REINFORCEMENT

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

2.014 CONCRETE MIXING

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

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

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. 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 5 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

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

2. 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. Install dovetail anchor slots in concrete structures as indicated.

3.03 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 48 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.

2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.04 SHORES AND RESHORES

A. Comply with ACI 318 (ACI 318M) and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.05 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

B. Granular Course: Cover vapor retarder with fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).

1. Place and compact a 1/2-inch- (13-mm-) thick layer of fine-graded granular material over granular fill.

3.06 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. 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 would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.07 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.

3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

5. Space vertical joints in walls practical. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.08 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Maintain reinforcement in position on chairs during concrete placement.

3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.09 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

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

3.010 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in 1 direction.

1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated 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.

2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:

   a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

   b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

   c. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.

   d. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.

3. Finish and measure surface with a dipstick measuring device by Face Construction Technologies or a F-meter measuring device by Allen Face & Company.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom. Coordinate finish with Section 093000 “Tiling”.

1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.011 MISCELLANEOUS CONCRETE ITEMS

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

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: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.012 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and

during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.

   b. Continuous water-fog spray.

   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Use only this method for slabs, concrete fill and toppings. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project..

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

   a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.013 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions. Refer to Section 033300 for other details.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.

2. Do not apply to concrete that is less than seven days old.

3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.014 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.015 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete, but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.016 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a resident inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports. Section 014523.

END OF SECTION 03 30 00

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SECTION 03 35 00 CONCRETE FINISHING

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. Deep penetrating concrete floor sealer.
   2. Accessories necessary for a complete installation

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications, application instructions, and recommendations. Include data substantiating product complies with requirements of the Contract Documents.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable requirements for interior finishes in CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA).

B. Accessibility Requirements:
   1. Comply with applicable requirements:
      a. Americans with Disabilities Act of 1990, as amended:
         1) ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.
      b. CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA).
      c. CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.

C. Manufacturer Qualifications: Provide products produced by a company specializing in production of concrete sealers for minimum of five (5) years.

PART 2 PRODUCTS

2.1 MATERIAL

A. Concrete Sealer: Deep penetrating sealer, water based, clear, non-yellowing, nontoxic, VOC compliant concrete sealer, integral with concrete through chemical reaction forming nonsoluble seal within pores and capillaries of concrete and sealing it against ingress of moisture while allowing concrete to breathe.

B. Basis of Design:
   1. Product: Subject to compliance with requirements, provide **Moxie International Inc.; Moxie Shield 1600 Concrete Sealer**, P.O. Box 838 Loomis, CA 95650; Contact Manufacturer’s representative: P:916-251-0825, F: 877-330-1930 Email: info@moxieshield.com.
      a. PROSOCO, Inc.

b. W.R. Meadows.

C. Physical Properties:
1. Permeability: Maximum 0.093 ml/m^2/s.
2. Specific gravity: 1.094.
3. PH: 11.50.
4. Flash point: Nonflammable.
5. Chemical identity: Mixture containing silicates, bonding catalysts, and inert materials.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental Requirements: Do not proceed with installation until areas to receive work are enclosed and temperature and relative humidity are stabilized and maintained for optimum quality control.

B. Environmental Limitations:
1. Comply with coating manufacturer's written instructions for substrate temperature, ambient temperature, humidity, ventilation, and conditions affecting floor treatment application. Do not apply coating until wet work in spaces is complete and dry; and overhead work, including installing mechanical systems, lighting, and athletic equipment, is complete:
a. Apply floor coatings when substrate temperature and surrounding air temperatures are between 50 degrees F and 95 degrees F (10 degrees C and 35 degrees C).
b. Do not apply floor coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.

3.2 EXAMINATION

A. Examine substrates for conditions affecting performance and conditions of floor treatment:
1. Verify compatibility with and suitability of substrates, including existing finishes or primers.
2. Verify plasticizers in existing concrete substrate will not impair bond.
3. Proceed with installation after correcting unsatisfactory conditions

3.3 PREPARATION

A. Clean substrate, removing projections and substances detrimental to the work; comply with recommendations of manufacturer of products to be installed for proper preparation procedures. Mask off or protect adjacent surfaces not scheduled to receive sealer.

3.4 APPLICATION

A. Spray apply sealer to comply with manufacturer's instructions except where Project conditions require extra precautions or provisions to ensure satisfactory performance of the Work:
1. Apply sealer to produce surface without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or surface imperfections. Produce sharp glass lines and color breaks.

3.5 CLEANING

A. After completing application, clean spattered surfaces. Remove spattered sealer by washing

or other appropriate methods for coating. Do not scratch or damage adjacent finished surfaces.

B. Clean Up: Remove rubbish, empty cans, rags, and discarded materials from site daily. Rinse and recycle or legally dispose of sealer and coating containers.

3.6 PROTECTION

A. Institute protective procedures and install protective materials as required to ensure that work of this Section will be without damage or deterioration at substantial completion.

END OF SECTION

SECTION 05 12 00 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Structural steel.

2. Grout.

B. Related Sections:

1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.

2. Division 05 Section "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.

3. Division 05 Section "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other metal items not defined as structural steel.

4. Division 09 painting Sections and Division 09 Section "High-Performance Coatings" for surface-preparation and priming requirements.

1.03 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:

1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches (38 mm).

2. Welded built-up members with plates thicker than 2 inches (50 mm).

3. Column base plates thicker than 2 inches (50 mm).

D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.04 SUBMITTALS

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

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

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

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.
3. Preheat and interpass temperatures.

D. Qualification Data: For qualified Installer and fabricator.

E. Welding certificates.

F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

G. Mill test reports for structural steel, including chemical and physical properties.

H. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Non-shrink grout.

I. Source quality-control reports.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that is licensed as a Los Angeles City Department of Building Safety Approved Fabricator or equal.

B. Installer Qualifications: A qualified installer that is licensed in the State of California and has a minimum of five (5) years of experience.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

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

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

E. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

F. Preinstallation Conference: Conduct conference at Project site.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.07 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:

1. W-Shapes: 60 percent.
2. Channels, Angles, Shapes: 60 percent.
3. Plate and Bar: 25 percent.
4. Cold-Formed Hollow Structural Sections: 25 percent.
5. Steel Pipe: 25 percent.
6. All Other Steel Materials: 25 percent.

C. W-Shapes: ASTM A 992/A 992M.

D. Channels, Angles, Shapes: ASTM A 36/A 36M.

E. Plate and Bar: ASTM A 36/A 36M.

F. Gusset Plates used on Braced Frames: ASTM A572, Grade 50.

G. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

H. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

1. Weight Class: As indicated on the Drawings.

2. Finish: Black except where indicated to be galvanized.

I. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.

J. Steel Forgings: ASTM A 668/A 668M.

K. Welding Electrodes: Comply with AWS requirements. Electrodes shall be E70 Series and shall meet a Charpy V-Notch Impact Energy of 20 Ft-Lbs. at -20°F.

2.02 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip or mechanically deposited zinc coating.

2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating finish.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain.

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

E. Unheaded Anchor Rods: ASTM F 1554, Grade as indicated on the Drawings.

1. Configuration: Straight.

2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.

3. Plate Washers: ASTM A 36/A 36M carbon steel.

4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.

5. Finish: Plain.

F. Headed Anchor Rods: ASTM F 1554, Grade as indicated on the Drawings.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.

2. Plate Washers: ASTM A 36/A 36M carbon steel.

3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.

4. Finish: Plain.

G. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.

2. Washers: ASTM A 36/A 36M carbon steel.

3. Finish: Plain.

H. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

I. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

1. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.03 PRIMER

A. Primer: High solids, single component rust-inhibitive alkyd primer.

B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.04 GROUT

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

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

2.05 FABRICATION

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

1. Camber structural-steel members where indicated.

2. Fabricate beams with rolling camber up.

3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.

4. Mark and match-mark materials for field assembly.

5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning."

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.06 SHOP CONNECTIONS

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

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, preheating, post-weld cooling and methods used in correcting welding work.
1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.
2. Preheat and interpass temperatures shall conform to Table 3.2 of AWS D1.1.

2.07 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 to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."
3. SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."
4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
5. SSPC-SP 14/NACE No. 8, "Industrial Blast Cleaning."
6. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
7. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."
8. SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning."
9. SSPC-SP 8, "Pickling."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.08 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

2. Galvanize lintels, shelf angles, and welded door frames attached to structural-steel frame and located in exterior walls.

2.09 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.

2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

3. Ultrasonic Inspection: ASTM E 164.

4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.

2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

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

3.02 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in

intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.03 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.

2. Weld plate washers to top of baseplate.

3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.04 FIELD CONNECTIONS

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

1. Joint Type: Slip critical.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

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

2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.

3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

4. Comply with AWS D1.1, Table 3.2 for preheat and interpass temperatures.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections. See Section 014523.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.06 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 05 12 00

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 for countertops.
   2. Steel framing and supports for mechanical and electrical equipment.
   3. Metal ladders.
   4. Pipe bollards.
   5. Accessories necessary for a coordinated and complete installation.

1.3 PERFORMANCE REQUIREMENTS

A. 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.

B. 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) 500-pound live load placed on the countertop and vanity.
         3) Deflection at midspan: L/1000 times span or 1/8 inch, whichever is less.

C. 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): 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), 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 - ladders, racks, platforms, and others specified within. 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. Welding Certificates.

D. 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 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA).
   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.

C. Coordination:
   1. 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.
   2. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.6 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.

1.7 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 metallically 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 inches by 1-5/8 inches (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 inches (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. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

M. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

N. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

O. Aluminum Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

P. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

Q. Nickel Silver Extrusions: ASTM B151/B151M, Alloy UNS No. C74500.

R. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

S. 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 aluminum.
   b. Provide stainless steel fasteners for fastening stainless steel.
   c. Provide stainless steel fasteners for fastening nickel silver.
   d. Provide bronze fasteners for fastening bronze.
   e. Steel bolts and nuts: Regular hexagon head bolts, ASTM A 307, Grade A, Property Class 4.6; with hex nuts, ASTM A563; and, where indicated, flat washers.
   f. Steel bolts and nuts: Regular hexagon head bolts, ASTM F3125, Type 3; with hex nuts, ASTM A563, Grade C3, Class 8S3; and, where indicated, flat washers.
   g. 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.
   h. Anchor bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
   i. Hot dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
   j. 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.
   k. Cast-in-place anchors in concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot dip galvanized per ASTM F2329.
   l. Post installed anchors:
      1) Torque controlled expansion anchors:
         a) Material for interior locations: Carbon steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
         b) Material for exterior locations and where stainless steel is indicated:
            1. Alloy Group 1 (A1) stainless steel bolts, ASTM F593, and nuts, ASTM F594.
   m. Slotted channel inserts: Cold formed, hot dip galvanized steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than three inches (75 mm) long at not more than eight inches (200 mm) o.c. Provide with temporary filler and tee head bolts, complete with washers and nuts, all zinc plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

T. 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/D1187M.
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 ten percent (10%) 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, CMU partition head supports, 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.
      b. Countertop framing: Custom fabricate countertop and vanity framing, using steel shapes and plates, and cold finished mild steel bars at exposed conditions, for support framing and plywood, to the thicknesses, sizes, and shapes shown, and as required to produce work of adequate strength and durability, without objectionable deflections. Use proven details of fabrication, as required, to achieve proper assembly and alignment of the various components of the work.
      c. Galvanize miscellaneous framing and supports at exterior locations; prime paint miscellaneous framing and supports at interior locations.
      d. Steel pipe columns:
         1) Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated:
            a) Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
            b) Unless otherwise indicated, provide 1/2-inch (12.7 mm) baseplates with four (4) 5/8-inch (16 mm) anchor bolts and 1/4-inch (6.4 mm) top plates.
            c) Galvanize miscellaneous framing and supports.

2.3 LADDERS

A. Roof Access Ladders - Comply with ANSI A14.3:
   1. Steel ladders:
      a. Space siderails 20 inches (457 mm) apart unless otherwise indicated.
      b. Siderails: Continuous, 3/8-inch by 2-inch (9.5 mm by 64 mm) steel flat bars, with eased edges.
      c. Rungs:
         1) 3/4-inch (19 mm) diameter steel bars.
         2) Fit rungs in centerline of siderails; plug weld and grind smooth on outer rail faces.
         3) Provide knurled rungs to produce nonslip surface.
      d. Support each ladder at top and bottom and not more than 48 inches (1219 mm) o.c. with welded or bolted steel brackets:
         1) Galvanize ladders, including brackets and fasteners.

B. Pit Access Ladders: Refer to Swimming Pool Drawings

2.4 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. Galvanize miscellaneous steel trim.

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 SP6/NACE No. 3, "Commercial Blast Cleaning."
      b. Items indicated to receive zinc-rich primer: SSPC SP6/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 PA1, "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.

F. Stainless Steel Finishes:
   1. Remove tool and die marks and stretch lines, or blend into finish:
      a. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
      b. Bright, directional Polish: No. 4 finish.
      c. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.8 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish - AAMA 611:
   1. Class I, clear anodic finish: AA-M12C22A41 (mechanical finish: non-specular as fabricated; chemical finish: etched, medium matte; anodic coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation, with edges and surfaces level, plumb, true, and free of rack, and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding:
   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.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on shop drawings.

3.3 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).

3.4 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 PA1 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

SECTION 05 52 00 METAL RAILINGS

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, but is not limited to:
   1. Steel pipe railings.
   2. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data:
   1. Technical data for railings and the following:
      a. Manufacturer's product lines of mechanically connected railings.
      b. Railing brackets.
      c. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples:
   1. For each type of exposed finish required:
      a. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
      b. Fittings and brackets.
      c. Assembled sample of railing system, made from full size components, including top rail, post, handrail, and infill. Sample need not be full height:
         1) Show method of connection and finishing members at intersections.

D. Qualification Data: For testing agency.

E. Mill Certificates: Signed by manufacturers of stainless steel products certifying that products furnished comply with requirements.

F. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E894 and ASTM E935.

G. Evaluation Reports: For post installed anchors, from ICC-ES.

1.4 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 and the 2016 ADA Standards for Accessible Design.
      b. 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
         1) Chapter 10 – Means of Egress:
            a) Section 1014 Handrails.

b) Section 1015.3 Guards.
2) CBC Section 11B-505, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.

2. Welding qualifications - qualify procedures and personnel according to the following:
   a. AWS D1.1/D1.1M Structural Welding Code – Steel.
   b. AWS D1.3/D1.3M Structural Welding Code - Sheet Steel.
   c. AWS D1.6/D1.6M Structural Welding Code - Stainless Steel.

B. Accessibility Requirements:
   1. Railings and handrails - according to CBC Section 11B-505:
      a. Top of gripping surfaces of handrails shall be 34 inches minimum and 38 inches maximum vertically above walking surfaces, stair nosings, and ramp surfaces. Handrails shall be at a consistent height above such surfaces.
      b. Clearance between handrail gripping surfaces and adjacent surfaces shall be 1-1/2 inches minimum. Handrail may be located in a recess if the recess is 3 inches maximum deep and provides 18 inches minimum clear space above the top of the handrail.
      c. Handrail gripping surfaces shall be continuous along their length and shall not be obstructed along their tops or sides. The bottoms of handrail gripping surfaces shall not be obstructed for more than 20% of their length. Where supports are provided, horizontal projections shall occur 1-1/2 inch minimum below the bottom of the handrail gripping surfaces:
         1) Handrail gripping surface with a circular cross section shall have an outside diameter of 1-1/4 inch minimum and 2 inches maximum.
      d. Handrail gripping surface with a non-circular cross section shall have an outside diameter of 4 inches minimum and 6-1/4 inch maximum, and a cross-sectional dimension of 2-1/4 inch maximum.
      e. Handrail gripping surfaces and any surfaces adjacent to them shall be free of sharp or abrasive elements and shall have rounded edges.
      f. Handrails shall not rotate within their fittings.
      g. Handrail gripping surfaces shall extend beyond and in the same direction of stair flights and ramp runs in accordance with CBC Section 11B-505.10. Such extensions are not required for continuous handrails at the inside turn of switchback or dogleg stairs and ramps.
      h. The orientation of at least one handrail shall be in the direction of the stair run, perpendicular to the direction of the stair nosing, and shall not reduce the minimum required width of the stair. CBC Section 11B-505.2.1
      i. A 2-inch minimum high curb or barrier shall be provided to prevent the passage of a 4 inch diameter sphere rolling off the edges on a ramp or landing surface. Such a curb or barrier shall be continuous and uninterrupted along the length of a ramp. CBC Section 11B-405.9.2

C. Source Limitations: Obtain each type of railing from single source from single manufacturer.

1.5 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer licensed in the State of California and experienced in the design of railings, including attachment to building construction.

B. Structural Performance:
   1. Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
      a. Handrails and top rails of guards:
         1) Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.

2) Concentrated load of 200 lbf (0.89 kN) applied in any direction.
3) Uniform and concentrated loads need not be assumed to act concurrently.
4) Design shall comply with the CBC Live Loads Section 1607A.8 CBC. Table 1607A.1 (15).

b. Infill of guards:
1) Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of one square foot (0.093 sq. m).
2) Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements:
1. Allow for thermal movements from ambient and surface temperature changes:
a. Temperature change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C, material surfaces).

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers are subject to compliance with requirements; provide products by the following:
1. Steel pipe and tube railings: Industrial Metal Supply Co. 1-818-729-3333.

B. Metal Surfaces: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

C. Brackets, Flanges, and Anchors:
1. Formed metal of same type of material and finish as supported rails unless otherwise indicated:
a. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch (38 mm) clearance from inside face of handrail to finished wall surface.

D. Steel and Iron:
1. Tubing: ASTM A500 (cold formed) or ASTM A513.
2. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
3. Plates, shapes, and bars: ASTM A36/A36M.

E. Fasteners:
1. Provide the following:
b. Hot dip galvanized railings: Type 304 stainless steel or hot dip zinc coated steel fasteners complying with ASTM A153/A153M or ASTM F2329 for zinc coating.
c. Provide exposed fasteners with finish matching appearance, including color and texture of railings.
d. Fasteners for anchoring railings to other construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

F. Miscellaneous Materials:
1. Welding rods and bare electrodes: Select according to AWS specifications for metal

alloy welded.
2. Etching cleaner for galvanized metal: Complying with MPI#25.
3. Galvanizing repair paint: High zinc dust content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
4. 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.
5. Bituminous paint: Cold applied asphalt emulsion complying with SSPC-Paint 12, containing no asbestos fibers, or cold applied asphalt emulsion complying with ASTM D1187/D1187M.
6. 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.

2.2 FABRICATION

A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. 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.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections.

H. Welded Connections:
1. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings:
   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 flux immediately.
   d. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Form Changes in Direction:
1. As detailed.

J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of

components.

K. Close exposed ends of railing members with prefabricated end fittings.

L. Provide wall returns at ends of wall mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

M. Brackets, Flanges, Fittings, and Anchors:
1. Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated:

2.3 FINISHES

A. Steel and Iron Finishes:
1. Galvanized railings:
a. Hot dip galvanize exterior steel railings, including hardware, after fabrication.
b. Comply with ASTM A123/A123M for hot dip galvanized railings.
c. Comply with ASTM A153/A153M for hot dip galvanized hardware.
d. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
2. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
3. Do not apply primer to galvanized surfaces.

PART 3 EXECUTION

3.1 COORDINATION

A. Coordinate installation of anchorages for railings. 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.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

3.2 FIELD CONDITIONS

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

B. Grade elevation review to actual conditions.

3.3 INSTALLATION

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation, measured from established lines and levels and free of rack:
1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in three feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and variations from parallel

with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.4 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections whether welding is performed in the shop or in the field.

3.5 ANCHORING POSTS

A. Core drill holes 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

3.6 ATTACHING RAILINGS

A. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Secure wall brackets and railing end flanges to building construction as follows:
   1. For concrete and solid masonry anchorage, use drilled in expansion shields and hanger or lag bolts.
   2. For steel framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.7 ADJUSTING AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

3.8 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 06 10 53 MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Wood blocking and nailers.
   2. Plywood.

1.3 SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:
   1. Preservative-treated wood.
   2. Fire-retardant-treated wood.

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, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded 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.

B. Maximum Moisture Content of Lumber: Per plan unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA 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 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 all miscellaneous carpentry unless otherwise indicated.
   1. Wood nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood plates in contact with concrete or masonry.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Fire retardant treated wood shall be tested in accordance with ASTM D2898 Method A and the requirements of CBC Section 2303.2 Products with a flame-spread index of 25 or less when tested according to ASTM E 84, 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 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 D 2898. Use for exterior locations and where indicated.
   2. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high-temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

C. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

D. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.4 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 nominal thickness.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of hot dipped galvanized or Type 304 stainless steel.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

C. Do not splice structural members between supports unless otherwise indicated.

D. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

3.2 PROTECTION

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

END OF SECTION

SECTION 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.

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.
   4. Greenguard Children and Schools (http://www.greenguard.org/).

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 two 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 two 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 two 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 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.

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. Board and Batt Insulation:
   1. Install insulation that is undamaged, dry, and unsoiled and has not been exposed to ice, rain, or snow at any time:
      a. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
      b. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

C. 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 three-inch (76 mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
      d. For metal framed wall cavities where cavity heights exceed 96 inches (2,438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
      e. 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.

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

SECTION 07 27 27 SELF-ADHERING WATER-RESISTIVE AIR BARRIER MEMBRANE

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 the following:
   1. Materials and installation methods for self-adhered vapor permeable air barrier membrane system located in the non-accessible part of the wall.
   2. Materials and installation methods to bridge and seal air leakage pathways in roof and foundation junctions, window and door openings, control and expansion joints, masonry ties, piping and other penetrations through the wall assembly.

B. Reference Standards:
   1. The following standards and publications are applicable to the extent referenced in the text. The most recent version of these standards is implied unless otherwise stated:
      a. ASTM International:
         1) ASTM C920 Specifications for Elastomeric Joint Sealants.
         2) ASTM D412 Standard Test Methods for Rubber Properties in Tension.
         3) ASTM D570 Test Method for Water Absorption of Plastics.
         4) ASTM D903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
         5) ASTM D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
         6) ASTM D1876 Test Method for Peel Resistance of Adhesives.
         7) ASTM D1938 Test Method for Tear Propagation Resistance of Plastic Film and Sheeting.
         8) ASTM D1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
         9) ASTM D4263 Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
         10) ASTM D4541 Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.
         11) ASTM D5034 Test Method for Breaking Strength and Elongation of Textile Fabrics.
         12) ASTM E96 Test Methods for Water Vapor Transmission of Materials.
         13) ASTM E154 Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
         14) ASTM E1186 Practice for Air Leakage Site Detection in Building Envelopes and Air Retarder Systems.
         15) ASTM E2178 Standard Test Method for Air Permeance of Building Materials.
         16) ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
      b. American Association of Textile Chemists and Colorists:
         1) AATCC-127 Water Resistance: Hydrostatic Pressure Test.

1.3 DEFINITIONS

A. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of air barrier.

B. Shop Drawings:
1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction:
   a. Include details of interfaces with other materials that form part of air barrier.
   b. Include details of mock-ups.

C. Samples:
1. Submit representative samples of the following for approval:
   a. Self-adhered air barrier membrane.
   b. Self-adhered transition membrane.
   c. Self-adhered through wall flashing.

D. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier, signed by product manufacturer.

E. Qualification Data: For applicator.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers, submit certified test report showing compliance with requirements specified for ASTM E2178.

G. Warranty: Submit a sample warranty identifying the terms and conditions.

1.5 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. The building envelope shall be designed and constructed with a continuous air barrier to control air leakage into, or out of, the conditioned space. An air barrier shall also be provided for interior partitions between conditioned space and space designed to maintain temperature or humidity levels that differ from those in the conditioned space by more than 50 percent of the difference between the conditioned space and design ambient conditions. The air barrier shall have the following characteristics:
1. It must be continuous, with all joints made airtight.
2. It shall have an air permeability not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3-inch water (1.57 psf) (equal to 0.02L/sq. m at 75 Pa), when tested in accordance with ASTM E2178.
3. It shall be capable of withstanding positive and negative combined design wind and fan

and stack pressures on the envelope without damage or displacement and shall transfer the load to the structure. It shall not displace adjacent materials under full load.
4. It shall be durable and maintainable.
5. The air barrier shall be joined in an airtight and flexible manner to the air barrier material of adjacent systems, allowing for the relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between:
   a. Foundation and walls.
   b. Walls and windows or doors.
   c. Different wall systems.
   d. Wall and roof.
   e. Wall and roof over unconditioned space.
   f. Walls, floor, and roof across construction, control, and expansion joints.
   g. Walls, floors, and roof to utility, pipe, and duct penetrations.
6. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made airtight.

1.6 QUALITY ASSURANCE

A. Manufacturer: Air barrier systems shall be manufactured and marketed by a firm with a minimum of 20 years' experience in the production and sales of waterproofing and air barriers. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified and include a list of projects of similar design and complexity completed within the past five (5) years.

B. Source Limitations: Obtain primary air barrier material and through wall flashing through one (1) source from a single manufacturer. Should Project require a vapor permeable and a vapor impermeable air barrier on same Project, obtain vapor-permeable and vapor impermeable air barrier and through wall flashing from one (1) source from a single manufacturer.

C. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

D. Mock-ups:
   1. Before beginning installation of air barrier, provide air barrier work for exterior wall assembly mock-ups, incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane:
      a. Coordinate construction of mock-up to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.
      b. If Architect determines mock-ups do not comply with requirements, reconstruct mock-ups and apply air barrier until mock-ups are approved.

E. Pre-Installation Conference:
   1. A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Pre-installation conference shall include the Contractor, installer, Architect, and system manufacturer's field representative. Agenda for meeting shall include but not be limited to the following:
      a. Review of submittals.
      b. Review of surface preparation, minimum curing period, and installation procedures.
      c. Review of special details and flashings.
      d. Sequence of construction, responsibilities, and schedule for subsequent operations.

e. Review of mock-up requirements.
f. Review of inspection, testing, protection, and repair procedures.

1.7 WARRANTY

A. Submit manufacturer's warranty that air barrier and accessories are free of defects at time of delivery and material specifications.

B. Warranty Period: Five (5) years from date of completion of the air barrier membrane installation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer’s instructions, recommendations, and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures, and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

B. Do not double stack pallets of fluid-applied components on the jobsite. Provide cover on top and all sides, allowing for adequate ventilation.

C. Protect fluid-applied components from freezing and extreme heat.

D. Sequence deliveries to avoid delays but minimize onsite storage.

PART 2 PRODUCTS

2.1 MEMBRANE (BASIS-OF-DESIGN)

A. Self-Adhered Air Barrier Membrane:
1. Perm-A-Barrier VPS 30, manufactured by GCP Applied Technologies, 62 Whittemore Avenue, Cambridge, MA; a self-adhered membrane consisting of a breathable carrier film with a specially designed adhesive, which permits the transfusion of water vapor and provides superior protection against the damaging effects of air and water ingress on building structures. Product shall have the following minimum physical properties:
   a. Air permeance, ASTM E2178: Not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3-inch water (1.57 psf) (equal to 0.02L/sq. m at 75 Pa).
   b. Assembly air permeance, ASTM E2357: Not to exceed 0.04 cfm/sq.ft. under a pressure differential of 0.3-inch water (1.57 psf) (equal to 0.2 L/sq.m at 75 Pa).
   c. Water vapor permeance, ASTM E96, Method B greater than ten (10) perms.
   d. Water resistance, AATCC-127: No less than five (5) hours at 21 inches/55 cm.
   e. Pull adhesion, ASTM D4541; minimum 16 psi:
      1) Peel adhesion, ASTM D903 (modified), minimum 1.5pli, per AC 38.
      2) UV exposure limit: Not more than 150 days.
      3) Fire propagation characteristics: Passes NFPA 285 testing as part of an approved assembly.
      4) Assembly water penetration, ASTM E331. Pass at. 15 psf.

B. Transition Membrane (Primerless):
1. Perm-A-Barrier® NPS Detail Membrane as manufactured by GCP Applied Technologies, 62 Whittemore Avenue, Cambridge, MA; 0.018-inch thick, sheet-applied, vapor impermeable membrane that forms a resilient, monolithic, fully bonded elastomeric membrane when applied to construction surfaces. The HDPE/aluminum-based membrane provides superior protection against the damaging effects of air and

liquid water ingress on the building structures. Product shall meet the following requirements:

a. Membrane air permeance, ASTM E2178: Not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3-inch water (1.57 psf) (equal to 0.02 L/s. x sq. m. at 75 Pa).
b. Water resistance, ASTM E331: Pass at 15 psf.
c. Water vapor permeance, ASTM E96, Method A: < 1 perm.
d. Water vapor permeance, ASTM E96, Method B: < 1 perm.
e. Elongation, ASTM D412, Die C: Minimum 200 percent.
f. Low temperature flexibility and crack bridging - ASTM C1305: Pass.
g. Nail sealability, ASTM D1970: Pass.

C. Transition Membrane:
1. Perm-A-Barrier® Detail Membrane manufactured by GCP Applied Technologies; 36 mil (0.9 mm) of self-adhesive rubberized asphalt integrally bonded to four mil (0.1 mm) of cross-laminated, high-density polyethylene film to provide a minimum 40 mil (1.0 mm) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming to the following:
   a. Water vapor transmission, ASTM E96, Method B: 2.9 ng/m2sPa (0.05 perms) maximum.
   b. Air permeance at 75Pa (0.3-inch water) pressure difference: 0.0006 L/(s.m2) (0.00012 cfm/ft2) maximum.
   c. Puncture resistance, ASTM E154: 178 N (40 lbs.) minimum.
   d. Lap adhesion at 25 degrees F (-4 degrees C), ASTM D1876: 880 N/m (5.0 lbs./in.) of width.
   e. Low temperature flexibility, ASTM D1970: Unaffected to-45 degrees F (-43 degrees C).
   f. Tensile strength, ASTM D412, Die C Modified: Minimum 2.7 MPa (400 psi).
   g. Elongation, ultimate failure of rubberized asphalt, ASTM D412, Die C: Minimum 200 percent.

D. Transition Membrane:
1. Perm-A-Barrier Liquid Flashing manufactured by GCP Applied Technologies; a fluid applied single component STPE elastomeric flashing installed at 25 wet mils, conforming with the following:
   a. Water vapor transmission, ASTM E96, Method B: Minimum ten (10) perms.
   b. Solids content by volume: 100 percent.
   c. Cure time at 50 percent R.H. 70F: 24 hours.
   d. Elongation, ASTM D412: 250 percent.
   e. Tensile strength, ASTM D412: 200 psi.
   f. Nail sealability, ASTM D1970: Pass.

E. Transition Aluminum Membrane:
1. Perm-A-Barrier Aluminum Flashing manufactured by GCP Applied Technologies; a 35 mil (0.9 mm) of self-adhesive rubberized asphalt integrally bonded to five mil (0.1 mm) of aluminum film to provide a minimum 40 mil (1.0 mm) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming to the following:
   a. Water absorption, ASTM D570: Maximum 0.1 percent by weight.
   b. Puncture resistance, ASTM E154: 355 N (80 lbs.) minimum.
   c. Lap adhesion at 25 degrees F (-4 degrees C), ASTM D1876 Modified: 880 N/m (5.0 lbs./in.) of width.
   d. Low temperature flexibility, ASTM D1970 Modified: Unaffected to -15 degrees F (-26 degrees C).
   e. Tensile strength, ASTM D412, Die C Modified: Minimum 4.1 MPa (600 Psi).
   f. Elongation, ultimate failure of rubberized asphalt, ASTM D412, Die C Modified:

Minimum 200 percent.

F. Flexible Membrane Through Wall Flashing:
1. Perm-A-Barrier Wall Flashing manufactured by GCP Applied Technologies; 32 mil (0.8 mm) of self-adhesive rubberized asphalt integrally bonded to eight mil (0.2 mm) of cross-laminated, high-density polyethylene film to provide a minimum 40 mil (1.0 mm) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming to the following:
   a. Water vapor transmission, ASTM E96, Method B; 2.9 ng/m2sPa (0.05 perms) maximum:
      1) Water absorption, ASTM D570: Maximum 0.1 percent by weight.
      2) Puncture resistance, ASTM E154: 356 N (80 lbs.) minimum.
      3) Initiation, ASTM D1004: minimum 58 N (13.0 lbs.) M.D.
      4) Propagation, ASTM D1938: Minimum 40 N (9.0 lbs.) M.D.
      5) Lap adhesion at 25 degrees F (-4 degrees C), ASTM D1876: 880 N/m (5.0 lbs./in.) of width.
      6) Low temperature flexibility, ASTM D1970: Unaffected to -45 degrees F (-43 degrees C).
      7) Tensile strength, ASTM D412, Die C Modified: Minimum 5.5 MPa (800 psi).
      8) Elongation, ultimate failure of rubberized asphalt, ASTM D412, Die C: Minimum 200 percent.

G. High Temperature Membrane:
1. Grace Ultra manufactured by GCP Applied Technologies; 26 mil (0.66 mm) of self-adhesive butyl integrally bonded to four mil (0.1 mm) of high-density polyethylene film to provide a minimum 30 mil (.76 mm) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming to the following:
   a. Heat resistance: 300 degrees F (149 degrees C).
   b. Tensile strength, ASTM D412, Die C, modified: 250 psi (1,720 kN/m2).
   c. Elongation, membrane, ASTM D412, Die C, modified: 250 percent.
   d. Adhesion to plywood, ASTM D903: 3.0 lbs/in. width (525 N/m).
   e. Low temperature flexibility, ASTM D1970: Unaffected to -20 degrees F (-29 degrees C).

2.2 PRIMERS, WHERE REQUIRED BY CODE OR APPLICATION

A. Wall Primer for self-adhered transition membrane and self-adhered flexible membrane wall flashing:
1. Perm-A-Barrier® WB Primer manufactured by GCP Applied Technologies; a water-based primer which imparts an aggressive, high tack finish on the treated substrate. Product shall have the following minimum physical properties:
   a. Flash point: No flash to boiling point.
   b. Solvent type: Water.
   c. VOC content: Not to exceed 10 g/L.
   d. Application temperature: 25 degrees F (-4 degrees C) and above.

2.3 PENETRATIONS AND TERMINATION SEALANT

A. Joint Treatment: Refer to sealant manufacturer’s recommendations (ref: gcpat.com).

B. Liquid Membrane for Details and Terminations:
1. Bituthene® Liquid Membrane manufactured by GCP Applied Technologies; a two-part, elastomeric, trowel grade material designed for use with self-adhered membranes and tapes. 10 g/L maximum VOC content.
2. Bituthene® Mastic manufactured by GCP Applied Technologies is designed to seal

terminations and edges of patches and overlaps in detail areas. 225 g/L maximum VOC content.

C. Substrate Patching Membrane:
1. Bituthene® Liquid Membrane manufactured by GCP Applied Technologies; a two-part, elastomeric, trowel grade material designed for use with self-adhered membranes and tapes. 10 g/L maximum VOC content.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

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

3.2 EXAMINATION

A. Verify that substrates and conditions are ready to accept the work of this Section. Notify Architect in writing of any discrepancies. Commencement of the work or any parts thereof shall mean acceptance of the prepared substrates.

B. All surfaces must be sound, dry, clean, and free of oil, grease, dirt, excess mortar, or other contaminants detrimental to the adhesion of the membranes. Fill voids, gaps, and spalled areas in substrate to provide an even plane. Strike masonry joints full-flush.

C. Curing compounds or release agents used in concrete construction must be resin based without oil, wax, or pigments

3.3 SURFACE PREPARATION

A. Refer to manufacturer’s literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, spalled areas, loose aggregate, and sharp protrusions. Remove contaminants such as grease, oil, and wax from exposed surfaces. Remove dust, dirt, loose stone, and debris. Use repair materials and methods that are acceptable to manufacturer of the air barrier assembly.

B. Exterior Sheathing Panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws in accordance with exterior sheathing manufacturer’s written instructions.

C. Masonry Substrates: Apply air and vapor barrier over concrete block and brick with smooth trowel-cut mortar joints, struck full and flush. Fill all voids and holes, particularly in the mortar joints, with a lean mortar mix, non-shrinking grout, or parge coat.

D. Related Materials: Treat construction joints and install flashing as recommended by manufacturer.

E. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

F. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

G. Remove fins, ridges, mortar, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.

H. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

I. At changes in substrate plane, apply sealant or Bituthene® Liquid Membrane at sharp corners and edges to form a smooth transition from one plane to another.

J. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.4 AIR BARRIER MEMBRANE INSTALLATION

A. Refer to manufacturer’s literature for recommendations on installation.

B. Apply air barrier membrane to achieve a continuous air barrier according to air barrier manufacturer's written instructions.

C. Application of Self-Adhered Air Barrier Membrane:
1. Install air barrier to dry surfaces at air and surface temperatures of 25 degrees F (-4 degrees C) and above in accordance with manufacturer's recommendations, at locations indicated on Construction Documents.
2. Priming the substrate is not required; however, priming can be used as an optional step in certain circumstances. Apply per the manufacturer’s written instructions.
3. Precut pieces of air barrier into easily handled lengths.
4. Remove release linear and position membrane carefully before placing against the surface. Can be applied vertically or horizontally.
5. Begin installation at the base of the wall placing top edge of membrane immediately below any masonry reinforcement or ties protruding from substrate.
6. When properly positioned, place against surface by pressing firmly into place. Roll membrane with extension-handled countertop roller immediately after placement.
7. Overlap adjacent pieces two inches (50 mm) and roll seams.
8. Subsequent sheets of membrane applied above shall be positioned immediately below masonry reinforcement or ties. Bottom edge shall be slit to fit around reinforcing wires or ties and membrane shall overlap the membrane sheet below by two inches (50 mm). Roll firmly into place.
9. Seal around masonry reinforcing or ties and all penetrations with penetration and termination sealant.
10. Coordinate the installation of air barrier with roof installer to ensure continuity of membrane with roof air barrier.
11. At end of each working day, seal top edge of air barrier to substrate with termination sealant.
12. Do not expose air barrier membrane to sunlight for more than six (6) months prior to enclosure.
13. Inspect installation prior to enclosing and repair punctures, damaged areas, and inadequately lapped seams with a patch of the membrane sized to extend six inches (150 mm) in all directions from the perimeter of the affected area.

3.5 TRANSITION MEMBRANE INSTALLATION

A. Install strips, transition membrane, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier. Install all transition membrane only after application of air barrier.

B. Apply primer to substrates to receive transition membrane at required rate and allow to dry. Limit priming to areas that will be covered by transition tape in same day. Re-prime areas exposed for more than 24 hours.

C. Prime glass-fiber-surfaced gypsum sheathing not covered with air membrane material with number of prime coats needed to achieve required bond, with adequate drying time between coats.

D. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

E. At end of each working day, seal top edge transition membrane to substrate with termination sealant.

F. Apply joint sealants forming part of air barrier assembly within sealant manufacturer's recommended application temperature ranges. Consult sealant manufacturer when sealant cannot be applied within these temperature ranges.

G. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition membrane so that a minimum of three inches (75 mm) of coverage is achieved over both substrates.

H. Transition Membrane: Roll firmly to enhance adhesion.

I. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

J. Repair punctures, voids, and deficient lapped seams in transition membrane. Slit and flatten fishmouths and blisters. Patch with transition membrane extending six inches (150 mm) beyond repaired areas in strip direction.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Inspections:
   1. Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:
      a. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
      b. Continuous structural support of air barrier system has been provided.
      c. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
      d. Site conditions for application temperature and dryness of substrates have been maintained.
      e. Maximum exposure time of materials to UV deterioration has not been exceeded.
      f. Surfaces have been primed, if applicable.
      g. Laps in transition membrane have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
      h. Termination sealant has been applied on cut edges.

i. Transition membrane has been firmly adhered to substrate.
j. Compatible materials have been used.
k. Transitions at changes in direction and structural support at gaps have been provided.
l. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
m. All penetrations have been sealed.

C. Tests:
1. Testing to be performed will be determined by Owner's testing agency from among the following tests:
a. Qualitative testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E1186, smoke pencil with pressurization or depressurization.

D. Remove and replace deficient air barrier components and retest as specified above.

3.7 CLEANING AND PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

B. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 150 days.

C. Clean spills, stains, and soiling from construction that would be exposed in the completed Work using cleaning agents and procedures recommended by manufacturer of affected construction.

D. Remove masking materials after installation.

END OF SECTION

SECTION 07 62 00 ROOF RELATED SHEET METAL

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. Metal heat exhaust vents.
      d. Sanitary vent pipes.
      e. Pipe box.
      f. Trim and miscellaneous sheet metal accessories.
      g. Pre-engineered metal perimeter edge and coping cap.

B. 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. Grout - Pitch Pans:
1. Type: Quick-setting, non-shrink, non-metallic, high strength formula complying with ASTM C1107.
2. Approved Products/Manufacturers: “Sure Grip High Performance Grout” manufactured by Dayton Superior Corporation, “Premier Quick-Trim” manufactured by L & M Construction Chemicals, Inc., “Masterflow” manufactured by Master Builders, Inc., “Sonnogrout 10K” manufactured by Sonneborn Building Products, or approved equal.

H. Pitch Pan Filler:
1. Type: Pourable polyurethane sealer, approved by roofing system manufacturer.
2. Approved Products/Manufacturers: “Quick Pitch Sealer” manufactured by U.S. Intec, “SPM Pourable Sealer” manufactured by Johns Manville, or approved equal.

I. 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.

J. Pipe Hangers and Supports: Refer to Section 07 72 00: Roof Accessories.

K. 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.

L. Splash Pans: 22 gauge stainless steel, of size and profiles indicated. Use at locations where roof drainage discharges over adjoining, lower roof level(s).

M. 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 ¾".
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.
2. Pitch Pans:
   a. 24 gauge stainless steel.
   b. Fabricate to provide installed minimum clear inside perimeter dimension of two (2) inches on each side of penetrating element.
   c. Fabricate pans to at least six (6) inches above the finished roof membrane and with 1/4 inch hem at top edge and with four (4) inch flanges. Round all corners of flange.
   d. Fabricate metal bonnets for all pans, NO EXCEPTIONS. Fabricate bonnets with metal compatible with metal to which bonnet is to be attached. On beams and other steel, weld in place bonnets fabricated from 1/4 inch steel plate. Draw band bonnets fabricated from 22 gauge stainless steel may be used on circular projections.

D. Metal Edge and Coping Cap:

1. Pre-Engineered System - Basis of Design: Metal Era, Inc., which is located at: 1600 Airport Rd.; Waukesha, WI 53188; Toll Free Tel: 800-558-2162; Tel: 262-549-6900; Fax: 800-373-9156; Email:request info (info@metalera.com); Web:www.metalera.com

3. Substitutions: Before proposal date upon roof consultant approval.

4. Requests for substitutions will be considered in accordance with provisions of Section 012513.

5. Manufacturers named within specification are approved for use on the Project providing:
   a. their products meet or exceed the specifications;
   b. company has a minimum of five (5) years' experience manufacturing products of the type specified;
   c. 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; and
   d. products are approved for use by the roofing membrane manufacturer.

E. Vent Hoods, Sleeves, Penetration Flashings, and Accessories: Minimum 24 gauge stainless steel, or as shown or directed otherwise.

F. Angle Termination Bar: Aluminum pressure bar 1/8 inch x one (1) inch.

G. Vent Pipe Flashing: Four (4) pound lead. Provide proper size to fold down inside of pipe a minimum of one (1) inch.

H. Roof Drain Flashing: Four (4) pound lead, minimum 30 inches by 30 inches.

I. Pipe Box Cover: 24 gauge stainless steel.

J. Heat Exhaust Curbs and Hoods: 22 gauge stainless steel.

K. Expansion Joint Cover: Minimum 24 gauge stainless steel (Provide pre-finished metal at

perimeter edge end termination.)

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. Gravel Guard/Fascia:
   1. Install per Pre-Engineered System requirements.
   2. Install with expansion joints 10 feet o.c., 1/2 inch expansion leeway, with cover plate.

3. Set in asphalt mastic and fasten into nailer at 3 inches o.c. staggered.
4. Buff sand Kynar surface of flange and prime.
5. Strip in flange with specified stripping plies set in hot bitumen extending 3 inches from outer edge of flange to at least 3 inches inward towards gravel stop. Provide finish stripping ply of modified bitumen base ply in hot bitumen extending 6 inches from the outer edge of the flange and butt base of gravel stop.

G. 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.

H. Pitch Pans, Metal Flanges:
1. Apply mastic under pitch pan or metal flashing flange at least 1/2 pound per linear foot.
2. Prime all metal flanges with asphalt primer prior to flashing installation.
3. Clean all projections enclosed in pitch pans in any manner suitable and coated with a rust inhibitive coating as approved by the Architect. Coating shall be allowed to dry prior to pitch pan fill.
4. Fill base of pitch pans with grout or cementitious binder and allow to cure.
5. Top Finish Fill: Self-leveling, one-part urethane; at least two (2) inches to top of pitch pan sides.
6. Strip in pitch pan flanges with two strips of specified stripping plies set in hot bitumen extending three (3) inches from the outer edge of the flange to at least three (3) inches inward toward base of pitch pan. Provide finish stripping ply of SBS modified bitumen membrane in hot bitumen extending six (6) inches from the outer edge of the flange and butt to base of pitch pan.

I. 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.

J. Roof Drains:
1. After membrane installation, prime bottom of lead flashing sheet and set in uniform bed of plastic roof cement at specified locations.
2. Extend lead flashing into drain bowl or pipe a minimum of two (2) inches and over top of piping/bowl connection, if possible. Apply a continuous bead of specified Type A sealant, at intersection of pipe and drain bowl.
3. If drain bowl and pipe connection is contaminated with bituminous material, strip-in area with three (3) coursing of plastic roof cement and fabric.
4. Prime top of lead flashing sheet to receive strip-in membrane.

K. Coping:
1. Install per Pre-Engineered System requirements.
2. Install wood nailers as shown on drawings.
3. Install metal cleats with appropriate fasteners spaced six (6) inches on center.
4. Install underlayment over the wood substrate. Lap ends minimum of six (6) inches and secure membrane in place. Seal laps with appropriate adhesive.
5. 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.
6. 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.

7. Install appropriate fastener through neoprene washer and cover plate between coping segments.
8. 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

SECTION 07 72 00 ROOF ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and Conditions of Contract, including General and Supplementary Conditions and Division 01 Administration Sections, apply to this Division.

1.2 SUMMARY

A. This Section includes the following:
   1. Equipment supports.

1.3 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

C. Coordination Drawings:
   1. Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
      a. Size and location of roof accessories specified in this Section.
      b. Method of attaching roof accessories to roof or building structure.
      c. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

D. Warranty: Provide manufacturer’s standard warranty.

1.4 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

B. Mock-ups: Refer to Section 07 62 00: Roof Related Sheet Metal.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed in other Part 2 articles.

2.2 METAL MATERIALS

A. Galvanized Steel Sheet: ASTM A653/A653M, G90 (Z275) coated.

B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, AZ50 (AZM150) coated.

C. Aluminum Sheet: ASTM B209, alloy and temper recommended by manufacturer for type of use and mill finish.

D. Aluminum Extrusions and Tubes: ASTM B221, alloy and temper recommended by manufacturer for type of use, mill finished.

E. Stainless-Steel Shapes or Sheet: ASTM A240/A240M or ASTM A666, Type 304 or Type 316, No. 2D finish.

F. Steel Shapes: ASTM A36/A36M, hot-dip galvanized to comply with ASTM A123/A123M, unless otherwise indicated.

G. Steel Tube: ASTM A500, round tube, baked-enamel finished.

H. Galvanized Steel Tube: ASTM A500, round tube, hot-dip galvanized to comply with ASTM A123/A123M.

I. Galvanized Steel Pipe: ASTM A53/A53M.

2.3 MISCELLANEOUS MATERIALS

A. Glass-Fiber Board Insulation: ASTM C726, 1 inch (25 mm) thick.

B. Polyisocyanurate Board Insulation: ASTM C1289, 1 inch (25 mm) thick.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, not less than 1-1/2 inches (38 mm) thick.

D. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

E. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

G. Elastomeric Sealant: ASTM C920, polyurethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

H. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, and heavy bodied for hooked-type expansion joints with limited movement.

I. Roofing Cement: ASTM D4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.4 EQUIPMENT SUPPORTS

A. Equipment Supports:
1. Provide metal equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported:
   a. Manufacturers:
      1) Colony Custom Curbs.
      2) Commodity Products Company, Inc.
      3) Conn-Fab Sales, Inc.
      4) Curbs Plus Inc.
      5) Custom Curb, Inc.
      6) LM Curbs.
      7) Loren Cook Company.
      8) Metallic Products Corporation.
      9) Pate Company (The).
      10) Roof Products & Systems Corporation.
      11) Roof Products, Inc.
      12) Thaler Metal Industries Ltd.
      13) ThyCurb; Div. of Thybar Corporation.
      14) Uni-Curb, Inc.
      15) Vent Products Company, Inc.
   b. Indicate load requirements on Drawings or insert below.
   c. Load Requirements: Provide roof curbs capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Coordinate dimension with rough-in information or Shop Drawings of equipment to be supported.
   d. Material: Galvanized or Aluminum-zinc alloy-coated steel sheet, 0.052 inch (1.32 mm) thick.
   e. Factory-install continuous wood nailers 3-1/2 inches (90 mm) wide at tops of equipment supports.
   f. Metal Counterflashing: Manufacturer's standard removable counterflashing, fabricated of same metal and finish as equipment support.
   g. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
   h. Equipment support height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer.
   i. Fabricate units to minimum height of 12 inches (300 mm), unless otherwise indicated.
   j. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

3.2 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

3.3 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work:
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
   2. Verify dimensions of roof openings for roof accessories.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. Metal Protection:
   1. Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer:
      a. Coat concealed side of uncoated aluminum and stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
      b. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
      c. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

E. Roof Curb Installation:
   1. Set roof curb so top surface of roof curb is level.

F. Equipment Support Installation:
   1. Set equipment support so top surface of equipment support is level.

G. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.

3.5 TOUCH UP

A. Touch up factory-primed surfaces with compatible primer ready for field painting in

accordance with Section 09 90 00: Painting and Coating.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

3.6 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION

SECTION 07 84 00 FIRESTOPPING

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. Penetration firestop systems.
2. Fire resistive joint systems.
3. Repair of firestop assemblies disturbed by the work.
4. Smoke barriers.
5. Accessories necessary for a complete installation.

B. Reference Standards:
1. Part 1 2022 California Administrative Code, Title 24 C.C.R.
2. Part 2 2022 California Building Code, Title 24 C.C.R.
3. Part 3 2022 California Electrical Code, Title 24 C.C.R.
4. Part 4 2022 California Mechanical Code, Title 24 C.C.R.
5. Part 5 2022 California Plumbing Code, Title 24 C.C.R.
6. Part 6 2022 California Energy Code, Title 24 C.C.R.
7. Part 9 2022 California Fire Code, Title 24 C.C.R.
8. Part 11 2022 California Green Building Standards Code (CALGreen Code), Title 24 C.C.R.
9. Part 12 2022 California Referenced Standards Code, Title 24 C.C.R.
10. NFPA 72 National Fire Alarm and Signaling Code (California Amended) Current Edition (Note: See UL Standard 1971 for Visual Devices).
11. NFPA 80 Fire Door and Other Opening Protectives, Current Edition.
12. NFPA 92 Standard for Smoke Control Systems.
13. NFPA 253 Critical Radiant Flux of Flooring Covering Systems, Current Edition.
14. NFPA 2001 Clean Agent Fire Extinguishing Systems (California Amended), Current Edition.
15. Fire Test Response Characteristics:
    a. Provide firestop systems complying with requirements:
        1) Penetration firestop systems are identical to those tested in accordance with UL. Provide rated systems complying with requirements:
            a) Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
            b) Penetration firestop system products bear classification marking of qualified testing and inspecting agency.
            c) Penetration firestop systems correspond to those indicated by reference to penetration firestop system designations listed by UL in its Fire Resistance Directory and FM Global in its Building Materials Approval Guide.
    b. Fire Resistive Joints:
        1) Perform fire resistance tests by UL with follow up inspection services for fire resistive joint systems acceptable to authorities having jurisdiction:
            a) Fire resistive joint system products bear classification marking of qualified testing and inspecting agency.
            b) Fire resistive joint systems correspond to those indicated by reference to penetration firestop system designations listed by UL in its Fire

Resistance Directory.

1.3 SUBMITTALS

A. Product Data: Technical data including installation recommendations, construction conditions, and applicable UL assemblies.

B. Shop Drawings:
   1. For each penetration firestop or fire resistive joint system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetration. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated:
      a. Submit documentation, including illustrations, from qualified testing and inspecting agency, applicable to each firestop system configuration for construction and penetrating items.

C. Product Certificates: For penetration firestop system products, signed by product manufacturer.

D. Product Test Reports: From a qualified testing agency indicating penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.4 PERFORMANCE REQUIREMENTS

A. Penetration Fire Resistance Systems:
   1. For penetrations through vertical and horizontal fire resistance rated constructions, including both empty openings and openings containing penetrating items, provide firestop systems produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and gases, and maintain original fire resistance rating of construction penetrated.
   2. Rated systems:
      a. Provide penetration firestop systems with ratings determined in accordance with UL 1479 for C-AJ, C-BJ, C-BK, F-A, F-B, F-C, W-J, W-K, and W-L classified systems:
         1) F rated systems: Provide penetration firestop systems with F ratings indicated, but not less than that equaling or exceeding fire resistance rating of constructions penetrated.
         2) T rated systems: For specified conditions, provide penetration firestop systems with T ratings indicated, as well as F ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas.
         3) L rated systems: Where penetration firestop systems are indicated in smoke barriers, provide penetration firestop systems with L ratings of not more than 3.0 cfm/sq. ft (0.01524cu. m/s x sq. m) at both ambient temperatures and 400 degrees F (204 degrees C).
         4) For penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to conditions both during and after construction.
         5) For piping penetrations for plumbing and wet pipe sprinkler systems, provide moisture resistant penetration firestop systems.
         6) For penetrations involving insulated piping, provide penetration firestop systems not requiring removal of insulation.
   3. For penetration firestop systems exposed to view, provide products with flame spread and smoke developed indexes of less than 25 and 450, respectively, determined in accordance with ASTM E84.

B. Fire Resistive Joint Systems:
   1. System produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and gases, and maintain original fire resistance rating of assembly in which fire resistive joint systems are installed:
      a. Joint systems in and between fire resistance rated constructions: Provide systems with assembly ratings equaling or exceeding fire resistance ratings of construction that are joined, with movement capabilities and L ratings indicated determined by UL 2079.
      b. Perimeter fire resistive joint systems: For joints between edges of fire resistance rated floor assemblies and exterior curtain walls, provide systems of type and with ratings indicated, determined by NFPA 285 and UL 2079.
      c. For fire resistive systems exposed to view, provide products with flame spread and smoke developed indexes of less than 25 and 450, respectively, determined in accordance with ASTM E84.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
   1. A firm experienced in installing firestop systems and who has been approved by FM Global according to FM Global 4991 Approval of Firestop Contractors or been evaluated by UL and found to comply with UL Qualified Firestop Contractor Program Requirements and has minimum five (5) years' documented experience in installing firestopping assemblies:
      a. Manufacturer's willingness to sell its penetration firestop system products to Contractor or to installer engaged by Contractor does not qualify buyer/installer.

B. Installation Responsibility: Assign installation of penetration firestop systems and fire resistive joint systems to a single qualified installer.

C. Source Limitations: Obtain firestop systems for each kind of penetration and construction condition indicated; one (1) source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver firestop system products to site in original, unopened containers or packages with intact and legible manufacturer labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturer:
   1. Subject to compliance with requirements, provide firestop systems by one of the following for each application required:
      a. Specified Technologies Inc
      b. Hilti, Inc.
      c. 3M; Fire Protection Products Division.
      d. USG Corporation.
      e. Tremco Commercial Sealants and Waterproofing.

B. Compatibility: Provide firestop systems compatible with each other; with substrates forming openings; and with items penetrating penetration firestop systems, under conditions of service and application, demonstrated by penetration firestop system manufacturer based on testing and field experience.

C. Accessories:
1. Provide components for each firestop system necessary to install fill materials. Use components specified by penetration firestop or fire resistive joint system manufacturer and UL. Accessories include, but are not limited to:
   a. Penetration firestop systems: Provide penetration firestopping produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and gases, and maintain original fire resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with substrates forming openings, and with penetrating items if any.
   b. Accessories - Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated:
      1) Permanent forming/damming/backing materials, including the following:
         a) Slag wool fiber or rock wool fiber insulation.
         b) Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
         c) Fire rated form board.
         d) Fillers for sealants.
      2) Temporary forming materials.
      3) Substrate primers.
      4) Collars.
      5) Steel sleeves.

D. Fill Materials:
1. Penetration firestop systems containing types of fill materials indicated. Fill materials are those referenced in directories of referenced testing and inspecting agencies as fill, void, or cavity materials:
   a. Cast in place firestop devices: Factory assembled devices for use in cast in place concrete floors and consisting of an outer metallic sleeve lined with intumescent strip, radial extended flange attached to one end of sleeve for fastening to concrete formwork, and neoprene gasket.
   b. Latex sealants: Single component latex formulations that after cure do not reemulsify during exposure to moisture.
   c. Firestop devices: Factory assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
   d. Intumescent composite sheets: Rigid panels consisting of aluminum foil faced elastomeric sheet bonded to galvanized steel sheet.
   e. Intumescent putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
   f. Intumescent wrap strips: Single component intumescent elastomeric sheets with aluminum foil on one side.
   g. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at site to form non-shrinking, homogeneous mortar.
   h. Pillows/bags: Reusable heat expanding pillows/bags consisting of glass fiber cloth cases filled with combination of mineral fiber, water insoluble expansion agents, and fire-retardant additives.
   i. Silicone foams: Multicomponent, silicone based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
   j. Silicone sealants - single component, silicone based, neutral curing elastomeric

sealants of grade indicated:

1) Grade: Pourable (self-leveling) formulation for openings in floors and horizontal surfaces, and non-sag formulation for openings in vertical and surfaces requiring nonslumping, gunnable sealant, unless indicated firestop system limits use to non-sag grade for both opening conditions.

E. Fire Resistive Joint Systems: Sealants complying with UL 1479 including F, T, and L ratings.

F. Fire Safing Insulation:

1. Semi-refractory blanket: Semirigid blankets designed for use as fire stops at openings between edge of slab and exterior wall panels, glass mat faced, low density; having nominal density of 4 lb/cu. ft. (64 kg/cu. m); complying with ASTM C612, Type 1A and 1B and ASTM E136 for combustion characteristics; thermal resistivity of four (4) degrees F x h x sq. ft./Btu x in. at 75 degrees F (27.7 K x m/W at 24 degrees C); with maximum flame spread and smoke developed values of 10 and 5. Use for floor perimeter fire and smoke containment. Install blanket with 20-gauge impaling clips recommended by manufacturer.
2. Caulking compound: Material approved by manufacturer of safing insulation for sealing joint between foil backing of safing insulation and edge of concrete floor slab against penetration of smoke.
3. Safing clips: Galvanized steel safing clips approved by manufacturer of safing insulation for holding safing insulation in place.

G. Duct Wrap for Ducts: Materials listed in the UL Fire Resistance Directory under File R8418, Category CAJ7009, File R14229 Categories CAJ 7013, CAJ 7015, CAJ 7020, CAJ 7022, YYET, and grease duct enclosures and having minimum two (2) hour fire resistive rating for grease or air duct enclosure materials.

H. Composition Edge Banding: Materials listed in UL Fire Resistance Directory UL 10C standard.

2.2 FIRE STOPPING SYSTEMS

A. Penetration System:

1. Penetrations in fire resistance rated walls - provide penetration firestopping with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa):
   a. Fire resistance rated walls include fire walls, fire barrier walls, smoke barrier walls, and fire partitions.
   b. F Rating: Minimum fire resistance rating of constructions penetrated.
2. Penetrations in horizontal assemblies - provide penetration firestopping with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa):
   a. Horizontal assemblies include floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
   b. F rating: At least one (1) hour, but not less than the fire-resistance rating of constructions penetrated.
   c. T rating: At least one (1) hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
3. Penetrations in smoke barriers:
   a. Provide penetration firestopping with ratings determined per UL 1479:
      1) L rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.
      2) W rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

4. Exposed penetration firestopping: Provide products with flame-spread and smoke developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

B. Joint Resistive Systems:
1. Joints in smoke barriers:
   a. Provide fire resistive joint systems with ratings determined per UL 2079:
      1) L rating: Not exceeding 5.0 cfm/ft (0.00775 cu. m/s x m) of joint at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.
2. Exposed fire resistive joint systems: Provide products with flame-spread and smoke developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.
3. Exposed fire-resistive joint systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

2.3 MIXING

A. For products requiring mixing before application, comply with penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental Limitations: Do not install firestop systems when ambient or substrate temperatures are outside limits permitted by firestop system manufacturer or when substrates are wet due to rain, frost, condensation, or causes.

B. Install and cure fire resistive joint systems in accordance with manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced air circulation.

C. Ventilate firestop systems per manufacturer's written instructions by natural means or, where inadequate, forced air circulation.

3.2 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that firestop resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core drilled holes, or cut openings to accommodate penetration firestop systems.

C. Joint System: Coordinate sizing of joints to accommodate fire resistive joint systems.

D. Do not cover up penetration firestop system or fire resistive joint system installations that will become concealed behind other construction until building inspector of authorities having jurisdiction have examined each installation.

3.3 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and conditions affecting performance of work. Proceed with installation after unsatisfactory conditions have been corrected.

3.4 PREPARATION

A. Surface Cleaning:
   1. Clean out openings immediately before installing penetration firestop systems complying with firestop system manufacturer's written instructions and with the following requirements:
      a. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestop systems.
      b. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestop systems. Remove loose particles remaining from cleaning operation.
      c. Remove laitance and form release agents from concrete.

B. Priming: Prime substrates where recommended in writing by penetration firestop system manufacturer complying with manufacturer's recommended. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of work and that would be permanently stained or damaged by contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.5 INSTALLATION

A. Penetration Firestop System:
   1. Install penetration firestop systems to comply with requirements and with firestop system manufacturer written installation instructions and published drawings for products and applications indicated:
      a. Install forming/damming/backing materials and accessories of types required to support fill materials during application and in the position needed to produce cross sectional shapes and depths required to achieve fire ratings indicated. After installing fill materials and allowing them to fully cure, remove combustible forming materials and accessories not indicated as permanent components of firestop systems.
      b. Install fill materials for firestop systems by proven techniques to produce results:
         1) Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire resistance ratings indicated.
         2) Apply materials for full contact and adhere to substrates formed by openings and penetrating items.
         3) For fill materials that remain exposed after completing work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

B. Fire Resistive Joint System:
   1. Install fire resistive joint systems to comply with requirements and manufacturer's written installation instructions for products and applications indicated:
      a. Install forming/packing/backing materials and accessories of types required to support fill materials during application and in position needed to produce cross sectional shapes and depths required to achieve fire ratings indicated.
      b. Install fill materials for joint systems by proven techniques to produce the following results:
         1) Fill voids and cavities formed by openings and forming/packing/backing

materials required to achieve fire resistance ratings indicated.

2) Apply fill materials to contact and adhere to substrates formed by joints.

3) For fill materials remaining exposed after completing work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.6 IDENTIFICATION

A. Identify firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within six inches (150 mm) of edge of the firestop systems so labels are visible at removal:

1. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces and, in combination with label material, resulting in partial destruction of label if removal is attempted. Include information on labels:
   a. The words Warning - Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage.
   b. Contractor's name, address, and phone number.
   c. Firestop system designation of applicable testing and inspecting agency.
   d. Date of installation.
   e. Penetration firestop system manufacturer's name.
   f. Installer's name.

3.7 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or fire resistive joint systems are damaged or removed due to testing, repair or replace fire resistive joint systems so they comply with requirements.

C. Proceed with enclosing fire resistive joint systems with construction after inspection reports are issued and installations comply with requirements.

D. Provide where required by code annual inspection of all fire resistive joint systems and recommendations for improvements. Include reporting with final documentation at end of project.

3.8 CUTTING AND PATCHING

A. Cut, patch, and repair firestopping to accommodate work. Repair cracks and indented surfaces. Repair surfaces around items built into or that penetrate surfaces. Repair and replace work to eliminate blister, buckles, dry outs, and similar imperfections. Repair and replace work required to comply with fire resistance ratings.

B. After completion of work in and around the areas of firestopping, repair and replace damaged firestopping.

3.9 CLEANING AND PROTECTION

A. Clean excess fill materials adjacent to openings as work progresses by methods and with cleaning materials approved in writing by penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation ensuring penetration firestop systems are without damage or deterioration at time of Substantial

Completion. If, despite protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestop systems immediately and install new materials to produce systems complying with requirements.

END OF SECTION

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.

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.
   2. VOC data: Submit manufacturer’s product data for sealants. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits.
   3. 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 five (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 that 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 C1021 to conduct the testing indicated.
      b. Test according to SWRI Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 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 that has failed to provide a weathertight system within specified warranty period:
   1. Warranty period: Five (5) 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: Five (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’s 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 C920 and requirements indicated for each liquid applied sealant specified, including those referencing ASTM C920 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 C1248 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 non-sag 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:

1) Performance: Non-stain, non-bleed, non-streaking to sealed and adjacent substrates. The minimum pli value after seven (7) day immersion shall not be less than 13 when tested in strict accordance with ASTM C794 Adhesion and Peel.
2) 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.

c. Product and manufacturer: Dow Corning; 756 Silicone Building Sealant - HP with Additive.

I. Silicone Sealant:
1. ASTM C920, Type S, Grade NS, Class 50, for Use NT:
a. Use: Typical joints between masonry, metals, glass, and plastics (single component sealants).
b. Properties:
1) Performance: Non-stain, non-bleed, non-streaking to sealed and adjacent substrates.
2) 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.
c. 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:
1) Performance: Non-stain, non-bleed, non-streaking 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:
1) Performance: Non-stain, non-bleed, non-streaking to sealed and adjacent substrates. The minimum pli value after seven (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, and 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. Non-elastomeric, one-part, non-sag, paintable latex sealant that is recommended for exposed applications on the interior. Complying with ASTM C834, 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. Non-sag, paintable, non-staining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90:
   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 non-staining, 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, non-staining, non-waxing, non-extruding backings of flexible plastic foam complying with ASTM C1330, 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, non-outgassing 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: Non-staining, non-absorbent material compatible with joint sealants and that will not stain nor mar the finish of surface adjacent to joints to which it is applied.
4. Cork joint filler: Resilient and non-extruding, 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. Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants applicable to materials, applications, and conditions indicated.

C. 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.

D. 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.

E. 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 percent of the joint width, but not less than 1/4 inch (6 mm) and not more than 1/2 inch (13 mm).

c. Apply non-elastomeric sealants to a depth approximately equal to the joint width.

F. Tooling of Non-Sag 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.

G. Installation of Preformed Silicone Sealant System:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.
3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

H. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.

I. 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 C919 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 ten (10) tests for the first 1,000 feet (300 m) of joint length for each kind of sealant and joint substrate.
      2) Perform one (1) test for each 1,000 feet (300 m) of joint length thereafter or one (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 C1193 or Method A, Tail Procedure, in ASTM C1521. 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

SECTION 081113 - 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 Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Section 04 22 00 – Concrete Unit Masonry
    a. Coordinate installation of fully grouted hollow metal doors and frames with concrete unit masonry.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Verification:

1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40” above sill) or UL 10C.

1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
3. Smoke Control Door Assemblies: Comply with NFPA 105.

    a. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:

1. CECO Door Products (C).
2. Curries Company (CU).

3. Or approved equal

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard polystyrene. Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value of 2.8 or better.
3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.

    a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.

5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Manufacturers Basis of Design:

1. CECO Door Products (C) Honeycomb Core - Regent Series.
2. CECO Door Products (C) Energy Efficient - Trio-E Series.
3. Curries Company (CU) - Energy Efficient - 777 Trio-E Series.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16” positive thermal break and integral vinyl weatherstripping.

C. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
3. Manufacturers Basis of Design:

    a. CECO Door Products (C) – SU SR Series.
    b. CECO Door Products (C) – Thermal Break TQB Series.
    c. Curries Company (CU) – M CM Series.
    d. Curries Company (CU) – Thermal Break TQ Series.

D. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
3. Manufacturers Basis of Design:

    a. CECO Door Products (C) - BU DU Series.
    b. CECO Door Products (C) - SU Series.
    c. Curries Company (CU) - M Series.

E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LOUVERS

A. Metal Louvers: Unless otherwise indicated provide louvers to meet the following requirements.

1. Blade Type: Vision proof inverted V or inverted Y.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.

1. Manufacturers: Subject to compliance with requirements, provide louvers to meet rating indicated.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.7 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator’s shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.8 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.9 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches high.
2) Four anchors per jamb from 60 to 90 inches high.
3) Five anchors per jamb from 90 to 96 inches high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.

10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.10 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

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

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

    a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.5 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION

SECTION 08 44 13 GLAZED ALUMINUM CURTAIN WALLS

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. Two Sided Structural Silicone Glazed aluminum curtain walls.
   2. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data: Manufacturer’s technical data for each type of product, including construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings:
   1. Submit plans, elevations, sections, full size details, and attachments to other work:
      a. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
      b. Include full size isometric details of each vertical to horizontal intersection of glazed aluminum curtain walls showing the following:
         1) Joinery, including concealed welds.
         2) Anchorage.
         3) Expansion provisions.
         4) Glazing.
         5) Flashing and drainage.
         6) Thermal breaks.
         7) Interface with building construction.
      c. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
      d. Indicate glazing details, methods, locations of various types and thickness of glass, emergency breakout locations, and internal sealant requirements.
      e. Indicate locations of exposed fasteners and joints for Architect's acceptance.

C. Maintenance Data: Submit maintenance data to include in maintenance manuals.

D. Maintenance Data for Structural Sealant: For structural sealant glazed curtain walls to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality control program.

1.4 PERFORMANCE REQUIREMENTS

A. Provide curtain wall assembly, storefront system, and windows by a single source and tested as a combined single assembly.

B. System Description:
   1. Curtainwall assembly fabricated from aluminum stick framed system with exposed interior and exterior metal framing. Design system to allow for installation tolerances,

expansion and contraction of adjacent materials, and joint design:

a. Drawings are diagrammatic and do not identify or solve thermal or structural movement, glazing, anchorage, or moisture disposal. Details establish basic dimension of unit, sight lines, and profiles of members.
b. Glass, sealants, and interior finishes do not contribute to framing member strength, stiffness, or lateral stability.
c. Design perimeter conditions to allow for installation tolerances, expansion and contraction of adjacent materials, and sealant manufacturer's recommended joint design.
d. Design attachments to address site conditions, expansion and contraction movements to eliminate possibility of loosening, weakening, or fracturing connection between units and building structure or between units themselves.
e. Allow for expansion and contraction due to structural movement without detriment to appearance or performance.
f. Design system to drain to exterior face of wall, water entering joints and condensation occurring within system by drain holes and gutters of adequate size to evacuate water without infiltration to interior or the top of lower lites of glass.
g. Design metal faces to be visually flat under lighting conditions.
h. Design interior dense EPDM wedge gasket with sealed corners, with maximum 30 percent compression when glazed, to create a water and air seal.
i. Design rigid isolators to maintain flatness of face caps and provide thermal break between exterior and interior members.
j. For stresses placed on structural silicone sealants, maintain sealant manufacturer's recommended maximum.
k. Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.

C. Performance Criteria:
1. Coordinate with Section 08 41 13: Aluminum-Framed Entrances and Storefronts for performance criteria, fabrication, and erection standards. Provide curtain wall assemblies to meet or exceed performance requirements:
   a. Design and fabricate curtain wall to withstand the operating loads without measurable permanent deflection. Limit deflections to provide the normal degree of rigidity required to avoid glass breakage, air infiltration, and objectionable results of excessive flexibility.
   b. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   c. Failure also includes the following:
      1) Thermal stresses transferring to building structure.
      2) Glass breakage.
      3) Noise or vibration created by wind and thermal and structural movements.
      4) Loosening or weakening of fasteners, attachments, and other components.
      5) Failure of operating units.

D. Structural - Test according to ASTM E330:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test durations: As required by design wind velocity, but not less than ten (10) seconds.

E. Air Infiltration - Test according to ASTM E283 for infiltration:

1. Fixed framing and glass area: Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) and 6.24 lbf/sq. ft. (300 Pa).

F. Water Penetration under Static Pressure - Test according to ASTM E331: No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 15 PSF of positive wind-load design pressure.

G. Water Penetration under Dynamic Pressure - Test according to AAMA 501.1:
1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 15 PSF of positive wind-load design pressure.
2. Maximum water leakage: According to AAMA 501.1. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

H. Seismic Performance:
1. Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to ASCE 7. Design and size components to withstand seismic loads and sway displacement as calculated in accordance with CBC Section 1613A:

I. Energy Performance:
1. Certify and label energy performance according to NFRC:
   a. Thermal transmittance (U-factor): Framing areas shall have U-factor of not more than 0.65 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
   b. Condensation resistance: Fixed glazing and framing areas shall have a CRF certified condensation resistance rating of no less than 55 as determined according to AAMA 1503.1-88.

J. Sound Transmission:
1. Provide window wall and storefront systems with fixed glazing and framing areas having sound transmission in accordance with ASTM E 90.

K. Thermal Movements:
1. Allow for thermal movements resulting from ambient and surface temperature changes:
   a. Temperature change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

L. Structural Sealant Joints:
1. Designed to carry gravity loads of glazing.
2. Designed to produce tensile or shear stress of less than 20 psi (138 kPa).

M. Structural Sealant:
1. Capable of withstanding tensile and shear stresses imposed by structural sealant glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure:
   a. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
   b. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

N. Design Modifications:
1. Submit design modifications necessary to meet performance requirements and field coordination:

a. Variations in details or materials shall not adversely affect the appearance, durability, or strength of components, nor shall variations cause excessive stress, or deflections, to building structural frame.
b. Maintain general design concept without altering size of members, profiles, and alignment.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Building code:
a. 2022 California Building Code (CBC) (CCR Title 24, Part 2, as adopted and amended by DSA):
1) CBC Section 1609A Wind Loads.
2) CBC Section 1613A Earthquake Loads.
2. Surface burning characteristics:
a. Comply with ASTM E84, testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency:
1) Flame spread index: 25 or less.
2) Smoke developed index: 450 or less.
3. Accessibility requirements:
a. Americans with Disabilities Act of 1990, as amended: ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.
b. CBC Chapter 11B, Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
4. Welding standards: Welding shall be performed by skilled and qualified mechanics. Welding shall be performed in accordance with the applicable provisions of AWS for Steel and AWS D1.2 Structural Welding Code - Aluminum.
5. Structural sealant glazing: Comply with ASTM C1401 for design and installation of structural sealant glazed curtain walls.
6. Energy performance standards: NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

B. Manufacturer/Fabricator Qualifications: Fabricator specializing in the fabrication of aluminum framed window wall and window systems and components, having minimum ten (10) years' documented experience, and with sufficient production capacity, organized quality control and testing procedures, and published written and illustrated installation manuals to produce and install the entrance assemblies required.

C. Installer Qualifications:
1. Firm that specializes in the erection of aluminum framed window wall, storefront, and window systems, having minimum ten (10) years' documented experience, and approved or certified by manufacturer/fabricator:

D. Product Options:
1. Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction:
a. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

E. Source Limitations: Obtain components of curtain wall system, including accessories from single manufacturer.

F. Pre-Installation Conference: Conduct conference at site.

G. Mockups:
1. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation:
   a. Build mockup of typical wall area as shown on Drawings.
   b. Perform testing on mockups according to specified requirements.
   c. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   d. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

H. Preconstruction Laboratory Mockups:
1. Preconstruction testing service: Owner will engage a qualified testing agency to perform testing on preconstruction laboratory mockups.
2. Build preconstruction laboratory mockups at testing agency facility; use personnel, products, and methods of construction that will be used at Project site:
   a. Size and configuration: As indicated on Drawings.
   b. Notify Architect seven (7) days in advance of the dates and times when preconstruction laboratory mockups will be constructed and tested.
3. Preconstruction laboratory mockup testing program:
   a. Test preconstruction laboratory mockups according to requirements. Perform the following tests in the following order:
      1) Structural: ASTM E330 at 50 percent of positive test load.
      2) Air infiltration: ASTM E283.
      3) Water penetration under static pressure: ASTM E331.
      4) Water penetration under dynamic pressure: AAMA 501.1.
      5) Structural - ASTM E330 at 100 percent of positive and negative test loads:
         a) Repeat the following: Air infiltration - ASTM E283; water penetration under static pressure - ASTM E331.
      6) Interstory drift - AAMA 501.4 at 100 percent of design displacement:
         a) Repeat the following: Air infiltration - ASTM E283; water penetration under static pressure - ASTM E331.
      7) Vertical interstory movement - AAMA 501.7:
         a) Repeat the following: Air Infiltration - ASTM E283; water penetration under static pressure - ASTM E331.
      8) Thermal cycling - according to AAMA 501.5:
         a) Repeat the following: Air infiltration - ASTM E283; water penetration under static pressure - ASTM E331.
      9) Structural - ASTM E330 at 100 and 150 percent of positive and negative test loads:
         a) Repeat the following: Air infiltration - ASTM E283; water penetration under static pressure - ASTM E331.
   b. Corrective measures:
      1) Correct deficiencies in mockups observed during testing and repeat tests as required to show compliance with performance standards. Deficiencies requiring repair or modification to mockup(s) require complete retesting of mockup(s) beginning with the specified preliminary test unless otherwise directed by the Architect:
         a) The Owner will pay the cost of the first mockup test. The cost of subsequent tests and retesting is the responsibility of the Contractor. The Contractor shall bear costs for additional retesting until compliance with performance standards is accomplished.
         b) Incorporate corrective measures indicated by the test report into the final exterior wall assemblies after review by the Architect.

1.6 WARRANTY

A. Assembly Warranty:
   1. Written warranty signed by manufacturer, Contractor, and installer in which the manufacturer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period:
      a. Failures include, but are not limited to, the following:
         1) Failure to meet performance requirements.
         2) Structural failures including, but not limited to, excessive deflection.
         3) Glass breakage due to defective design.
         4) Noise or vibration created by wind and thermal and structural movements.
         5) Deterioration of metals, finishes, and materials beyond normal weathering.
         6) Water penetration through fixed glazing and framing areas.
         7) Deterioration of materials and finishes beyond normal weathering.
         8) Failure of insulating glass.
         9) Noise or vibration created by wind and thermal and structural movements.
         10) Failure of operating components.
   2. Warranty period: Two (2) years from date of Substantial Completion.

B. Finish Warranty:
   1. Written warranty signed by manufacturer in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory applied finishes within specified warranty period:
      a. Deterioration includes, but is not limited to, the following:
         1) Color fading more than five (5) Hunter units when tested according to ASTM D2244.
         2) Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
         3) Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Warranty period: Two (2) years from date of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Identify components of curtainwall work after fabrication by marks clearly indicating location in the building. Package components to protect components from damage during shipping and handling.

B. Storage on Site: Store units, components, and materials in clean, dry location, away from uncured concrete, masonry work, sprayed on fireproofing work, and construction activities. Cover with nonstaining waterproof paper, tarpaulin, or polyethylene sheeting to permit circulation of air inside the covering.

C. Keep handling on site to a minimum. Exercise care to avoid damage to finishes of metals or breakage of glass.

PART 2 PRODUCTS

2.1 FRAMING

A. Manufacturers are subject to compliance with requirements. Provide products by one of the following:
   1. Kawneer North America; an Alcoa company.
   2. Arcadia, Inc.
   3. EFCO Corporation.
   4. Oldcastle Building Enclosure.

5. Trulite Glass & Aluminum Solutions, LLC.
6. U.S. Aluminum; a brand of C.R. Laurence.
7. YKK AP America Inc.

B. Framing Members:
1. Extruded or formed aluminum framing members of thickness required and reinforced necessary to support imposed loads:
   a. Construction: Thermally broken.
   b. Glazing system: Retained mechanically with gaskets on two sides.
   c. Glazing plane: Front.
   d. Finish: Resin based coating
   e. Fabrication method: Field fabricated system.

C. Pressure Caps: Aluminum components that mechanically retain glazing with snap on aluminum trim that conceals fasteners.

D. Brackets and Reinforcements: High strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Materials:
1. Aluminum:
   a. Alloy and temper recommended by manufacturer for type of use and finish indicated:
      1) Sheet and plate: ASTM B209.
      2) Extruded bars, rods, profiles, and tubes: ASTM B221.
      3) Extruded structural pipe and tubes: ASTM B429.
2. Steel reinforcement:
   a. Zinc rich, corrosion resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard:
      1) Structural shapes, plates, and bars: ASTM A36.
      2) Cold rolled sheet and strip: ASTM A1008.
      3) Hot rolled sheet and strip: ASTM A1011.
3. Carbon steel: ASTM A36.

2.2 GLAZING

A. Glazing Gaskets: Sealed corner pressure glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

B. Glazing Sealants: Recommended by manufacturer.

C. Structural Glazing Sealants - ASTM C1184:
1. Chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in curtainwall assembly indicated:
   a. Color: Black

D. Weatherseal Sealants – ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O:
1. Chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural sealant, weatherseal sealant, and structural sealant glazed curtainwall manufacturers

for this use:

a. Color: Match structural sealant.

2.3 ACCESSORIES

A. Fasteners and Accessories:
   1. Corrosion resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials:
      a. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
      b. Reinforce members as required to receive fastener threads.
      c. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Anchors:
   1. Three-way adjustable anchors with minimum adjustment of one inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer:
      a. Concrete and masonry inserts: Hot dip galvanized cast iron, malleable iron, or steel inserts complying with ASTM A123 or ASTM A153 requirements.

C. Concealed Flashing: Corrosion resistant, nonstaining, nonbleeding flashing compatible with adjacent materials

D. Bituminous Paint: Cold applied asphalt mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.4 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Physical and thermal isolation of glazing from framing members.
   4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   5. Provisions for field replacement of glazing from exterior.
   6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Fabricate components to resist water penetration:
   1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
   2. Pressure equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

E. After fabrication, clearly mark components to identify locations according to shop drawings.

2.5 ALUMINUM FINISHES

A. Fluorocarbon Coating - AAMA 2605.2:
   1. Resin: 70% PVDF Kynar 500/Hylar 5000.
   2. Substrate: Cleaned and pretreated with chromium phosphate.
   3. Primer: Manufacturer's standard resin base compatible coating. Dry film thickness.
      a. Extrusion: Minimum 0.20 mil.
   4. Color Coat: 70% PVDF, dry film thickness.
      a. Extrusion: 1.0 mil.
   5. Color: Selected by Architect.
   6. Acceptable coating manufacturer's.
      a. PPG Industries, Inc.
      b. Valspar Corporation.
      c. BASF.

2.6 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality control procedures complying with ASTM C1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Field Measurements:
   1. Verify dimensions of supporting structure by field measurements before fabrication so curtainwall work is accurately designed, fabricated, and fitted to the structure. Indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work. Use Contractor's lines and benchmarks as a basis for measurements:
      a. Established dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating curtainwalls without field measurements. Coordinate supporting structure construction to ensure actual dimensions correspond to established dimensions.

3.2 EXAMINATION

A. Examine openings, substrates, adjoining construction, structural support, anchorage, and conditions for compliance with requirements for installation tolerances and conditions affecting performance of the work:
   1. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and built in components to ensure weathertight window wall installation.
   2. Notify Architect in writing of dimensions or conditions found that prevent proper execution of the window wall work, including specified tolerances.

B. Proceed with installation after correcting unsatisfactory conditions.

3.3 PREPARATION

A. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.4 INSTALLATION

A. Coordinate installation with building enclosure work.

B. Comply with manufacturer's written instructions for installing curtain wall, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112:
   1. Do not install damaged components.
   2. Fit frame joints to produce hairline joints free of burrs and distortion.
   3. Rigidly secure nonmovement joints.
   4. Remove loose particles present or resulting from fabrication or field cutting and drilling by blowing out joints with oil free compressed air, or by vacuuming joints.
   5. Remove protective coatings, oils from cutting and drilling operations, and residue on metallic surfaces with solvents that leave no residue.
   6. Do not allow solvent to air dry without wiping. Use lint free towels for wiping of surfaces. Wipe metal surfaces with IPA (isopropyl alcohol) or xylene unless otherwise required by compatibility and adhesion testing results. Seal joints watertight. Clean excess joint sealants from finished surfaces.
   7. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
   8. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
   9. Seal joints watertight unless otherwise indicated.
   10. Set components within erection tolerances with uniform joints. Place components on shims and fasten to supporting substrates using bolts and similar fasteners.
   11. Do not erect components that are warped, deformed, bowed, dented, defaced, or damaged and impair strength or appearance. Remove and replace members damaged in process of erection.
   12. Coat concealed surfaces of dissimilar materials, and ferrous metal components, with heavy coating of bituminous paint, zinc rich primer or separation in accordance with manufacturer's recommendations. Where aluminum components will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
   13. Do not burn, cut into, or field drill holes or slots in building framing member without written acceptance of the structural engineer.

C. Metal Protection:
   1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
   2. Where aluminum is in contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

D. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

E. Install components plumb and true in alignment with established lines and grades.

F. Permanently fasten to building structure with manufacturer recommended attachments and shims to permanently fasten system to building structure. Securely anchor components and units in place, allowing for required movement, including expansion and contraction. Set sill members in bed of sealant. Set other members with internal sealants and baffles to provide weathertight construction.

G. Water Drainage: Compartmentalize each light of glass using joint plugs and silicone sealant to divert water to the horizontal weep locations. Locate weep holes in the horizontal

pressure plates and covers to divert water to the exterior of the building.

H. Glazing:
1. Install glazing gaskets and sealants in accordance with manufacturer's instructions without exception; including surface preparations. Refer to Section 08 80 00: Glazing:
a. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion:
1) Preparation includes, but is not limited to, cleaning and priming surfaces.

I. Weatherseal: Install weatherseal sealant according to Section 07 92 00: Joint Sealants and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

3.5 ERECTION TOLERANCES

A. Erection Tolerances:
1. Install glazed aluminum curtain walls to comply with the following maximum tolerances:
a. Plumb: 1/8 inch in ten feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
b. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
c. Alignment:
1) Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
2) Where surfaces are separated by reveal or protruding element from 1/2 to one inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
3) Where surfaces are separated by reveal or protruding element of one inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
d. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.
e. Tolerances are not accumulative.

3.6 FIELD QUALITY CONTROL

A. The Owner reserves the rights to engage an independent testing and inspection agency to verify the adequacy of the Contractor’s quality control. Obtain inspections from representative of the Owner’s independent testing and inspection agency. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Test Area: Perform tests on representative areas of glazed aluminum curtain walls.

C. Field Quality Control Testing:
1. Perform the following tests on representative areas of glazed aluminum curtain walls.
a. Water spray test:
1) Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration:
a) Perform a minimum of two (2) tests in areas as directed by Architect.
b) Perform tests in each test area as directed by Architect. Perform at least three (3) tests, prior to 70 percent completion.
b. Air infiltration:
1) ASTM E783 at 1.5 times the rate specified for laboratory testing but not more than 0.09 cfm/sq. ft. (0.45 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa):

a) Perform a minimum of two tests in areas as directed by Architect.
b) Perform tests in each test area as directed by Architect. Perform at least three (3) tests, prior to 70 percent completion.

c. Water penetration: ASTM E1105 at a minimum cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing, but not less than 6.24 lbf/sq. ft. (300 Pa) and shall not evidence water penetration.

D. Structural Sealant Adhesion:
1. Test structural sealant according to recommendations in ASTM C1401, Destructive Test Method A, Hand Pull Tab (Destructive), Appendix X2:
a. Test a minimum of two (2) areas on each building facade.
b. Repair installation areas damaged by testing.

E. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

G. Remove and replace noncomplying windows and retest as specified.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 CLEANING

A. Clean metal surfaces promptly after installation, exercising care to avoid damage to factory finished exposed surfaces.

B. Wash glass on both faces not more than four (4) days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer. Remove excess glazing and sealant compounds, dirt, and other substances.

C. Immediately remove deleterious material from surfaces of aluminum.

3.8 PROTECTION

A. Institute protective measures required throughout the remainder of the construction period to ensure that window wall work will be without damage or deterioration, other than normal weathering, at time of acceptance.

END OF SECTION

SECTION 08 56 19 PASS-THRU WINDOWS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sliding pass-thru window units.
   2. Glazing.

1.2 REFERENCES

A. American Architectural Manufacturers Association:
   1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
   2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.

B. American Society Mechanical Engineers Standards:
   1. ASME SA-240/SA-240M - Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

C. ASTM International:
   1. ASTM B221/B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. SAE International:
   1. AMS5511 - Steel, Corrosion-Resistant, Sheet, Strip, and Plate, 19Cr - 9.5Ni (304L), Solution Heat Treated.
   2. AMS5513 - Steel, Corrosion-Resistant, Sheet, Strip, and Plate 19cr 9.2Ni (SAE 30304) Solution Heat Treated.

1.3 PERFORMANCE REQUIREMENTS

A. System Design: Design and size components to withstand dead loads and live loads caused by pressure and negative wind loads acting normal to plane of window as calculated in accordance with applicable code.

B. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, and migrating moisture occurring within system, to exterior by weep drainage network.

1.4 SUBMITTALS

A. Product Data - Manufacturer's standard specifications and descriptive literature, including:
   1. Certified test laboratory reports to show compliance with requirements:
      a. Windows with sizes exceeding the gateway sizes do not qualify under these tests.
      b. Windows manufactured with configurations different than the tested configurations do not qualify under these tests; windows can be tested for performance outside the already tested gateway sizes.
      c. Windows with hardware different from what is referenced on the test reports do not qualify under these tests.

B. Manufacturer's standard head, jamb, and sill details.
   1. Manufacturer's Certificates: Submit certified independent testing agency reports

indicating window unit meets or exceeds specified performance requirements.

C. Shop Drawings - For each installation and for special components not dimensioned or detailed in manufacturer's product data:
   1. Provide shop drawings indicating details of construction and installation including, but not limited to, window location chart, window schedule, size, type and design, sections and details of multiple window assemblies, hardware, glazing details, frame type, STC, glass types, screens, and handing operation.

D. Samples:
   1. Window section:
      a. Submit eight-inch by eight-inch (8" × 8") minimum corner section sample of frame for each glazing type specified.
      b. Sample will be used to verify construction, corner joint, frame finish and color.
      c. Quantity 3.
   2. Glazing:
      a. 12 × 12 inch.
   3. Finish - AAMA 611 Anodized Architectural Coatings; AAMA 2605 for Organic Coatings on Aluminum Extrusions:
      a. Class 1 Anodized.

E. Manufacturer's written instructions, including:
   1. Delivery, storage, and handling recommendations.
   2. Preparation and installation recommendations.

F. Installer's Experience: Submit verification of evidence of work similar to work of this Section.

G. Warranty:
   1. Fully executed, issued in Districts name and registered with manufacturer, including:
      a. Manufacturer's one (1) year warranty, from date of accepted delivery, covering defects in materials.

1.5 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by UL or testing firm acceptable to authority having jurisdiction.

B. Accessibility Requirements:
   1. Pass-through windows of sales/service counter shall comply with the reach and access requirements of CBC Sections 11B-227.3, 11B-305, 11B-306, 11B-308, 11B-309, and 11B-904.4.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum 10 years documented experience.
   1. Participates in a Quality Assurance validation Program.
      a. Facility Audit.

B. Installer: Company specializing in installation of window systems specified with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Product Requirements: Requirements for transporting, handling, storing, and protecting

products.

B. Ordering: To avoid construction delays comply with ordering instructions and lead time requirements as set by window system manufacturer.

C. Pack window units and accessories in manufacturer's standard shipping containers and protective packaging. Deliver units in manufacturer's original packaging and unopened containers with identification labels intact.

D. Store window units and accessories on raised blocks to prevent moisture damage protected from exposure to weather and vandalism.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication and record on shop drawings.

1.9 COORDINATION

A. Coordinate work with adjacent materials specified in other Sections and as indicated on Drawings and approved shop drawings.

1.10 WARRANTY

A. Furnish manufacturer's standard warranty document, executed by an authorized officer in which manufacturer agrees to repair or replace windows, drawers and air curtains that fail in materials or workmanship within specified warranty period. This warranty is in addition to, and not a limitation of other rights Owner has under the contract.
   1. Warranty Period:
      a. One year parts and labor from date of installation.
   2. Failures include, but are not limited to, the following:
      a. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
      b. Structural failures including deflections exceeding 1/4 inch.
      c. Excessive air leakage.
      d. Faulty operation of sliding window hardware.

PART 2 PRODUCTS

2.1 ALUMINUM PASS-THRU, SERVICE WINDOW UNITS

A. Manufacturers:
   1. CR Laurence Co. Inc. or approved equal.
      a. Model DW Series 5000 – XOX
         1) Service Opening: Refer to drawings
         2) Rough Opening: Field Verify and coordinate with manufacturer’s requirements.
         3) Glazing:
            a) 1/2 inch clear tempered.
         4) Screen: None
         5) Finish: Powder coated aluminum.
         6) Color: As selected by Architect.

2.2 FABRICATION

A. Fabricate window to dimensions indicated on Drawings.

B. Fabricate windows, and accessories to provide a complete system for assembly of components and anchorage of window, and accessories, as indicated on Drawings.

C. Provide weep holes and internal water passages for exterior security windows to conduct infiltrating water to the exterior.

D. Rigidly fit and secure joints and corners with internal reinforcement. Make joints and connections flush, hairline, and weatherproof.

E. Prepare components with reinforcement required for hardware.

F. Preglazed Fabrication: Preglaze window units at factory.

G. Weather Stripping: Factory applied.

H. Bottom Sills Tracks: Stainless steel construction, no bottom tracks at sliding units.

I. Handles: Built-in Window Frames.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify construction is ready to receive Products specified in this section.

B. Verify rough openings are correct size and in correct location.

C. Examine roughing-in for embedded and built-in anchors.

D. Inspect built-in and cast-in anchor installations, before installing security windows, to verify that anchor installations comply with requirements.

E. For glazing materials whose orientation is critical for performance, verify installation orientation.

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

3.2 INSTALLATION

A. Install Products in accordance with manufacturer’s instructions.

B. Align Products plumb, level and square.

C. Rigidly secure Products to adjacent supporting construction.

D. Glaze windows in accordance with manufacturer’s instructions.

E. Seal perimeter joints in accordance with Section 07 90 00: Joint Sealants.

F. Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.3 ADJUSTING

A. Adjust horizontal-sliding, transaction security windows to provide a tight fit at contact points for smooth operation and a secure enclosure.

B. Remove and replace defective work, including windows that are warped, bowed, or otherwise unacceptable.

3.4 CLEANING AND PROTECTION

A. Remove protective material from factory finished surfaces.

B. Wash surfaces by method recommended and acceptable to sealant and window manufacturer, rinse and wipe surfaces clean.

C. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

D. Clean metal and glass surfaces to polished condition.
   1. Lubricate sliding security window hardware.

E. Provide temporary protection to ensure that windows are without damage at time of Substantial Completion.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Flush Wood Doors”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 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: 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.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. 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.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.
h. Warranty information for each product.

4. 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. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. 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.

E. Proof of Compliance: (California located Projects): Provide a list of product(s) containing chemicals known to cause cancer or reproductive toxicity as defined by the Office of Environmental Health Hazard Assessment (OEHHA) under Proposition 65 (CA Code of Regulations, Title 27, Section 27001). The list includes the specific chemical(s), if the chemical will be exposed to consumers, the means of warning, and an illustration of the label.

F. Informational Submittals:

1. 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.

G. 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 Procedures.

1.4 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. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. 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.

D. 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.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. California Building Code: Provide hardware that complies with CBC Section 11B.

1. All openings as a part of an accessible route shall comply with CBC Section 11B-404.

2. The clear opening width for a door shall be 32" minimum. For a swinging door it shall be measured between the face of the door and the stop, with the door open 90 degrees. There shall be no projections into it below 34" and 4" maximum projections into it between 34" and 80" above the finish floor or ground. Door closers and stops shall be permitted to be 78" minimum above the finish floor or ground. CBC Section 11B-404.2.3.

3. Operable hardware on accessible doors shall comply with CBC Section 11B-309.4 and shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. Operable parts of such hardware shall be 34" minimum and 44" maximum above finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides.

4. Hardware (including panic hardware) shall not be provided with "nightlatch" function for any accessible doors or gates unless the following conditions are met:

   a. Such hardware has a 'dogging' feature and is dogged during the time the facility is open.
   b. All 'dogging' operation is performed only by employees as their job function (non-public use).

5. The force for pushing or pulling open a door shall be in accordance with CBC Section 11B-404.2.9.

   a. Interior hinged doors, sliding or folding doors, and exterior hinged doors: 5 pounds (22.2 N) maximum. Required fire doors: the minimum opening force allowable by the DSA authority, not to exceed 15 pounds (66.7N). These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.
   b. The force required for activating any operable parts, such as lever hardware, or disengaging other devices shall be 5 pounds (22.2N) maximum to comply with CBC Section 11B-309.4.
   c. The 5 pound (22.2 N) maximum force shall be validated for the size of the door used. The Building Materials Listing of the California State Fire Marshal shall indicate that the door hardware meets the 5 pound (22.2 N) force and shall also list the largest door that can be used.

6. Door closing speed shall comply with CBC Section 11B-404.2.8. Closers shall be adjusted so that the required time to move a door from an open position of 90 degrees to a position of 12 degrees from the latch is 5 seconds minimum. Spring hinges shall be adjusted so that the required time to move a door from an open position of 70 degrees to the closed position is 1.5 seconds minimum.

7. Floor stops shall not be located in the path of travel and 4” maximum from walls.

8. Thresholds shall comply with CBC Section 11B-404.2.5.

G. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

H. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" 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.

1. 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.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

J. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 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".

1.6 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.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. 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: 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:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

1.8 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.

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:

1. 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.

C. 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 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

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:

a. Non-removable Pins: With the exception of electric through wire hinges, 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.

5. Manufacturers:

a. Hager Companies (HA) - BB Series, 5 knuckle.
b. McKinney (MK) - TA/T4A Series, 5 knuckle.
c. dormakaba Best (ST) - F/FBB Series, 5 knuckle.

2.3 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. Hager Companies (HA) - ETW-QC (# wires) Option.
b. McKinney (MK) - QC (# wires) Option.

2.4 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.

1. Manufacturers:

a. Corbin Russwin Hardware (RU).
b. No Substitution.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. 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.
6. Keyway: Match Facility Standard.

C. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.

D. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

E. Construction Keying: Provide construction master keyed cylinders.

F. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.5 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Heavy duty mortise locks shall have a ten-year warranty.

2. Manufacturers:

a. Corbin Russwin Hardware (RU) - ML2000 Series.

B. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed.

1. Heavy duty cylindrical locks shall have a seven-year warranty.

2. Vertical Impact: Exceed 100 vertical impacts (20 times ANSI/BHMA A156.2 requirements).

3. Furnish with solid cast levers, standard 2 3/4” backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.

4. Locks are to be non-handed and fully field reversible.

5. Manufacturers:

   a. Corbin Russwin Hardware (RU) - CLX3300 Series.

2.7 LOCK AND LATCH STRIKES

A. Strikes: 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:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.8 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.

2. 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.

3. 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.

4. 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.

5. 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.

6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or 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.

8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.

9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

10. Rail Sizing: Provide exit device rails factory sized for proper door width application.

11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed 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.

    1. Manufacturers:

        a. Von Duprin (VD) - 35A/98 XP Series.

2.9 ELECTROMECHANICAL EXIT DEVICES

A. Electromechanical Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices subject to same compliance standards and requirements as mechanical exit devices. Electrified exit devices to be of type and design as specified below and in the hardware sets.

1. Where conventional power supplies are not sufficient, include any specific controllers required to provide the proper inrush current.

2. Manufacturers:

   a. Von Duprin (VD) - 35A/98 XP Series.

2.10 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.

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. 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 Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.

4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

6. 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 (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty 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 and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.

2. Manufacturers:

   a. Corbin Russwin Hardware (RU) - DC6000 Series.
   b. LCN Closers (LC) - 4040 Series.

2.11 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:

   a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

   a. Hager Companies (HA).
   b. Rockwood (RO).

2.12 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: ANSI/BHMA A156.16, Grade 1 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.

1. Manufacturers:

   a. Hager Companies (HA).
   b. Rockwood (RO).

2.13 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. Smoke Labeled Gasketing: 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.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: 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 UL-10C.

1. 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.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. National Guard Products (NG).
2. Pemko (PE).
3. Reese Enterprises, Inc. (RE).

2.14 ELECTRONIC ACCESSORIES

A. Linear Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw plus 50% for the specified electrified hardware and access control equipment.

1. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

2. Manufacturers:

a. Von Duprin (VD) - PS.

2.15 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.

2.16 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 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.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 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: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. 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 Division 7 Section "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.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

3.5 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.

3.6 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.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 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.

1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer’s Abbreviations:

1. MK - McKinney
2. RU - Corbin Russwin
3. VD - Von Duprin
4. RO - Rockwood
5. PE - Pemko

Hardware Sets

Set: 1.0

Doors: 101A

2	Hinge, Full Mortise, Hvy Wt	T4A3386 (NRP)	US32D	MK
1	Electric Hinge, Hvy Wt	T4A3386 QCW	US32D	MK
1	Rim Exit Device	.AX .PA 99.L .E .996L(Std) .06	.626	VD
1	Cylinder	CR3000 CMK (Match Facility	626	RU

		Standard Keyway)		
1	Surface Closer	DC6200 A3	689	RU
1	Kick Plate	K1050 10" High CSK BEV	US32D	RO
1	Threshold	Per Sill Detail		PE
1	Gasketing (Head)	2891AS		PE
1	Gasketing (Jambs)	290AS		PE
1	Rain Guard	346C (Omit at Overhang)		PE
1	Sweep	18062CNB		PE
1	Power Supply	PS904		VD

Notes: Card reader and wiring by Security. Door typically closed and locked. Presenting valid credential will momentarily release lever allowing entry. In case of fire alarm or power loss door will remain locked (fail secure). Free egress at all times.

Set: 2.0

Doors: 105B

3	Hinge, Full Mortise	TA2314 (NRP)	US32D	MK
1	Storeroom Lock	ML2057 NSA CMK (Match Facilty Keyway)	630	RU
1	Surface Closer	DC6200 A4	689	RU
1	Kick Plate	K1050 10" High CSK BEV	US32D	RO
1	Threshold	Per Sill Detail		PE
1	Gasketing (Head)	2891AS		PE
1	Gasketing (Jambs)	290AS		PE
1	Rain Guard	346C (Omit at Overhang)		PE
1	Sweep	18062CNB		PE

Set: 3.0

Doors: 101B

2	Hinge, Full Mortise, Hvy Wt	T4A3786 (NRP)	US26D	MK
1	Electric Hinge, Hvy Wt	T4A3786 QCW	US26D	MK
1	Rim Exit Device	.AX .PA 99.L .E .996L(Std) .06	.626	VD
1	Cylinder	CR3000 CMK (Match Facility Standard Keyway)	626	RU
1	Surface Closer	DC6200	689	RU
1	Kick Plate	K1050 10" High CSK BEV	US32D	RO
1	Wall Stop	400/403/441	US26D	RO
3	Silencer	608-RKW		RO

1 Power Supply	PS904		VD

Notes: Card reader and wiring by Security). Door typically closed and locked. Presenting valid credential will momentarily release lever allowing entry. In case of fire alarm or power loss door will remain locked (fail secure). Free egress at all times.

Set: 4.0

Doors: 103A, 104A, 105A, 107A

3 Hinge, Full Mortise	TA2714 (NRP)	US26D	MK
1 Classroom Lock	CLX3355 NZD CMK (Match Facility Keyway)	626	RU
1 Wall Stop	400/403/441	US26D	RO
3 Silencer	608-RKW		RO

END OF SECTION 087100

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 C1036.

B. Interspace: Space between lites of an insulating glass unit.

1.4 PERFORMANCE REQUIREMENTS

A. 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.

B. Structural Performance:
   1. Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the CBC and ASTM E1300:
      a. Design Wind Pressures: Indicated on Structural Drawings.
      b. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE 7, based on heights above grade indicated on Drawings:
         1) Wind Design Data: As indicated on Drawings.
         2) Basic Wind Speed: 95 mph.
         3) Importance Factor: 1.0.
   2. Exposure Category: C.
   3. 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.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. 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 laminated glass lites, properties are based on products of construction

indicated.

c. For insulating glass units, properties are based on units of thickness indicated for overall unit and for each lite.
d. 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).
e. 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.
f. 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. Size: 12 inch x 12 inch.

C. Glazing Schedule: List glass types and thickness for each size opening and location. Use same designations indicated on Drawings.

D. 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.

E. 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.

F. 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.
b. 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.
b. 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.
   b. IGMA: SIGMA TM-3000 Vertical Glazing Guidelines.
   c. GANA: Laminated Glazing Reference Manual.
   d. AAMA: AAMA GDSG-1 Glass Design for Sloped Glazing.
   e. AAMA: TIR A7 Sloped Glazing Guidelines.
   f. IGMA for Sloped Glazing: IGMA TB-3001 Guidelines for Sloped Glazing.
   g. IGMA for Insulating Glass: SIGMA TM-3000 North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use.
5. Fire Rated Door Assemblies: Assemblies complying with NFPA 80 listed and labeled by UL for fire ratings indicated, based on testing according to NFPA 252.
6. 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).
   b. Thickness of Tinted Glass: Provide same thickness for each tint color indicated.
7. 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.
   b. 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 C1021 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.
   b. Use ASTM C1087 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.
   c. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
   d. Schedule enough time for testing and analyzing results to prevent delaying the Work.
   e. 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 warrant, 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. Vitro Architectural Glass (Basis of Design).
      b. AGC Glass Company North America, Inc.
      c. Cardinal Glass Industries.
      d. Guardian Industries Corp.;
      e. Pilkington North America.
      f. Viracon.

B. Ultraclear Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3.

C. Fully Tempered Float Glass:
   1. ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) 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.

2.2 INSULATING GLASS

A. Factory assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.

B. Performance Properties:
   1. Basis of Design Product: Vitro Architectural Glass:
   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.
      b. Manufacturers: Subject to compliance with requirements, provide products by Technoform Glass Insulation NA, Inc.
      c. 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 C920, 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.
      b. GE Construction Sealants; Momentive Performance Materials Inc.
      c. May National Associates, Inc.; a subsidiary of Sika Corporation.
      d. Pecora Corporation.
      e. Sika Corporation.

E. Glazing Sealant - Neutral curing silicone glazing sealant complying with ASTM C920, 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.
      b. Dow Corning Corporation.
      c. GE Construction Sealants; Momentive Performance Materials Inc.
      d. May National Associates, Inc.; a subsidiary of Sika Corporation.
      e. Pecora Corporation.
      f. Polymeric Systems, Inc.
      g. Sika Corporation.

F. Glazing Sealant - Neutral curing silicone glazing sealant complying with ASTM C920, 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.
      b. Dow Corning Corporation.
      c. GE Construction Sealants; Momentive Performance Materials Inc.
      d. May National Associates, Inc.; a subsidiary of Sika Corporation.
      e. Polymeric Systems, Inc.
      f. Schnee-Morehead, Inc., an ITW company.
      g. Sika Corporation.

G. Glazing Sealant - Acid curing silicone glazing sealant complying with ASTM C920, 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.
      b. Bostik, Inc.
      c. Dow Corning Corporation.
      d. GE Construction Sealants; Momentive Performance Materials Inc.
      e. May National Associates, Inc.; a subsidiary of Sika Corporation.
      f. Pecora Corporation.
      g. Polymeric Systems, Inc.
      h. Schnee-Morehead, Inc., an ITW company.
      i. Sika Corporation.

H. Glazing Sealants for Fire rated Glazing Products - Neutral curing silicone glazing sealant complying with ASTM C920, 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.
   b. 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 C1281 and AAMA 800 for products indicated below:
   a. Tape, where indicated.
   b. Tape, for glazing applications in which tape is subject to continuous pressure.
   c. 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. Type 1, for glazing applications in which tape acts as the primary sealant.
   b. 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 C1330, 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, 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 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.

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): **CTG1** (transparent)
   1. Double Glazed Tinted Solar Control Insulating Glass Unit; 6mm Solarban® 70 (2) | Air 1/2" (12.7mm) | 6mm Clear:
      a. Conformance: ASTM E2190.
      b. Outdoor Lite: Tempered Float Glass as manufactured by Vitro Architectural Glass:
         1) Conformance: ASTM C1036, Type 1, Class 2, Quality q3.
         2) Glass Thickness: 6mm (1/4")
         3) Magnetic Sputter Vacuum Deposition Coating (MSVD): ASTM C1376.
         4) Coating: Solarban® 70 on Surface # 2
      c. Interspace Content: Air 1/2" (12.7mm)
      d. Indoor Lite: Clear tempered float glass as manufactured by Vitro Architectural Glass:
         1) Conformance: ASTM C1036, Type 1, Class 1, Quality q3.
         2) Glass Thickness: 6mm (1/4")
      e. Performance Requirements:
         1) Visible Light Transmittance: 64 percent minimum.
         2) Winter Nighttime U-Factor: 0.28 (Btu/hr*ft2*°F) maximum.
         3) Shading Coefficient: 0.31 maximum.
         4) Solar Heat Gain Coefficient: 0.27 maximum.
         5) Outdoor Visible Light Reflectance: 13 percent maximum.

P. Insulating-Glass Unit(s): **CTG2** (translucent)
   1. Double Glazed Tinted Solar Control Insulating Glass Unit; 6mm Solarban® 70 (2) | Air 1/2" (12.7mm) | Acid Etch (3) 6mm Clear:
      a. Conformance: ASTM E2190.
      b. Outdoor Lite: Tempered Float Glass as manufactured by Vitro Architectural Glass:
         1) Conformance: ASTM C1036, Type 1, Class 2, Quality q3.
         2) Glass Thickness: 6mm (1/4")
         3) Magnetic Sputter Vacuum Deposition Coating (MSVD): ASTM C1376.
         4) Coating: Solarban® 70 on Surface # 2.
      c. Interspace Content: Air 1/2" (12.7mm)
      d. Indoor Lite: Clear tempered float glass as manufactured by Vitro Architectural Glass:
         1) Conformance: ASTM C1036, Type 1, Class 1, Quality q3.
         2) Coating: Pavia Acid Etch Obscure on Surface #3.
         3) Glass Thickness: 6mm (1/4")
      e. Performance Requirements:
         5) Visible Light Transmittance: 64 percent minimum.
         6) Winter Nighttime U-Factor: 0.28 (Btu/hr*ft2*°F) maximum.
         7) Shading Coefficient: 0.31 maximum.
         8) Solar Heat Gain Coefficient: 0.27 maximum.
         9) Outdoor Visible Light Reflectance: 13 percent maximum.

3.6 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.

END OF SECTION

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. Cementitious Backer Units.
   3. Glass-Mat Sheathing.
   4. Accessories necessary for a complete installation.

1.3 PERFORMANCE REQUIREMENTS

A. Comply with manufacturer's load tables and the following design pressures and deflections:
   1. Partitions Receiving Stone Cladding, Lath and Plaster, or Plaster Veneer: 1/360 at 15 psf.
   2. Partitions Receiving Monitors, Televisions, Heavy Audio/Visual Equipment: 1/360 at 15 psf.
   3. Typical Partitions: 1/240 at 5 psf.
   4. Other Partitions: 1/240 at 5 psf.
   5. 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 E119 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 E90 and classified according to ASTM E413 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 inches by 12 inches (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 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
   a. CBC-7 – Chapter 7, Fire Resistant Materials and Construction
   b. CBC-19A – Chapter 19A, Concrete
   c. CBC – Chapter 25, Gypsum Board and Plaster.
2. Fire Resistance Rated Assemblies: For fire resistance rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. Single Source Responsibility:
1. Framing Members: Obtain steel framing members from single manufacturer.
2. Panel Products: Obtain each type of gypsum board and other panel products from single manufacturer.
3. 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. Steel Studs and Tracks:
   a. USG Corp. Basis of Design.
   b. ClarkDietrich
   c. CEMCO; California Expanded Metal Products Co.
   d. Custom Stud.
   e. MBA Building Supplies.
   f. MRI Steel Framing, LLC.
   g. Phillips Manufacturing Co.
   h. SCAFCO Steel Stud Co.
   i. Steel Network, Inc. (The).
   j. Telling Industries.

B. Framing Members:

1. ASTM C754 for component sizes and conditions under specified maximum deflection and lateral loading conditions indicated:
   a. Steel Sheet Components: Comply with ASTM C645 requirements for metal.
   b. Protective Coating: ASTM A653/A653M, G60 (Z180), hot dip galvanized.

C. Steel Framing Components:
   1. ASTM C754 for conditions indicated; hot dip galvanize complying with ASTM A653 Z180:
      a. Steel Studs and Runners: ASTM C645, 0.0179 inch (0.45 mm) minimum base metal thickness; Depth indicated on Drawings.
      b. Dimpled Steel Studs and Runners: ASTM C645, equivalent to minimum base metal thickness indicated on Drawings for depth indicated on Drawings.
      c. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
      d. Cold Rolled Channel Bridging: 0.0538 inch (1.37 mm) bare steel thickness, with minimum 1/2 inch (12.7 mm) wide flanges. Depth indicated on Drawings.
      e. Clip Angle: Not less than 1-1/2 inches by 1-1/2 inches (38.1 mm by 38.1 mm), 0.068 inch (1.73 mm) thick, galvanized steel.
      f. Hat Shaped, Rigid Furring Channels: ASTM C645; 0.0179 inch (0.45 mm) minimum base metal thickness; Depth indicated on Drawings.
      g. Resilient Furring Channels: 1/2 inch (12.7mm) deep, steel sheet members designed to reduce sound transmission. Configuration: Asymmetrical or hat shaped.
      h. Cold Rolled Furring Channels - 0.0538 inch (1.37mm) bare steel thickness, with minimum 1/2 inch (12.7mm) wide flanges:
         1) Depth: Indicated on Drawings.
         2) Furring Brackets: Adjustable, corrugated edge type of steel sheet with minimum bare steel thickness of 0.0312 inch (0.79 mm).
         3) Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch (1.59mm) diameter wire, or double strand of 0.0475 inch (1.21mm) diameter wire.
      i. Z Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.
      j. Auxiliary Framing Materials: Fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
      k. Slip Type Head Joints - Where indicated, provide one of the following:
         1) Single Long Leg Runner System: ASTM C645 top runner with 2 inch (50.8 mm) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging, located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
         2) Double Runner System: ASTM C645 top runners, inside runner with 2 inch (50.8 mm) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
         3) Deflection Track - Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs. Provide one of the following:
            a) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
            b) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
            c) Superior Metal Trim; Superior Flex Track System (SFT).
      l. Firestop Tracks:
         1) Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire resistance rated assembly indicated; in thickness not less than indicated for studs and in

width to accommodate depth of studs. Provide one of the following:
a) Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
b) Grace Construction Products; FlameSafe FlowTrak System.
c) Metal-Lite, Inc.; The System.
d) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series as applicable.

D. Gypsum Board:
1. ASTM C1396/C1396M, applicable to type of gypsum board indicated and whichever is more stringent:
a. Core - Use Type X throughout:
1) Thickness: 5/8 inch (15.9 mm).
2) Long Edges: Tapered and featured (rounded or beveled) for prefilling.
b. Ceiling Type - Manufactured for sag resistance:
1) Thickness: 1/2 inch (13mm).
2) Long Edges: Tapered.
c. Moisture and Mold Resistant Type - Type X with moisture and mold resistant core and surfaces. Core:
1) Thickness: 5/8 inch (15.9 mm).
2) Long Edges: Tapered.

E. Cementitious Backer Units:
1. ASTM C1288 or ASTM C1325:
a. Thickness: 1/2 inch (12.7 mm) and 5/8 inch (15.9 mm) to match conditions.
b. Long Edges: Standard.
c. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

F. Exterior Gypsum Board For Walls and Soffits:
1. Basis of Design: Securock Brand Ultralight Glass-Mat Sheathing, by USG.
2. Glass Mat Gypsum Sheathing Board: ASTM C1177/C1177M, with standard edges.
3. Core: 1/2 inch (12.7 mm).

G. Exterior Trim:
1. ASTM C1047, hot dip galvanized steel sheet, plastic, or rolled zinc:
a. Shapes:
1) Cornerbead.
2) LC Bead: J shaped; exposed long flange receives joint compound.
3) Expansion (Control) Joint: One piece, rolled zinc with V shaped slot and removable strip covering slot opening.

H. Interior Trim:
1. ASTM C1047; galvanized or aluminum coated steel sheet, rolled zinc, plastic, or paper faced galvanized steel sheet:
a. Shapes:
1) Cornerbead.
2) LC Bead: J shaped; exposed long flange receives joint compound.
3) L Bead: L shaped; exposed long flange receives joint compound.
4) U Bead: J shaped; exposed short flange does not receive joint compound.
5) 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.

I. Continuous Corner:
   1. 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:
      a. Subject to compliance with requirements, provide basis of design or comparable by one of the following:
         1) Pittcon Industries.
         2) Fry Reglet Corporation.
         3) Schluter.

J. Joint Treatment - ASTM C475/C475M:
   1. Joint Tape:
      a. Exterior Gypsum Soffit Board: USG Sheetrock Brand Paper Tape.
      b. Glass Mat Gypsum Sheathing Board Exterior Applications: USG Sheetrock Brand Paper Tape.
      c. 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.
      e. Glass Mat Sheathing Board: USG Sheetrock Brand Easy Sand Setting-Type Joint Compound.

K. Auxiliary Gypsum Materials:
   1. Comply with referenced installation standards and manufacturer's written recommendations:
      a. Steel Drill Screws: ASTM C1002, use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
      b. Sound Attenuation Blankets:
         1) ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool:
            a) Fire Resistance Rated Assemblies: Comply with mineral-fiber requirements of assembly.
      c. Acoustical Sealant:

1) Nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90:
   a) 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 splotchy 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 INSTALLATION

A. Installation Standard: ASTM C754, except comply with framing sizes and spacing indicated.

B. Gypsum Board Assemblies: Comply with requirements in ASTM C840 applicable to framing installation.

C. Framing Assembly:
   1. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall:
      a. Install studs so flanges within framing system point in same direction. Space studs in single layer application as indicated on drawings.
      b. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling:
         1) Door Openings - Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs:

a) Install two studs at each jamb, unless otherwise indicated.
b) Install cripple studs at head adjacent to each jamb stud, with minimum 1/2-inch (12.7mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
c) Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

2) Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

c. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

D. Sound Insulation: Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

E. Gypsum Panels:
1. Comply with ASTM C840. 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.

F. 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.

b. Multilayer Application:

1) 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.

2) 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.

3) Fastening Methods: Fasten base layers and face layers separately to supports with screws.

G. 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.

H. Exterior Gypsum Board Soffits:

1. Apply panels perpendicular to supports, with end joints staggered and located over supports:
   a. Install with 1/4 inch (6.4 mm) open space where panels abut other construction or structural penetrations.
   b. Fasten with corrosion-resistant screws.

I. 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 C840 and in specific locations approved by Architect for visual effect.
   b. Exterior Trim:
      1) Install in the following locations:
         a) Cornerbead: Use at outside corners.
         b) 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) LC Bead: Use at exposed panel edges.
      3) L Bead: Use where indicated or necessary.
      4) U Bead: Use at exposed panel edges.

J. 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 C840:
      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.

d. Glass Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
e. Glass Mat Faced Panels: Finish according to manufacturer's written instructions.

K. Installation Tolerances:
1. 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.

3.4 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

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.

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 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
         1) CBC 2022, 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 E119 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.
5. Acrylic Based Finish Coat:
   a. California Stucco Product.
   b. Dryvit Systems.
   c. El Rey Solutions.
   d. Finestone, BASF Corp.
   e. Omega Products International.
   f. Senergy, BASF Corp.
   g. Sto Corp.

B. Cold Formed Steel Framing: Refer to Sections 05 40 00 for steel fabrications and 09 21 16 for Gypsum Board Assemblies framing for exterior plaster.

C. Metal Lath:
1. Expanded Metal Lath:
   a. ASTM C847, cold rolled carbon steel sheet with ASTM A653/A653M, 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.

D. Building Wrap: Provide per Specification Section 07 27 27 – Self-Adhering Water-Resistive Air Barrier Membrane.

E. Accessories:
1. Comply with ASTM C1063, 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 A653/A653M, G60 (Z180) zinc coating.
      2) Cornerite: Fabricated from metal lath with ASTM A653/A653M, G60 (Z180), hot dip galvanized-zinc coating.
      3) Outside Corner Reinforcement: Fabricated from metal lath with ASTM A653/A653M, 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.
b) Smallnose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.
5) Casing Beads: Fabricated from zinc or zinc coated (galvanized) steel; square edged style; with expanded flanges.
6) Control Joints: Fabricated from zinc or zinc coated (galvanized) steel; one piece type, folded pair of unperforated screeds in M shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
7) Expansion Joints: Fabricated from zinc or zinc coated (galvanized) steel; folded pair of unperforated screeds in M shaped configuration; with expanded flanges.

F. 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 C932.
4. Fasteners for Attaching Metal Lath to Substrates: ASTM C1063.
5. Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21 mm) diameter unless otherwise indicated.

G. Plaster Materials:
1. Portland Cement - ASTM C150/C150M, 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 C206, Type S; or ASTM C207, Type S.
4. Sand Aggregate - ASTM C897:
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.
7. Acrylic Based Finish Coatings:
a. Factory mixed acrylic emulsion coating systems formulated with colorfast mineral pigments and fine aggregates; for use over cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic based finishes:
1) Color: Selected by Architect.

2.2 PLASTER MIXES

A. Comply with ASTM C926 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 C926.

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 C926.

3.4 INSTALLATION

A. Metal Lath:
   1. Install according to ASTM C1063:
      a. Partition Framing and Vertical Furring: Flat diamond mesh lath.
      b. Horizontal Framing: Flat diamond mesh lath.

B. Accessories:
   1. Install according to ASTM C1063 and at locations indicated on Drawings:
      a. Reinforcement for External (Outside) Corners:
         1) Install cornerbead at exterior locations.
         2) Install cornerbead at interior locations.
      b. Control Joints - Locate as approved by Architect for visual effect:
         1) As required to delineate plasterwork into areas (panels) of the following maximum sizes:
            a) Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
            b) Horizontal and Other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).
         2) At distances between control joints of not greater than 18 feet (5.5 m) o.c.
         3) As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
         4) Where control joints occur in surface of construction directly behind plaster.
         5) Where plasterwork areas change dimensions, to delineate rectangular shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.5 PLASTER APPLICATION

A. Comply with ASTM C926:
   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. Acrylic Based Finish Coatings (Contractor Option to Plaster Finish Coat): Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.

F. 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

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. Johnsite, a division of Tarkett Group.
      b. Burke, a division of Mannington Commercial.
      c. The R.C. Musson Rubber Co.

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.

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

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.

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 E648 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 E662.
   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. 2022 CBC Section 11B-302.1.
      d. Resilient Flooring shall be stable, firm, and slip resistant. 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) Basis of Design: **Altro USA Inc. - LVT**
         2) Alternates include:
            a) Tarkett
            b) Or approved equal

B. Luxury Solid Vinyl Tile (LVT-1) - ASTM F1700:
   1. Collection: To be selected by Architect.
   2. Color: To be selected by Architect.
   3. Thickness: 0.125 inch (3.2 mm).
   4. Size: 18” x 36”
   5. Design: Mystix
   6. Shape: Plank

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. 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 F710:
   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 F1869. 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 F2170. 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. 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.

E. 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

SECTION 09 68 01 CARPETING WALK-OFF-MATS

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. Walk Off Carpet.
   2. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data:
   1. Technical data including installation recommendations for each type of substrate:
      a. Carpet:
         1) For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

B. Samples:
   1. For each products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules:
      a. Carpet: 12 inch (300 mm) square Sample from approved color and product of carpet.
      b. Exposed Edge, Transition, and Other Accessory Stripping: 12 inch (300 mm) long Samples.
      c. Mitered Carpet Border Seam: 12 inch (300 mm) square Sample. Show carpet pattern alignment.
      d. Carpet base and accessory samples.

C. Product Test Reports: For carpet and carpet cushion, for tests performed by a qualified testing agency.

D. Shop Drawings: Showing extent of product, seam direction, and location and type of carpet accessories. Submittal to indicate columns, doorways, enclosing walls or partitions, casework, and locations where cutouts are required.

E. Maintenance Data:
   1. For carpet to include in maintenance manuals. Include the following:
      a. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
      b. Precautions for cleaning materials and methods that could be detrimental to carpet and carpet cushion.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Fire Test Response Characteristics:
      a. Provide products with the critical radiant flux classification determined by testing

identical products in accordance with ASTM E648:
1) Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2. Accessibility Requirements:
   a. Comply with applicable requirements:
      1) Americans with Disabilities Act of 1990, as amended:
         a) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design.
         b) 2010 ADA regulations.
      2) CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
         a) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
         b) Carpet shall be securely attached and shall have a firm cushion, pad, or backing or no cushion or pad. It shall have a level loop, textured loop, level cut pile, or level cut/uncut pile texture. Pile height shall be ½ inch maximum.
         c) Exposed edges shall be fastened to floor surfaces and shall have trim on the entire length. Carpet edges shall comply with CBC Section 11B-303.
3. AQMD - Air Quality Management District, Local Regulations.
4. SCAQMD – South Coast Air Quality Management District Regulations Rule 1168 Adhesive and Sealant Applications.
5. CRI – Carpet and Rug Institute Green Label Plus.
6. Carpet shall have level loop, textured loop, or level-cut/uncutpile texture, firm cushion, pad or backing (or no cushion or pad) and maximum pile height of 1/2 inch in accordance with CBC Section 11B-302.2. Carpet edges shall comply with CBC 11B-302.2 and carpet trim to CBC Section 11B-303.

B. Installer Qualifications: Installer having minimum 5 years documented experience as a commercial carpet installer, who is certified by the International Certified Floorcovering Installers Association at the Commercial II or higher certification level.

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.

D. Pre-installation Conference:
   1. Pre-Installation conference to be conducted at project site.

1.5 WARRANTY

A. Written warranty in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period:
   1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, excessive surface wear, excess static discharge, and delamination.
   3. Warranty Period: 25 years from date of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

B. Store in a dry location between 65 degrees F and 90 degrees F and a relative humidity below 65%. Protect from damage and soiling. Stack carpet rolls horizontally, elevated

above slab level on a flat surface, stacked no higher than two rolls.

C. Store materials in area of installation for minimum period of 48 hours prior to installation.

D. Protect carpet from damage, dirt, stains, and moisture.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturer's:
1. Carpet series and patterns indicated on Finish Schedule. Subject to compliance with requirements, provide products by one of the following:
   a. Mohawk Group.
   b. Mannington Mills.
   c. Tarkett.
   d. Patcraft.
   e. Shaw Contract Group.

B. Carpet (Walk-Off):
1. Type: Patterned carpet tiles.
2. Construction: Patterned Loop
3. Color: First Step II-GT315.
4. Locations: As shown on Drawings.
5. Basis of design: Tuff Stuff II, by Mohawk.

C. Applied Soil Resistance Treatment: Standard with manufacturer.

D. Antimicrobial Treatment: Standard with manufacturer.

E. Adhesives: Water resistant, mildew resistant, nonstaining, pressure sensitive type to suit products and subfloor conditions indicated, complying with flammability requirements for installed carpet and is recommended by carpet manufacturer for releasable installation.

F. Trowelable Leveling and Patching Compounds: Latex modified, hydraulic cement based formulation provided or recommended by carpet cushion manufacturer.

G. Adhesives: Water resistant, mildew resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet and carpet cushion manufacturers.

H. Extra Carpet: After completion of the carpet installation, the carpet subcontractor shall provide an additional three (3) percent of total yards installed of each carpet specified to the Owner for future carpet replacement that may be required. This extra stock is to be unused rolls, tiles, and mats and does not include scraps.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet and carpet cushion until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient

temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet and carpet cushion over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

3.2 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

B. Concrete Subfloors:
   1. Verify that concrete slabs comply with ASTM F710 and the following:
      a. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond.
      b. Prior to delivery of flooring materials, contractor shall conduct Calcium Chloride “dome” test to verify that concrete floors are dry with maximum moisture vapor emissions of 3 lbs. per 1000 square feet. in 24 hours, and exhibit negative alkalinity, carbonation or dusting. Apply moisture test in four (4) different areas of each floor location with at least one test for each 1,000 square feet of floor area.
      c. Prior to delivery of carpeting, conduct Relative Humidity Test Method in accordance with ASTM F2170 using a Wagner Rapid RH probe to verify relative humidity and surface pH of concrete floor slabs, the method:
         1) Requires drilling holes at diameter not to exceed outside diameter of probe by more than 0.04 inch to depth equal to 40 percent of slab's thickness (elevated structural slab shall be tested at depth equal to 20 percent of slab thickness).
         2) Place probe to full depth of test hole, place cap over probe.
         3) Permit test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.
         4) Remove cap and press button on the probe to obtain reading.
         5) Relative humidity readings for substrates receiving non-permeable flooring are 75% or lower.
      d. Testing shall require 3 tests in first 1,000 square feet, with one additional test per each additional 1,000 square feet of concrete slab surface.
      e. Alkalinity Testing: Concrete floors shall be tested for alkalinity prior to installation of flooring. Levels of pH shall not exceed written recommendations of flooring manufacturer or adhesive manufacturer, or both.
      f. Delivery of flooring materials and beginning of installation means acceptance of existing substrate and site conditions.
      g. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
      h. Install Vapor Emission Treatment Systems where tests reveal presence of more than acceptable moisture level in accordance with Test Method ASTM F1869 or ASTM F2170.

C. Proceed with installation after correcting unsatisfactory conditions.

3.3 PREPARATION

A. Comply with CRI 104, Section 7.3 *Site Conditions; Floor Preparation* and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet and cushion manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.4 INSTALLATION

A. Comply with CRI 104 and carpet and carpet cushion manufacturer written installation instructions for the following:
   1. Direct Glue Down Installation: Comply with CRI 104, Section 9 *Direct Glue Down Installation*.

B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position:
   1. Do not bridge building expansion joints with carpet.
   2. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
   3. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

C. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

D. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, *Patterned Carpet Installations* and with carpet manufacturer's written recommendations.

E. Install in accordance with CBC Section 11B-302.2

3.5 CLEANING AND PROTECTING

A. Perform cleaning operations immediately after installing carpet:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
   2. Remove yarns that protrude from carpet surface.
   3. Vacuum carpet using commercial machine with face beater element.

B. Protect installed carpet to comply with CRI 104, Section 16, *Protecting Indoor Installations*.

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet cushion manufacturer.

END OF SECTION

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.

1.3 DEFINITIONS

A. Standard coating terms defined in ASTM D16 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.
      c. Submit Zero VOC compliant products only.

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.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with Federal and State/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. Performance and Durability:
      a. ASTM D16 Standard Test Method for Load Testing Refractory Shapes at High Temperatures.
      b. ASTM D2486 Standard Test Method for Scrub Resistance of Interior Wall Paint.
      c. ASTM D2805 Standard Test Method for Hiding Power of Paints by Reflectometry.
      d. ASTM D4828 Standard Test Method for Practical Washability of Organic Coatings.

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 manufacture 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 Design is **Dunn Edwards Corporation paints.** 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:

1. Proprietary Names: Paint Schedule is based on a single manufacturer for convenience. With exception to the paint used in the theater. 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. Furnish product technical data, including per cent solids by weight and volume; VOC content limits and emissions data; and certificates of performance for comparable paint products of specified manufacturer.
2. Other Acceptable Paint Manufacturers:
   a. Sherwin-Williams Co.
   b. Vista Paint

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) and SCAQMD Rule1113:
      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 and the SCAQMD.

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.

H. Theater Black: No Exceptions or alternates.

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 taped joints are tapes 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. Spray Textured Ceiling Substrates: Verify surfaces are dry.

F. 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: Previously painted surfaces have failed to accept new paint systems. Determined cause of failure and take corrective measures to ensure each surface accepts new paint system. Failure of new paint system is not permitted.

G. 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 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. Preprimed 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 preprimed 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 F1869. 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 F2170. 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.
c. 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 SP6/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 PA1 for touching up shop primed surfaces.

K. Aluminum Substrates: Clean surfaces to remove oil, grease, surface oxidation, and contaminants in accordance with SSPC SP1 Solvent Cleaning. Lightly abrade surface with a nonmetallic pad.

L. 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.

M. 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 deflects the 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.

N. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

O. 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.

P. Pipe Covering and Insulation: Clean to remove loose, foreign, and objectionable material before applying sealing coat.

Q. 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.

R. 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.

S. 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.

3.5 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. Block Fillers: Apply block fillers to concrete masonry block at rate to ensure complete coverage with pores filled.

I. 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.

J. 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.

K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

L. 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.

3.6 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.

3.7 CLEANING AND PROTECTION

A. It is of the upmost importance the sites remain 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. Krud Kutter Metal Clean and Etch.
      b. Primer: One (1) coat Ultrashield ULDM00 DTM Gray Primer.
      c. Finish: Two (2) coats Ultrashield ULSH40 Low Sheen High Performance Acrylic Urethane.
      d. Finish: Two (2) coats US Coatings RustGrip 2300 1-2 Mils DFT.
   2. Un-galvanized Metal:

a. Primer: One (1) coat Ultrashield ULDM00 DTM Gray Primer.
b. Finish: Two (2) coats Ultrashield ULSH40 Low Sheen High Performance Acrylic Urethane.

3. Concrete and CMU:
   a. Primer/Finish: (2) coats Eff-Stop Premium ESPR00 Masonry Primer / (2) coats US Coatings AquaGrip 2600 3-5 Mils DFT.
4. Wood (Includes plywood siding and wooden trim):
   a. Primer: One (1) coat EZ-Prime EZPR00 Exterior Wood Primer.
   b. Finish: Two (2) coats Spartashield SSHL60 100% Acrylic Gloss.
5. Fiber-Cement Materials:
   a. Primer: One (1) coat Eff-Stop Premium ESPR00 Masonry Primer.
   b. Finish: Spartashield SSHL60 100% Acrylic Gloss.
6. All piping in mechanical rooms shall be painted in their entirety, in the following colors:
   a. Aristoshield ASHL70 High-Gloss Enamel:
      1) Gas lines: Orange
      2) Domestic cold water: White
      3) Domestic hot water: Pink
      4) Heating hot water: Red
      5) Condenser water: Green
      6) Chilled water: Blue

C. Interior Surfaces:
1. Galvanized Metal:
   a. Primer: One (1) coat Ultrashield Galvanized Metal Primer ULGM00.
   b. Finish: Two (2) coats Aristoshield ASHL50 Semi-Gloss Enamel.
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: Bloc-Rust Premium BRPR00 Rust Preventative Primer; Aluminum: Ultrashield Galvanized Metal Primer ULGM00.
   c. Two (2) coats Aristoshield ASHL50 Semi-Gloss Enamel.
3. Gypsum Wallboard:
   a. Primer: One (1) coat Vinylastic Premium VNPR00 Acrylic Wall Sealer.
   b. Finish: Two (2) coats Spartawall Premium SWLL30 Acrylic Latex Eggshell.
4. Primer Concrete and CMU (Enamel):
   a. One (1) coat Smooth Blocfil Premium SBPR00 100% Acrylic Block Filler.
   b. Finish: Two (2) coats Premium SWLL50 Acrylic Latex Semi-Gloss.
5. Wood (Painted):
   a. Primer: Interkote Premium IKPR00 100% Acrylic Enamel Undercoater.
   b. Finish: Aristoshield ASHL50 Semi-Gloss Enamel.
6. Wood (Stained):
   a. Stain: Gemini Craftsman Collection Wiping Stain CCW Water-Based Series.
   b. Finish (First Coat): WB-0230 Gemini Titanium Clear Urethane Satin
   c. Finish (Second Coat): Gemini WB-0230 Gemini Titanium Clear Urethane Satin.
7. Gypsum Wallboard (Epoxy) – Kitchens, bathrooms, laboratories, etc.:
   a. Primer: One (1) coat US Coatings AquaGrip 2600 2-3 Mils DFT.
   b. Finish: Two (2) coats US Coatings AquaGrip 2600 3-5 Mils DFT per coat.
8. CMU (Epoxy) - Kitchens, bathrooms, laboratories, etc.:
   a. Primer: Two (2) coats Smooth Blocfil Premium SBPR00 100% Acrylic Block Filler.
   b. Finish: Two (2) coats US Coatings AquaGrip 2600 3-5 Mils DFT.
9. 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; US Coatings RustGrip 2300 1-2 Mils DFT.
   b. Finish: Two (2) coats bright aluminum paint, US Coatings UreGrip 3000 VOC 2-3 Mils DFT per coat.

D. Paint Types: Refer to the Finish Schedule in the Drawings.

END OF SECTION

SECTION 10 01 00 MISCELLANEOUS SPECIALTIES

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. Furnish and install the following:
      a. Removeable Pipe Bollards.
      b. Television.
      c. Television Mounting Brackets.
      d. Skateboard Deterrent Devices.

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.
   3. Manufacturer's operation and maintenance data, as applicable.

B. Shop Drawings: Show sizes, locations and installation details.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Specifications are based on named products and manufacturers. Other manufacturers must have a minimum of five (5) years’ experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

2.2 MATERIALS

A. Removeable Pipe Bollards:
   1. Lockable Steel Bollards for installation in site concrete:
      a. Features:
         1) Height: 36 inches above finished surface
         2) Diameter: 3-1/2 inch
         3) Pre-manufactured ground sleeve with cover .
      b. Finish: Factory powder coating
      c. Color: Yellow
      d. Number/Location: As shown on drawings.
      e. Basis of Design: **Model No. RP3503 as manufactured by TrafficGuard, Inc.,** Geneva, IL; (877) 727-7347, or Architect approved equal.
   2. Install per Manufacturer’s Installation Instructions.

B. Television and Mounting Brackets:
   1. Wall Brackets for mounting on metal studs:

a. Features:
   1) Size: Universal mounting arms able to accept maximum VESA pattern 600x400 mm.
   2) Pull-out swivel with up to 90° rotation depending on screen size.
   3) 2.5” deep in closed position, up to 16.6” fully extended.
   4) 15° minimum tilt.
   5) +/-4° minimum level adjustment.
   6) Built-in cord management.
   7) Maximum TV weight: 100 pounds.
   8) Includes screen attachment hardware.
b. Securely holds a 42-75 inch television.
c. Color: Black.
d. Number/Location: As shown on drawings.
e. Basis of Design: **Model No. MD2296 as manufactured by Mounting Dream**, City of Industry, CA; (626) 604-9048, or Architect approved equal.

2. Wall Mounted Television:
   a. Features:
      1) Size: 65 inch.
      2) Depth: 2.3 inch.
      3) Weight: 48 pounds.
      4) Resolution: 3840 x 2160 (UHD).
      5) Dynamic Contrast Ratio: 1,000,000:1.
      6) Refresh Rate: 60Hz.
      7) Smart TV capable with loadable applications.
      8) Audio: Built-in speakers w/ Bluetooth connectivity.
      9) WiFi: 802.11ac enabled.
      10) Interfaces:
          a) (3) HDMI In (v2.0)
          b) (1) USB 2.0
          c) (1) RJ45 LAN
          d) (1) 3.5mm Stereo Speaker Out
      11) Mount: VESA compatible 300 x 300
      12) Color: Black
      13) Number/Location: As shown on drawings
      14) Basis of Design: **Model No. UR640S as manufactured by LG**, or Architect approved equal.

3. Skateboard Deterrent:
   a. Features:
      1) Size: 8” x 1-1/8” x 1-1/8”.
      2) Mount: Surface mounted on concrete, pre-drilled for epoxy anchor.
      3) Finish: 6061-T6 Aluminum
      4) Number/Location: Top of concrete seat walls at 36” on center unless noted otherwise. Refer also to drawings.
      5) Basis of Design: **Model No. Gorilla-135 as manufactured by Park Warehouse**, or Architect approved equal.

PART 3 EXECUTION

3.1 COORDINATION

A. Coordinate Work of this Section with work of other sections in which items are to be installed.

3.2 EXAMINATION

A. Verify electrical requirements, where applicable, are installed and ready for connection.

B. Verify items fastened to walls have proper blocking or support items installed.

C. Verify locations for items are ready for their installation.

3.3 INSTALLATION

A. Install all items in accordance with manufacturer's printed instructions in locations shown on drawings or otherwise indicated.

B. Provide blocking for LCD TVs mounting as indicated in drawings or per manufacturer’s instructions.

3.4 CLEANING AND ADJUSTING

A. Make final adjustment after installation

B. Clean all items of dirt and foreign matter which may affect appearance and operation.

C. Adjust items for proper operation.

D. Instruct Owner’s personnel on proper operation and maintenance of items.

END OF SECTION

SECTION 10 11 00 MARKERBOARDS

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. Markerboard assemblies.
   2. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data:
   1. Technical data for each type of product including construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units:

B. Samples:
   1. Submit for each type of visual display unit indicated:
      a. Visual Display Panel: Not less than 8-1/2 inches by 11 inches (215 mm by 280 mm), with facing, core, and backing indicated for final work. Include one panel for each type, color, and texture required.
      b. Trim: 6 inch (150 mm) long sections of each trim profile.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Surface Burning Characteristics:
      a. Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency:
         1) Flame Spread Index: 25 or less.
         2) Smoke Developed Index: 450 or less.
   2. Accessibility Requirements:
      a. Comply with applicable requirements:
         1) Americans with Disabilities Act of 1990, as amended:
            a) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design.
         2) CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
            a) CBC Chapter 11B, Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.

B. Installer Qualifications: Entity having minimum 5 years documented experience that employs installers and supervisors who are trained and approved by manufacturer.

C. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.

1.5 WARRANTY

A. Porcelain Enamel Face Sheets:
   1. Written warranty in which Manufacturer agrees to repair or replace porcelain enamel face sheets that fail in materials or workmanship within specified warranty period:
      a. Failures include, but are not limited to, the following:
         1) Surfaces lose original writing and erasing qualities.
         2) Surfaces exhibit crazing, cracking, or flaking.
         3) Noticeable deterioration of finish.
         4) Writing surface delamination.
         5) Unit releasing from substrate.
   2. Warranty Period: Life of the Building.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

PART 2 PRODUCTS

2.1 MATERIALS

A. Porcelain Enamel Face Sheet: PEI-1002, with face sheet two or three coat process.

B. Particleboard: ANSI A208.1, Grade M-1.

C. Extruded Aluminum: ASTM B221, Alloy 6063.

D. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

E. Primer/Sealer: Mildew resistant primer/sealer recommended in writing by visual display unit manufacturer for intended substrate.

2.2 MARKERBOARD ASSEMBLY

A. Manufacturers:
   1. Subject to compliance with requirements, provide products by one of the following:
      a. Platinum Visual Systems (Basis of Design)
      b. Polyvision
      c. Tri-Best
      d. Comparable product.

B. Markerboard Assembly: Basis of Design, BTS Series by Platinum Visual Systems.
   1. Factory fabricated:
      a. Corners: Square.
      b. Width: Indicated on Drawings.
      c. Height: Indicated on Drawings.
      d. Mounting Method: Rail support system

C. Markerboard Panel: Magnetic ceramic coated steel.
   1. Color: White

D. Aluminum Frames:

1. Fabricated from not less than 0.062 inch (1.57 mm) thick, extruded aluminum; slim size and standard channel frame.
2. Aluminum Finish: Clear anodic finish.

E. Chalktray:
1. Continuous:
a. Box Type: Extruded aluminum with slanted front, grooved tray, and cast aluminum end closures.

2.3 FINISH REQUIREMENTS

A. Comply with NAAMM *Metal Finishes Manual for Architectural and Metal Products* for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Aluminum Finishes:
1. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

3.2 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the work.

B. Examine walls and partitions for proper preparation and backing for visual display units.

C. Proceed with installation after correcting unsatisfactory conditions.

3.3 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation. Clean substrates of substances, such as dirt, mold, and mildew, that impair the performance of and affect the smooth, finished surfaces of visual display boards.

3.4 INSTALLATION

A. Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Rail Support System:
   1. Install horizontal support rail to provide mounting heights indicated on Drawings. Attach to wall with fasteners at 12 inches (300 mm) o.c.:
      a. Hang visual display units on rail support system.

3.5 CLEANING AND PROTECTION

A. Clean markerboards according to manufacturer's written instructions. Attach one removable cleaning instructions label to markerboard unit in each room.

B. Touch up factory applied finishes to restore damaged or soiled areas.

C. Cover and protect markerboards after installation and cleaning.

END OF SECTION

SECTION 10 14 00 GRAPHICS, SIGNAGE AND DIMENSIONAL LETTERING

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. Dimensional Lettering
6. Accessories necessary for a complete installation.
7. Mascot Logo.

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-302.2.
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 Section11B-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:
    1) A tactile sign shall be located per CBC Section and Figure 11B-703.4.2 as follows:
        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 leafs.
        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 leafs.
        e) 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 Sign Systems, 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 B26/B26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

C. Aluminum Sheet and Plate: ASTM B209, 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 B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

E. Acrylic Sheet: ASTM D4802, 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 D1187.

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:
      1) 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.

B. Dimensional Lettering:
1. Characters with uniform faces, sharp corners, and precisely formed lines and profiles:
   a. Basis of Design: Series “LC” by ASI Sign Systems, Inc.
   b. Character Material: Cast aluminum.
   c. Character Height: 18 inches.

d. Character Depth: 1 inch.
e. Finish: Satin Anodized
f. Mounting: Concealed studs.
g. Typeface: Leelawadee UI

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.
7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

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.
2. Baked Enamel or Powder Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

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 leafs.
      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 leafs.
      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. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

G. 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

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

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 01 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 E814, and shall bear the Warnock Hersey label.
10. Provide one (1) Fire Extinguisher with each Fire Extinguisher Cabinet.

C. Fire Extinguishers (F.E):
1. Approved Manufacturers: Amerex Corporation, or approved equal.
2. Models/Types:
   a. Multipurpose dry chemical with 10 lbs. capacity: C rating conforming to MP10 Series. UL Rating: 4A:80B:C.
   b. Wet-Chemical Type, WC Series, (FE-K): UL-rated 2-A: K, 2.5-gal. (9.5-L) nominal capacity, with potassium carbonate-based chemical in stainless-steel container; with pressure-indicating gage.
3. Mounting: Provide eye brackets for direct wall mounting to hook and for mounting in Fire Extinguisher cabinets. Refer to drawings for location and quantity.
4. 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

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 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" OSHPD Edition dated 2009 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 Cal Green 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 22 00 00

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. 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.

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.

2. Cleanouts: Floor cleanouts: Smith 4020 with nickel bronze top in finished areas; Smith 4220 in utility areas. Wall cleanouts: Smith 4530 with stainless steel cover and screw. Comparable models of Josam, Wade, Zurn or equal.

B. Water and Gas:

1. Hot and 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 – 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.

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. 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.

c. 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.

d. 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.

e. Gas Valves: 2" and smaller, Milwaukee BB2-100; 2-1/2" and larger, Rockwell #142 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. 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.

1. Accessibility Notes:

   a) Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Section 11B-213.3.

   b) Effective March 1, 2017m all single user toilet facilities shall be identified as Gender Neutral facilities by a door symbol that complies with CBC Sections 11B-216.8 and 11B-703.7.2.6.3. No pictogram, text or braille is required on the symbol. If tactile requirements of CBC Section 11B-703.

   c) Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.

   d) Clearance around accessible water closets and in toilet compartments shall be 60 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the rear wall per CBC Section 11B-604.3.1.

   e) Heights and location of all accessible fixtures shall be mounted according to CBC Section 11B-602 through 11B-612.

   f) Accessible fixture controls shall comply with CBC Section 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for children's water closets, 11B-605.4 for urinals, 11B-606.4 for lavatories and sinks, 11B-607.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.

   g) Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC Section 11B-306 when a forward approach is required. CBC Section 606.3 and 11B-606.7.

   h) Water supply and drainpipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Section 11B-606.5.

2. Cal Green Notes, Non-Residential Water Conserving Plumbing Fixtures and Fittings, CCR Title 24, Part 11, Section 5.303.3:

   a) For occupancies within the authority of the California Building Standarcs Commission as specified in Section 103, the provisions of Sections 5.303.3 and 5.303.4 shall apply to new fixtures in additions or areas of alteration to the building.

   b) Standards for plumbing fixtures and fittings: Plumbing fixtufe and fittings shall be installed in accordance with the California Plumbing Code, and shall meet the applicable standards references in Table 1701.1 of the California Plumbing Code and in Chapter 6 of this code.

   c) Water Closets: effective flush volume shall not exceed 1.28 gallons per flush.

   d) Urinals: effective flush volume of wall-mounted shall not exceed 0.125 gallons per flush.

e) Showerheads:

1) Single showerhead: shall have a maximum flow rate of not more than 1.8 gallons per minute at 80 psi.

2) Multiple showerheads: when a shower is served by more than one showerhead, the combined flow rate of all showerheads and/or other shower outlets controlled by a single valve shall not exceed 1.8 galloms per minute at 80 psi, or the shower shall be designed to allow only one shower outlet to be in operation at a time.

f) Faucets and fountains:

1) Lavatories: faucets shall have a maximum flow rate of not more than 0.5 gallons per minute at 60 psi.

2) Kitchen: faucets shall have a maximum flow rate of not more than 1.8 gallons per minute at 60 psi. Kitchen faucets may temporarily increase the flow above the maximum rate, but not to exceed 2.2 gallons per minute at 60 psi, and must default to a maximum flow rate of 1.8 gallons per minute at 60 psi.

3) Wash fountains shall have a maximum flow rate of not more than 1.8 gallons per minute/20 [rim space (inches) at 60 psi].

4) Metering faucets shall not deliver more than 0.20 gallons per cycle / 20 [rim space (inches) at 60 psi].

5) Where complying faucets are unavailable, aerators or other means may be used to achieve reduction.

g) Commercial kitchen equipment:

1) Food waste disposers shall either modulate the use of water to o more than 1 gpm when the disposer is not in use (not actively grinding food waste/no-load) or shall automatically shut off after no more than 10 minutes of inactivity. Disposers shall use no more than 8 gpm of water.

2) Cal-Green section 5.303.4.1 code section does not affect local jurisdiction authority to prohibit or require disposer installation.

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.
4. Basis of Design: Manufacturers and model numbers listed in schedules as the basis of design are intended to represent the standard of quality and the features desired.
5. 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.
6. 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 not included in equipment package. Manual and magnetic starters shall have ambient compensating running over-current protection in all ungrounded conductors. Magnetic starters shall be manual reset. Controllers and other devices shall be in NEMA 3 or 12 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. Design shall limit starting inrush current and running current to values shown on drawings.
    d. Starters: Motor starters shall be provided for all equipment except where starter is in a motor control center as designated on the electrical drawings.
    e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt 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 recommended external wiring.

B. Water Heater, Gas: 150 psi working pressure. Fully insulated. Automatic temperature control. High limit control. Provide ASME rated temperature and pressure relief valve sized in accordance with energy input, dielectric couplings and drain cock. UL listed and CEC approved. Extended warranty for a period of 3 years minimum. State, Lochinvar, A.O. Smith, National, Rheem or equal.

C. Circulation Pump: Bronze pump with stainless steel or non-metallic impeller. Shaft shall be stainless steel or ceramic with carbon bearings with EPDM O-ring and gaskets. Replaceable cartridge type circulators shall have stainless steel cartridge. Connections shall be sweat, threaded or flanged. Taco, Bell & Gossett, Grundfos, Armstrong or equal.

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)
½	6
¾	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.

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.

3.02 PIPING INSULATION INSTALLATION:

A. Domestic Tempered Water Supply:

1. General: All domestic tempered water supply piping, except for exposed connections to fixtures, shall be insulated. Do not insulate unions or valves less than 2", unless exposed to weather.
2. Install elastomeric pipe insulation by slipping over end of pipe. Where not feasible, slit insulation longitudinally, snap over piping and seal with adhesive. Insulate fittings with larger diameter sleeves or insulation, lapping pipe insulation a minimum of 2 in.
3. Butt sections of insulation tightly together and seal with adhesive to provide a continuous vapor and thermal barrier.
4. Pipe: Apply pre-molded fiberglass sections to pipe using integral pressure sealing lap adhesive in accordance with manufacturer's recommendations. Stagger longitudinal joints. Seal butt joints with factory supplied sealing tape.
5. Fittings and Valves:
   a. Wrap fitting with pre-cut fiberglass blanket to thickness matching adjoining insulation. Cover blanket with PVC jacket in accordance with manufacturer's recommendations. Seal all joints with factory supplied pressure sealing vapor barrier tape with 2" (min.) overlap on both sides of joint. Insulate valves to stem.
   b. For miscellaneous fittings for which PVC jackets are not available or where proximity of fittings precludes a neat-appearing installation, the contractor may cover the fiberglass blanket with stretchable glass fabric and at least two coats of vapor barrier coating. All exposed ends of insulation shall be adequately sealed.

B. 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.

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 22 00 01

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 furnishings 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. System insulation.
4. Controls and control wiring and conduit for control wiring.

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 condensate drains to equipment.
3. Access doors.

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-181 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.

D. Spiral Duct: Ductwork shall be galvanized steel with uni-seal spiral seamlock and uni-seal fittings, ASTM A653. United McGill Corp or equal. All exposed spiral duct shall be painted, color selected by Owner.

E. Exterior Duct shall be single wall galvanized sheet steel, ASTM A527 with external insulation.

F. Bonding Adhesive: Durodyne WBG, Scotchgrip Adhesive 4230 or equal.

G. Duct Mastic: Minnesota Mining and Manufacturing Duct Sealer 800, Tuff-Bond No. 12, Glencoat Seal-Flex or equal.

H. 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 (SMACNA "J" Type connection) or equal.

I. Fiber Tape: Mineral impregnated fiber tape and plastic activator-adhesive. Hardcast Inc., United McGill Uni-Cast or equal.

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 T & B, Krueger, Anemostat, Price, 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 re-selected by the Contractor for the proper diffusion, spread, drop and throw.
3. Frame and 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, ½” 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).

E. Fire/ Smoke Damper: Multi-blade construction in accordance with CBC & CMC. UL 555 and UL 555S labels. Blades shall have metal-to-metal seals and not rely on actuator torque to maintain leakage rating. Prefco, Air Balance, Ruskin, Greenheck 5020-1 with 5800MB2 power open/spring close operator, or equal.

F. Displacement Ventilation Diffusers: The perforated face diffusers shall be constructed with equalization baffles behind the operative diffuser faces for uniform, low velocity, distribution of supply air. Both the equalization baffles and faces shall be securely retained in the diffuser frames with no visible fasteners on the front or side panels. The diffuser frames shall be constructed of high strength aluminum extrusion. The operative faces shall be constructed of painted high-gauge steel. The paint shall be powder coated polyester, color selected by Architect. The diffuser shall be provided with concealed mounting brackets. Diffuser manufacturer shall provide sound and pressure drop data derived from tests in accordance with ASHRAE Standard 70-1991. Provide and install 22 gauge solid steel face duct cover with extruded aluminum frame from top of diffuser to ceiling for all exposed diffuser/ duct installations, see plans.

G. Fire Damper: Dynamic rated fire dampers, U.L. 555 label. Prefco, Air Balance, Ruskin, Greenheck or equal.

H. Louvers: Refer to the Air Distribution Schedule on the drawings. Manufacturer's model numbers are listed to complete the description. Equivalent models of Ruskin, Greenheck, Dayton or approved equal. Contractor shall fabricate and provide 16 GA. galvanized perforated panel (50% Free Area) over exterior of all louvers and have field painted to match exterior wall. Refer to the floor plans for all sizes.

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-181 not exceeding a flame spread of 25 and smoke developed of 50.

B. Fiber Glass Blanket for interior ducts shall be 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. Bonding Adhesive: Benjamin Foster 85-15 or equal.

C. Exterior duct shall be insulated with R-8 fiber glass banket, composed of glass fibers bonded together with a thermosetting resin and with a foil scrim kraft (FSK) or vinyl vapor-retardant facing or foil faced, R-8 and wrapped with all-service jacket facings (ASJ)

D. Alternate method of duct exterior protection can be application of Polyguard Alumaguard® self-adhering peel and stick flexible, zero-perm, weatherproof claddings over the duct insulation wrap.

2.04 PIPING MATERIALS:

A. Condensate Piping

1 Condensate piping shall be minimum ¾ inch PVC piping with a minimum of 1/8 inch slope per foot. Terminate condensate piping in an approved manner to tie into exisating sewer line as shown in plumbing drawings.

E. 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 recommendation. Felt Lined, Kin-Line 450 F.
   b. Construction Channel: 12 gage 1-5/8" x 1-5/8" steel channel. Single or multiple sections. Self-locking nuts and fittings. Kin-Line, Unistrut.
2. Pipe Sleeves: 24 gage galvanized steel. Adjus-to-Crete #10 with #99 thimble for floors. #100 for walls.

2.05 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. Electrical: Electrical equipment shall be in accordance with NEMA Standards and UL or ETL listed where applicable standards have been established.
4. 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-13. 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. Packaged Heat Pump Unit:

1. General: Self-contained heating/cooling 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. Multivane, centrifugal supply fan. ARI certified. Gas equipment AGA certified. BDP, Carrier, York, Trane, Lennox and Daikin. Unit shall use (R-410A) refrigerant. Unit shall be installed in accordance with the manufacturer's instructions. Unit must be selected and installed in compliance with local, state, and federal codes.
2. Quality Assurance:

   Unit meets ASHRAE 90.1 minimum efficiency requirements. Unit shall be rated in accordance with AHRI Standards 210/240 (04-06 sizes) or 340/360 (07 size). Unit shall be designed to conform to ASHRAE 15. Unit shall be UL-tested and certified in accordance with ANSI Z21.47 Standards and UL-listed and certified under Canadian standards as a total package for safety requirements. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

   Unit shall be designed in accordance with ISO 9001, and shall be manufactured in a facility registered by ISO 9001:2015. Roof curb shall be designed to conform to NRCA Standards.

   Unit shall be subjected to a completely automated run test on the assembly line. The data for each unit will be stored at the factory, and must be available upon request. Unit shall be designed in accordance with UL Standard 1995, including tested to withstand rain. Unit shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box up to 40 mph. Unit shake tested to assurance level 1, ASTM D4169 to ensure shipping reliability.

3 Delivery, Storage, and Handling:

Unit shall be stored and handled per manufacturer's recommendations. Lifted by crane requires either shipping top panel or spreader bars. Unit shall only be stored or positioned in the upright position.

4 Operating Characteristics:

Unit shall be capable of starting and running at 115°F (46°C) ambient outdoor temperature, meeting maximum load criteria of AHRI Standard 210/240 or 340/360 at ±10% voltage. Compressor with standard controls shall be capable of operation down to 40°F (4°C), ambient outdoor temperatures. Accessory winter start kit is necessary if mechanically cooling at ambient temperatures down to 25°F (–4°C). Unit shall discharge supply air vertically or horizontally as shown on contract drawings.

5 Unit Cabinet:

Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a prepainted baked enamel finish on all externally exposed surfaces. Unit cabinet exterior paint shall be: film thickness, (dry) 0.003-in. minimum, gloss (per ASTM D523, 60°F/16°C): 60, Hardness: H-2H Pencil hardness.

Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 210/240 and or 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum $^{1}/_{2}$-in. thick, 1 lb density, flexible fiberglass insulation, neoprene coated on the air side. Aluminum foil-faced fiberglass insulation shall be used in the heat compartment.

Base of unit shall have a minimum of four locations for thru-the-base gas and electrical connections (factory-installed or field-installed), standard.

Unit shall have base rails on a minimum of 2 sides. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging. Holes shall be provided in the base rail for moving the rooftop by fork truck. Base rail shall be a minimum of 16 gage thickness.

Condensate pan and connections shall be a sloped condensate drain pan made of a corrosion resistant material and comply with ASHRAE Standard 62. Use a $^{3}/_{4}$-in. 14 NPT drain connection, possible either through the bottom or side of the drain pan. Connection shall be made per manufacturer's recommendations. All unit power wiring shall enter unit cabinet at a single, factory prepared, knockout location. Standard unit shall have a thru-the-base electrical location(s) using a raised, embossed portion of the unit basepan.

Cabinet panels shall be easily removable for servicing. Unit shall have one factory installed, tool-less, removable, filter access panel. Panels covering control box, indoor fan, indoor fan motor, gas components (where applicable), and compressors shall have molded composite handles. Handles shall be UV modified, composite. They shall be permanently attached, and recessed into the panel. Screws on the vertical portion of all removable access panel shall engage into heat resistant, molded composite collars. Collars shall be removable and easily replaceable using manufacturer recommended parts.

6 Coils:

Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed. Evaporator coils shall be leak tested to 150 psig, pressure tested to 450 psig, and qualified to UL 1995 burst test at 1775 psig. Condenser coils shall be leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 1995 burst test at 1980 psig.

7 Refrigerant Components:

Refrigerant circuit shall include the following control, safety, and maintenance features:

Fixed cooling orifice metering system shall include a multiple feed distribution system that optimizes coil performance. Fixed heating orifice metering system shall include a multiple feed distribution system that optimizes coil performance.

Refrigerant filter drier shall be of solid core design. Service gage connections on suction and discharge lines. Pressure gage access through a specially designed access port in the top panel of the unit. Suction line accumulator to provide protection in all operating modes from cooling, heating and reverse cycle switching.

Compressors:

Unit shall use fully hermetic, heat pump duty scroll compressor on single circuit independent refrigeration circuit. Compressor motors shall be cooled by refrigerant gas passing through motor windings. Compressors shall be internally protected from high discharge temperature conditions. Compressors shall be protected from an over-temperature and over-amperage conditions by an internal, motor overload device. Compressor shall be factory mounted on rubber grommets. Compressor motors shall have internal line break thermal, current overload and high pressure differential protection. Crankcase heaters shall not be required for normal operating range, unless required by compressor manufacturer due to refrigerant charge limits. Compressor shall be of a single stage cooling capacity design.

8 Filter Section:

Filters shall be held in place by a pivoting filter tray, facilitating easy removal and installation. Shall consist of factory installed, low velocity, throw-away 2-in. thick fiberglass filters. Filters shall be standard, commercially available sizes. Only one size filter per unit is allowed.

9 Evaporator Fan and Motor

Direct Drive Evaporator fan motor shall be a ECM motor design with permanently lubricated bearings and thermal overload protection. Shall have slow ramp up to speed capabilities. Shall require no fan/motor belts for operation, adjustments and or initial fan speed set up. Shall be internally protected from electrical phase reversal and loss.

Evaporator Fan shall be single speed snd easily set with dedicated selection switch and adjustment pot on unit control board. Blower fan shall be a Vane Axial fan design with 75% less moving parts than a conventional belt drive system. Fan shall be constructed of a cast aluminum stator and high impact composite material on rotor and air inlet casing. It shall be constructed with a corrosion resistant material and dynamically balanced. It shall have slow ramp up to speed capabilities to help reduce sound and comfort issues typically associated with single speed belt drive systems. Unit shall be a slide out design with two screw removal.

Shall include an easily accessible unit Control Board to conveniently and safely provide connection points for vital control functions such as: smoke detectors, phase monitor, economizer, thermostat, DDC control options, and low and high pressure switches. Controller shall also provide an intuitive means to adjust the indoor fan speed through a simple switch and pot adjustment design.

10 Condenser Fans and Motors:

Condenser fan motors shall be a totally enclosed motor, use permanently lubricated bearings and have inherent thermal overload protection with an automatic reset feature. Shall be a direct-driven propeller type fan constructed of high impact composite mate-rial. Shall have high impact composite blades completely formed into one piece without blade fasteners or connectors and shall be dynamically balanced.

11 Automatic Shutoff: For units or zones providing air in excess of 2000 cfm, provide smoke detectors in supply air stream to automatically shut off all power to air moving equipment and alert fire alarm system when smoke is detected in accordance with CMC Section 608.

12 Economizer with Power Exhaust: Economizer shall be a modulating power exhaust type where the unit will exhaust at the minimum outside air setpoint and exhaust 100% during economizer mode. Economizer with power exhaust is shipped separately and shall be field installed and wired under this section.

a. Provide plastic air sampling tube to sense pressure in room for control of power exhaust. Tube shall be placed thru ceiling with escutcheon plate in room that unit serves.

b. Modulating Economizer Sequence of Operation:
The economizer system initially responds to a signal from the cooling thermostat and functions as a true first stage for cooling, while providing maximum fuel economy. The economizer is automatically locked out during the heating mode and holds the outdoor air damper at the minimum position settings.

During the occupied period, the discharge sensor provides a signal to the actuator during free cooling or economizer mode. The signal opens the economizer damper until the discharge temperature drops below 50 degrees F. At this time the signal causes the motor to drive the damper back to minimum position. As the discharge temperature climbs to 60 degrees F the motor will drive back open. During the occupied period, the actuator will not close past the minimum position. **(The setpoints maybe changed by Commissioning Contractor to optimize controls for LEED Certification or Title 24 Requirements.)**

If the fully open actuator cannot satisfy the space demand, mechanical cooling is sequenced on.

During the unoccupied period, the actuator will override minimum position setting and drive fully closed. On a loss of power, the actuator will spring return fully closed.

When in heating operation, or when outdoor air temperature or enthalpy conditions are high, economizer operation is locked out, and actuator is held at minimum position.

The staging relay is used when the first stage compressors must provide mechanical cooling when assisting the economizer.

The staging relay can be omitted when the second stage compressors can be used to assist the economizer with mechanical cooling.

c. CO2 Sensor Economizer Integration:
When a CO2 sensor is used in conjunction with an economizer, the minimum position jumper between P and P1 on the logic is removed, and the sensor connected. When the CO2 sensor gets a reading higher than the setpoint, the sensor will signal the logic to modulate the o/a dampers open. The HVAC unit functions as if there is no economizer during the CO2 call for fresh air.

When the CO2 level falls below the setpoint, the damper modulates back to the minimum position.

d. Modulating Power Exhaust Sequence of Operation:
When the outside air damper on an economizer starts to open, extra air is introduced the system. As this happens, a mercury switch mounted on the economizer closes. This causes a switch to close on the variable speed controller, allowing high voltage power to be sent to an exhaust motor and blower.

The mercury switch is adjusted to close at the 1% outside air damper position.

The power exhaust is a centrifugal blower power exhaust. The power exhaust uses an adjustable transducer (0-10 VDC) to accurately compare the space pressure to atmospheric pressure, and adjust the amount of exhaust air accordingly. The exhaust

volume adjustment is accomplished using a variable frequency drive with a built-in PID control to maintain a field adjustable pressure set point.

OR

Economizer shall be a modulating gear driven type where the outside air will modulate from closed to minimum outside air setpoint and 100% during economizer mode. Economizer is shipped separately and shall be field installed and wired under this section.

13 Guarantee: Provide 5 year extended parts warranty on the condenser coil and compressor. Provide Herosite coating on condenser coils.

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 Manual for Mechanical Systems” dated 1998, including Appendix E.
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. Ducted Returns: All air handling that is not directly located in the space that it serves shall have ducted returns.
6. 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 fiber tape and adhesive per manufacturer's printed instruction. Ducts in weather shall be sealed air and water tight with duct mastic before closing and taping.
      i. Where Ductmate type 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).

3.02 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 Smoke Damper: Fire smoke dampers shall be installed in accordance with their State Fire Marshal approval and the manufacturer's recommendations.

C. Gym: Attach safety cable to inside of duct and to grille neck with #10 sheet metal screws.

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. 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.

3.06 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. Thermostats shall have the capability of terminating all heating at a temperature of no more than 70 degrees F, or terminating all cooling at a temperature of no less than 78 degrees F, and to provide a temperature range of up to 10 degrees 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.

3.09 SYSTEM AIR BALANCE:

A. Scope: Provide services necessary to initially deliver the air quantities shown on the plans and finally to balance for uniform temperature in the spaces served. Adjust all elements in grilles and diffusers for proper air distribution and to minimize drafts. Submit final Air Balance Report for approval before final completion of the construction contract. Comply with SMACNA manual for the balancing and adjustment of air distribution systems.

B. As a minimum, the balance report shall include CFM and neck size at each supply, return and exhaust grille, total CFM and external static pressure for all air moving equipment, and name plate and actual motor amps for indoor air fans.

C. As a part of the work of this contract, THIS DIVISION shall make any changes in the pulleys, belts, and dampers or the addition of dampers required for correct balance as recommended by air balance agency, at no additional cost to Owner.

OR

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 10%, minus 10% 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 Handling System):

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 10% 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.

I. 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 this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section Includes:
1. Materials and equipment shall be furnished and installed in support of electrical work described in these plans and specifications including but not limited to, raceways, boxes, enclosures, feeders, branch circuiting, supports, terminal cabinets, sleeves, gutters, panels, transformers, switchgear, lighting fixtures, controls, relays, contactors, in order to complete and make fully functional the systems described.
2. Complete fire alarm and annunciation system as shown and/or required by the (local jurisdiction having authority, California State Fire Marshal) including monitoring equipment and wiring for central station connection.
3. Lighting systems, both interior and exterior as shown on the plans and as specified herein, including controls, occupancy sensors, lumen sensors, photocell controls, LED'S supports, fasteners, straps, and miscellaneous mounting hardware and support structures for such equipment.
4. HVAC and plumbing electrical: Conduit, conductors and terminations for all line voltage power, line voltage controls and fusible and/or non-fusible safety disconnect switches for HVAC equipment, including but not limited to air conditioners, furnaces, fans, heat pumps, system pumps, condensing units. Provide protective equipment unless otherwise noted, etc. including protective devices.
5. Power and Lighting Distribution: Furnish and install power and lighting distribution systems including but not limited to panels, feeders, transformers, branch circuits, devices, fixtures, disconnect switches, contactors, controls, etc. for a complete working system.
6. Data systems infrastructure including all boxes, raceways, cable tray, wire basket tray, dedicated branch circuits, sleeves and penetrations, etc. as described and as shown in plans, risers, specifications and/or required for a complete and operating system.
7. Allocation of time to adequately train the Owner on the use and operation of all systems installed within the facility or on the property.

B. System Description:
1. The electrical plans indicate the general layout and arrangement; the architectural drawings and field conditions shall determine exact locations. Field verify all conditions and modify as required to satisfy design requirements as well as code minimums. Maintain all required working clearances as described in CEC Article 110 as well as other applicable articles.
2. Discrepancies shall be brought immediately to the attention of the Architect for clarification. The Architect shall approve any changes. Prior to rough-in, refer to architectural plans that shall take precedence over electrical plans with respect to locations.

C. Related Work Under Other Sections:
1. Mechanical Wiring: Control circuit wiring, energy management controls and interlocks for mechanical equipment shall be installed by Mechanical Contractor.
2. HVAC Control Raceway: Raceways, boxes, and control wiring for thermostats, temperature sensors and control components specified within the mechanical

specifications, shall be furnished and installed as required, and installed in accordance with the minimum wiring methods allowed for branch circuit wiring in Division 26.

1.3 SUBMITTALS AND SHOP DRAWINGS

A. Before construction, submit in accordance with the General Conditions of this Specification.

B. Manufacturers' specifications, catalog cuts and shop drawings as required to demonstrate compliance with the specifications. Identify specific intended use for each component where submittal may be ambiguous. Submit entire bound submittal at one time; partial submittals will not be accepted. At a minimum, submittals will be required for the following:
   1. Distribution equipment including transformers, distribution panels and breakers, motor controls, distribution and branch circuit panels, grounding, surge protection device, etc.
   2. Electrical equipment including disconnects, fuses, raceways, straps and racks, fittings, conductors, boxes, gutters, devices, plates, etc.
   3. Lighting equipment including fixtures, LED’s, mounting accessories, color charts (where required), etc.
   4. Lighting control equipment including low voltage switching system, dimmer switchbank / accessories, occupancy sensing equipment, time clocks, contactors, photocells, lumen sensors, etc.
   5. Complete system component submittals for:
      a. Voice Public Address System / Intercom / Clock.
      b. Fire Alarm System.
      c. Communication Systems including but not limited to; cable, fiber, terminations, cable management, cable tray, patch panels, equipment racks, cabinets, jacks, plates, cable labeling.
   6. Conduit including all fittings, etc.
   7. Wiring and cable, etc.

C. The intent of these specifications is to establish a standard of quality for materials and equipment. Therefore, some items are identified by manufacturer or trade name designation. Substitutions shall be subject to the Architect's approval. Where the substitution will affect other trades, coordinate all changes with those trades concerned and pay any additional costs incurred by them as a result of this substitution. Approval of substitutions shall not relieve the Contractor from providing an operational system in accordance with all applicable codes and ordinances.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Storage of equipment for the job is the responsibility of the Electrical Contractor and shall be scheduled for delivery to the site, as the equipment is required. Damage to the equipment delivered to the site or in transport to the job shall be the responsibility of the Electrical Contractor.

PART 2 PRODUCTS

2.1 MATERIALS

A. Materials shall be new and bear the label of or be listed by a nationally recognized testing laboratory. The quality and suitability of all materials shall conform to the standards and practices of this trade.

B. Supplied materials shall be of a current manufactured product line. Discontinued products are not acceptable. Where products are identified on the contract documents by part number, EC may supply the current product model or series which meets the specification

and intended use of the specified component.

PART 3 EXECUTION

3.1 INSTALLATION

A. Professionalism and appearance of installations shall be in accordance with accepted practices of this trade. Installation methods shall conform to manufacturers' specifications and recommendations. The Contractor shall man the job with qualified journeymen and helpers in this trade for the duration of the job. It is the Contractor's responsibility to communicate with and keep the job superintendent appraised of changes or clarifications, etc.

B. Employment of any person on any job in the capacity of an electrician is not permitted unless such person has qualified for and holds a valid Journeyman Electrician Pocket Card or General Journeyman Electrician Certificate issued by the State of California Division of Apprenticeship Standards except, Contractor may employ electrical helpers or apprentices on any job of electrical construction, new or existing, when the work of such helpers or apprentices is performed under the direct and constant personal supervision of a journeyman electrician holding a valid Pocket Card accepted by the State of California Division of Apprenticeship Standards:
   1. Each Pocket Card carrying journeyman electrician will be permitted to be responsible for the quality of workmanship for a maximum of one helper or apprentice during any same time period, provided the nature of work is such that good supervision can be maintained and the quality of workmanship is the best, as expected by Owner and implied by the latest edition of the National Electrical Code.

C. Materials shall be installed in accordance with the manufacturers' specification and recommendations. They must conform to the approval AHJ adopted codes and standards, but not less than the 2022 CEC and all applicable codes and standards, including but not necessarily limited to California Code of Regulations Title 24, NFPA, National Electrical Manufacturers Association, ANSI, CBC, and any other adopted ordinances of applicable agencies having jurisdiction.

D. Electrical Contractor shall lay work out in advance in order to avoid unnecessary cutting, chasing, and drilling of floors, walls, ceilings and other surfaces. Work of this nature shall be carefully done so as not to damage work already performed by other trades. Such alterations shall not depreciate the integrity of the structure. Approval for cuts or penetrations in structural members shall be by the Architect.

E. Supporting Devices:
   1. Verify mounting height of all luminaires or items prior to installation when heights are not detailed.
   2. Install vertical support members for equipment and luminaires, straight and parallel to building walls.
   3. Support conduits within 18” of outlets, boxes, panels, cabinets and deflections. Maximum distance between supports not to exceed spacing per CEC.
   4. Securely suspend all junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from the floor above or roof structure to prevent sagging and swaying.
   5. Provide seismic bracing per CBC requirements for this building location.
   6. Supporting Devices: Safety factor of 4 required for every fastening device or support for electrical equipment installed. Support to withstand four times weight of equipment it supports. Bracing to comply with seismic design category as per Structural Engineer.

F. Coordinate work with other trades as required to eliminate any delays during construction. Coordinate changes with other prime contractors to avoid construction conflicts.

G. Engineer's Field Observation: Site visits during construction for field observations and reports will be conducted by electrical engineer when directed by the Architect. A list of items that need to be addressed will be submitted to the Architect for forwarding to the Contractor.

H. Drawings of Record: Provide a full and accurate set of field record drawings marked up in a neat and understandable manner submitted to the Owner Representative, Construction Manager, or Architect upon completion of the work and prior to issuance of a certificate of completion. The drawings shall dimension all electrical facilities including but not limited to underground conduit, vaults, boxes as well as conduit routing scaled to within 12" of actual field conditions and shall be kept up to date reflecting changes or deviations. Electrical facilities shall be accurately drawn on the plan to scale. Refer to the general conditions of these specifications for additional requirements. Record drawings shall be required to identify both horizontal and vertical dimensions to visible and fixed points such as concrete, asphalt, buildings, sidewalks, etc.

I. Identification: Provide engraved laminated plastic nameplates for all switchboards, panelboards, fire alarm terminal cabinets, telephone and cable television backboards, main devices, control panels, time clocks, contactors and safety disconnect switches accurately identifying each device. Labels shall be attached to the equipment by means of screws or rivets. Self-adhering labels will not be acceptable. Refer to Section 26 05 53: Identification of Electrical Systems.

J. Safety: The Electrical Contractor is responsible to maintain equipment in a safe and responsible manner. Keep dead front equipment in place while equipment is energized. Conduct construction operations in a safe manner for employees as well as other work persons or anyone visiting the job site. Provide barriers, trench plates, flags, tape, etc.

K. Guarantees: Equipment and labor shall be guaranteed and warranted free of defects, unless otherwise stated to be more restrictive, for a period of one year from the date of final acceptance by the Owner. A written warranty shall be presented to the Architect at the time of completion prior to final acceptance. Equipment deemed to be damaged, broken or failed should be repaired or replaced at no additional cost to the Owner. Materials or system requiring longer than a one-year warranty as described herein shall be separately warranted in separate letters of guarantee stating the duration of warranty.

L. Operating and Installation Manuals: Provide two copies each of manuals, operating and installation instructions for equipment indicated in submittal packages. Instruct the Owner's representative as to the operation and location of equipment necessary to allow them to operate the facility upon final acceptance. This instruction period shall be prearranged with the Owner's representative prior to occupancy of the facility and the weeks prior to training scheduled.

END OF SECTION 26 05 00

SECTION 26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. Section includes:
1. Wires and cables.
2. Connectors.
3. Lugs and pads.

B. System Description:
1. Provide wires, cables, connectors, lugs, strain reliefs, racking insulators for a complete and operational electrical system.

1.3 SUBMITTALS

A. Provide product data for the following equipment:
1. Wires.
2. Cables.
3. Connectors.
4. Lugs.
5. Splice Kits.

B. Provide the insulation cable testing report in the project closeout documentation, refer to Closeout Requirements in the General Conditions portion of this specification.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Confirm to requirements of the CEC, latest adopted version with amendments by local Authority Having Jurisdiction (AHJ).
2. Furnish products listed by UL or other testing firm acceptable to AHJ.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Wires and Cables: General Cable, Okonite, Southwire, or approved equal.

B. Connectors: Burndy, Ilsco, Thomas & Betts, or approved equal.

C. Wire connectors shall be minimum 75 degree centigrade rated and properly sized for the number of conductors being connected, terminated, spliced etc. All above grade connectors shall be solderless lug or plastic wire nut type, screw on, pressure cable type (wire nut or spring nut type), 600 Volt, 105-degree C, with skirt to cover all portions of stripped wires. Connector shall be U.L. rated for number and size of conductors being joined together as a splice.

D. Splices:
1. Branch Circuit Splices: Ideal, Scotch-Lock, 3M, or approved.
2. Feeder Splices: Compression barrel splice with two layers Scotch 23 and four layers of Scotch 33+ as vapor barrier.
3. Screw Terminal Lugs.
4. Kearney Split Bolt.

2.2 WIRES AND CABLES FOR LINE VOLTAGE SYSTEM AND CONTROLS.

A. Wire and Cable Shall Be:
1. Copper, 600 volt rated throughout. Conductors 12AWG to 10AWG, solid or stranded. Conductors 8AWG and larger, stranded.
2. Phase color to be consistent at all feeder terminations; A-B-C, top to bottom, left to right, front to back. Phasing tape shall be permitted on sizes #6 and larger.
3. Color Code Conductors as Follows:

PHASE	208 VOLT	240 VOLT DELTA	480 VOLT
A	Black	Black	Brown
B.	Red	Orange (High Leg)	Orange
C.	Blue	Blue	Yellow
Neutral	White	White	White w/colored strip
Ground	Green	Green	Green
Isolated Ground	Green w/yellow trace	Green w/yellow trace	N/A

4. All conductors shall be copper unless otherwise noted. Minimum size for individual conductors shall be #12 AWG unless otherwise noted. Sizes #8 AWG and larger shall be stranded conductor. Individual conductors shall be insulated with type, XHHW, THW, THHN/THWN 600- volt insulation unless otherwise noted. Control, signal, communication conductors shall be as dictated by the vendor of that equipment or as specified here-in. Proper insulation type shall be used for the proper environmental application (i.e., waterproof, wet location, plenum, temperature rated). If a condition exists where the application is uncertain, contact the Engineer for direction. Contractor is responsible to follow specific cabling requirements described in other sections of this specification relative to various communications and controls systems as well as the respective riser diagrams shown on plans. If a discrepancy occurs, communicate such discrepancy to the Architect and Engineer immediately for resolution.
5. Insulation types THWN, THHN or XHHW. Minimum insulation rating of 90C for branch circuits.
6. Refer to signal and communications specification sections for cable requirements.

2.3 CONNECTORS

A. Copper Pads: Drilled and tapped for multiple conductor terminals.

B. Lugs: Indent/compression type for use with stranded branch circuit or control conductors.

C. Solid Conductor Branch Circuits: Spring connectors, wire nuts, for conductors 12 through 8AWG.

2.4 LUGS AND PADS

A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation: Conductors shall not be installed until after conduit systems are permanently in place. Use an approved non-hardening type wire pulling lubricant if lubricant is to be used. Maintain all conduits and wire pulls free from foreign material. If due to field conditions, more than a total of 300 degrees of bend are required; a pull box shall be furnished and installed for ease of installation. Said pull boxes must be sized and rated for the appropriate application and must remain easily accessible upon completion of the project (approval of the location shall be obtained from the Architect prior to installation). Show these pullboxes on the field record drawings. Conductors installed in underground raceways on site shall be duct sealed and taped where they exit the raceway to prevent the entrance of foreign material and moisture after the conductors are installed. Proper drainage shall be provided for underground pull and splice boxes.

B. Insulation: Use proper insulation types where temperature and environment are a factor.

C. Labeling: All conductors in panels, switchboards, terminal cabinets, vaults, pull boxes, and junction boxes shall be labeled with tape number markers indicating circuit number and identifying system. All labeling shall be permanent. See Section 26 05 53: Identification of Electrical Systems.

D. All conductors, wiring, cable where installed below floor, slab or underground shall be considered wet locations, and shall be rated accordingly. Non-waterproof cabling is not allowed in any below grade or wet application.

E. Cables routed together in cable tray shall be stacked, organized and tie wrapped together in a neat and workman like manner. Random cable routing is not acceptable.

F. Cable and conductors routed through pull boxes and vaults shall be properly supported. Bend radius of cable or conductor shall not be less than six times the overall cable diameter.

G. Wires and Cables:
   1. Conductor Installation:
      a. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
      b. Install conductors with care to avoid damage to insulation.
      c. Do not apply greater tension on conductors than recommended by manufacturer during installation.
      d. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation.
   2. Conductor Size and Quantity:
      a. Install no conductors smaller than 12AWG unless otherwise shown (e.g. – Fire alarm and communications systems, as defined in their respective specifications sections and/or drawings).
      b. Provide all required conductors for a fully operable system.
   3. Provide dedicated neutrals (one neutral conductor for each phase conductor). Exceptions may only be granted with Electrical Engineer approval.
   4. Conductors in Cabinets:
      a. Cable and train all wires in panels and cabinets for power and control neatly and uniformly. Use plastic ties in panels and cabinets.
      b. Tie and bundle feeder conductors in wireways of panelboards.
      c. Hold conductors away from sharp metal edges.

3.2 FIELD QUALITY CONTROL

A. Tests:
   1. Test conductor insulation on feeders of 400 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below.
   2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit report with operating and maintenance manual.

END OF SECTION 26 05 19

SECTION 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

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. Grounding and bonding requirements of electrical installations for personnel safety and to provide a low impedance path for possible ground fault currents as described in CEC Article 250.
2. “Grounding electrode system” refers to all electrodes required by CEC, as well as including made, supplementary, lightning protection system and telecommunications system grounding electrodes.
3. The terms “connect” and “bond” are used interchangeably in this specification and have the same meaning.

B. Related Sections:
1. Section 26 05 00: Common Work Results for Electrical.
2. Section 26 05 19: Low-Voltage Electrical Power Conductors and Cables.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be permitted to be identified per CEC.

B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes No. 10 AWG and smaller shall be ASTM B1 solid bare copper wire.

C. Conductor sizes shall not be less than what is shown on the drawings and not less than required by the CEC, whichever is greater.

2.2 SPLICES AND TERMINATION COMPONENTS

A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

PART 3 EXECUTION

3.1 GENERAL

A. Ground in accordance with the CEC, as shown on drawings, and as hereinafter specified.

B. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, fire sprinklers, plumbing piping, raceways, junction boxes, outlet boxes,

cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.3 SECONDARY EQUIPMENT AND CIRCUITS

A. Metallic Piping, Building Steel, and Supplemental Electrode(s):
   1. Provide a grounding electrode conductor sized per CEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
   2. Provide a supplemental ground electrode and bond to the grounding electrode system.

B. Service Disconnect: Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors.

C. Switchgear, Switchboards, and Motor Control Centers:
   1. Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
   2. For service entrance equipment, connect the grounding electrode conductor to the ground bus.
   3. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.
   4. Triple Ground Rod: The ground system shall consist of three ground rods, arranged in an equilateral triangular pattern located at least five (5) feet outside of the housekeeping pad. Space 15 feet apart and drive into the earth to a point two (2) feet below finished grade to top of rods. Grounding electrode conductor shall form a continuous loop around rods, and conductor shall be properly bonded to each rod by a fusion weld similar to "Cadweld".
   5. Extend grounding electrode conductor from this ground rod(s) to the grounded service conductor (neutral) in the main switchboard at an accessible point on the ground bus per NEC 250-24.
   6. Install grounding electrode conductor of 3/0 Copper.

D. Transformers:
   1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
   2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from bar at the service equipment.

E. Conduit Systems:
   1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor sized per CEC.
   2. Nonmetallic conduit systems shall contain an equipment grounding conductor, except that non-metallic feeder conduits which carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment need not contain an equipment grounding conductor.
   3. Metal conduit containing only a grounding conductor, and which is provided for

mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.

F. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, power and lighting branch circuits.

G. Boxes, Cabinets, Enclosures, and Panelboards:
1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes.
2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.

H. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.

I. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

J. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

K. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

3.4 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.5 TELECOMMUNICATIONS SYSTEM

A. Bond telecommunications system grounding equipment to the electrical grounding electrode system.

3.6 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 15 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Owner. Final tests shall assure that this requirement is met and test results shall be submitted to the Owner with final close out documents.

B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of- potential method as defined in IEEE Standard 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

C. Below-grade connections shall be visually inspected by the IOR prior to backfilling. The Contractor shall notify the IOR 24 hours before the connections are ready for inspection.

D. Furnish a copy of tests to Owner at completion of project.

END OF SECTION 26 05 26

SECTION 26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

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. Section Includes:
1. Conduit and fittings.
2. Outlet boxes.
3. Weatherproof outlet boxes.
4. Junction and pull boxes.
5. Floor boxes.
6. Cabinets, termination cabinets.
7. Gutters.

B. Related Work:
1. Installation of all wire, cable, conductor, boxes/gutters, pull ropes, fiber optic cable raceway, conduit, innerduct, cable sleeve and duct as described on the plans and/or as specified here-in. This scope shall include pathways to be installed underground onsite and offsite, underslab, above grade, both concealed and exposed, overhead concealed and exposed as appropriately applied. Raceways/boxes shall be installed in accordance with their intended and allowed uses and as specified here-in whichever is more restrictive. Size and capacity of all raceway/boxes shall be as specified here-in or as depicted on the drawings, but shall not be less than that required by code. Larger raceway sizes may be specified than code would permit. The specifications shall govern.
2. Listed products for termination, coupling, extending, benching supports of raceways shall be used.
3. Raceways/boxes described by this section shall include, but not be limited to, power for site utilities and lighting, site and building communications, controls, fire alarm, data system, power distribution, lighting, lighting controls, video, intercom, and other building low voltage/communications systems controls as may be required.
4. Protection of and cleanliness of pathways and raceways must be assured during the construction process in order to eliminate the possibility of debris entering the conduit, duct, pathway resulting in decreased wire capacity and potential damage to installed conductors and cables.
5. Pathways are shown in a diagrammatic way and are generally accurate as to routing, however, it is the Contractor’s responsibility as a means and methods process to coordinate with all other trades that require space within a building. The Contractor shall obtain approval for installation of raceways routing through structural footings, retaining walls, columns, beams, purlins, grade beams, etc.
6. It is the Contractor’s responsibility to insure that all raceway and boxes systems penetrate fire assemblies and sound rated assemblies in an approved manner using the appropriate and listed products for the purpose.
7. Minimum conduit size shall be 3/4" except if plan shows or code requires larger size. Exception: Use minimum 1" for underslab and below grade applications outside of building exterior walls.
8. All electrical systems shall be installed in an approved conduit system. This shall include but not be limited to all systems described in Section B.3 above.
9. All line voltage wiring above-grade within the building shall be installed in metallic

conduit.

10. Empty or future conduits shall be properly plugged with plastic caps or inserts with a 3/8” polyethylene pull rope. Plastic or "duct" tape will not be acceptable.
11. All low voltage systems including data, voice, intercom, fire alarm, public address, etc. shall be in raceways separated from line voltage cabling. Voice / Data and Direct Digital Control (DDC) systems for HVAC cabling shall be routed as specified in Section 27 41 16 and 23 09 23 respectively, and as recommended by EIA/TIA standards. It shall be the contractor’s responsibility to provide raceway down walls to outlet boxes and to provide sleeves across inaccessible ceiling spaces.
12. Underground conduits entering building shall have the open end of conduit within building above the elevation of the conduit outside the building such that water cannot enter building through conduit. If such a condition exists, a pull box outside of building footprint shall be installed in conduit route before conduit enters building whereby top of pull box is below finish floor of building and moisture may exit box before entering building.
13. No single conduit run of any type shall exceed 300 degrees of radius bend from termination box to termination box.
14. Separate Raceway System - Provide a separate raceway system for each of the following systems installed. Do not combine different systems into a raceway or cable tray system, unless otherwise noted or allowed. Mechanical controls and raceway shall be provided by others in separate raceway from the below systems:
    a. Fire Alarm.
    b. Line Voltage.
    c. All other low voltage systems provided by electrical contractor.
15. Spare, Future Conduits: Conduits labeled conduit only, spare, or for future use, shall be provided with a pullrope, capped at each end, labeled as spare with destination marked, and turned over to the Owner in an unused state. Contractor shall not utilize these conduits for the installation of cabling or conductors as part of this scope of work. Contractor to verify and install at no additional cost to the Owner, additional conduits as required for the installation of the systems being installed.
16. Outlet System: Provide electrical boxes and fittings as required for a complete installation. Including but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts, covers and all other necessary components.
17. Code Compliance: Comply with CEC as applicable to construction and installation of electrical boxes and fittings and size boxes according to CEC 312, 314 and 366 except as noted otherwise.
18. Outlets to be flush mounted: Maintain integrity of insulation and vapor barrier. Unless otherwise noted, flush mount all outlet boxes.
19. Provide putty pads of proper type around outlet boxes and/or as detailed on plan to meet sound transmission restrictions and fire ratings of walls.

1.3 SUBMITTALS

A. Provide Product Data for the Following Equipment:
1. Conduit and fittings.
2. Outlet boxes.
3. Weatherproof outlet boxes.
4. Junction and pull boxes.
5. Floor boxes.
6. Cabinets, termination cabinets.
7. Gutters.
8. Putty pads.
9. Raceways

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Conform to requirements of the CEC, latest adopted version with amendments by local AHJs.
   2. Furnish products listed by UL or other independent and nationally recognized testing firm.

PART 2 PRODUCTS

2.1 MATERIALS

A. Heavy wall Rigid Non-Metallic Conduit, shall be PVC schedule 40 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.

B. Extra heavy wall non-metallic conduit, shall be PVC schedule 80 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.

C. Galvanized Rigid Steel (GRS) conduit shall be hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.

D. Electrical Metallic Tubing (EMT) shall be zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.

E. Electrical Non-Metallic Tubing (ENT), shall be listed to requirements of U.L. 1653, in accordance with CEC Article 362, and meet requirements of BI National Standard CAN/CSA- C22.2 No. 227.1-U.L. 1653. ENT shall be rated for 90 degrees C conductors and shall be recognized for use in 2-hour fire resistance non-load bearing and load bearing wall assemblies. ENT shall be recognized for through-penetration firestop systems as classified to meet U.L. and ICC building codes. ENT shall only be allowed for data cabling systems and will not be permitted for Fire Alarm or line-voltage systems.

F. Flexible Metal Conduit (FMC) shall be continuous wound reduced wall galvanized steel produced to UL standards.

G. Liquid tight flexible metal conduit shall have a thermoplastic cover over a galvanized steel core containing an integral copper ground in sizes to 1 1/4" and shall be in compliance with UL standards and CEC Article 350.

H. Wire basket tray shall be 12” wide with 4” side rails minimum unless otherwise noted. It shall be U.L. listed and use listed connectors, elbows, tees, etc. and be cut and installed using listed equipment. Material shall be zinc electroplated steel.

I. Cable runway tray shall be 12” wide with 4” side rails minimum unless otherwise noted. It shall be U.L. listed and use listed connectors, elbows, tees, etc. Material shall be hollow steel with gray painted finish.

J. Manufacturers:
   1. Outlet Boxes: Bowers, Raco, Orbit, Steel City or equal.
   2. Weatherproof Outlet Boxes: Bell, Red Dot, Carlon or equal.
   3. Floor Boxes: Wiremold/Walker, Hubbell, Steel City, or equal.
   4. Junction and Pull Boxes: Circle AW, Hoffman, Wireguard or equal.
   5. Box Extension Adapter: Bell, Red Dot, Carlon or equal.
   6. Conduit Fittings: O-Z Gedney, Thomas & Betts, Raco, Crouse Hinds, or equal.
   7. Putty pads: 3M, Hilti, or equal.

8. Heavy wall rigid non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
9. Extra heavy wall non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
10. Galvanized Rigid Steel (GRS) conduit shall be hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.
11. Electrical Metallic Tubing (EMT) shall be zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.
12. Electrical Non-Metallic Tubing (ENT), shall be listed to requirements of U.L. 1653, in accordance with CEC Article 362, and meet requirements of BI National Standard CAN/CSA-C22.2 No. 227.1-U.L. 1653. ENT shall be rated for 90 degrees C conductors and shall be recognized for use in 2-hour fire resistance non-load bearing and load bearing wall assemblies. ENT shall be recognized for through-penetration firestop systems as classified to meet U.L. and CBC building codes.
13. Flexible Metal Conduit (FMC), Alflex, American Flexible Conduit or equal.
14. Liquid tight flexible metal conduit, Anacanda (type UA), Electri-flex Liquatite or equal.
15. Floor Boxes, Single Gang, Walker/Wiremold 880 CS Series or approved equal.
16. Floor Boxes, Multiple Gang, Walker/Wiremold RFB Series or Walker Omnibox multi-service floor box with carpet plates, and/or water resistant device covers.
17. Masonry Boxes, outlets in concrete, Raco Series 690 or equal.
18. Wire basket tray, B-line, GS Metals, Cablofil, Chatsworth, FlexTray or equal.
19. Cable runway tray, B-line, CPI, Homaco, Chatsworth, FlexTray or equal.

2.2 OUTLET BOXES

A. NEMA 1 gutter, junction and pull boxes shall be fabricated from code gage steel finished in grey enamel with screw cover fronts and concentric knockouts in all sides.

B. NEMA 3R gutter, junction and pull boxes shall be fabricated from code gage galvanized steel with screw cover fronts and concentric knockouts in the bottom only. Any penetrations to the side, top or back shall be weatherproofed in an approved manner such as “MYERS” gasketed type hub or equal.

C. Steel outlet boxes and plaster rings shall be galvanized rigid assemblies, either one piece pressed or factory welded construction containing the size and number of knockouts required. Steel outlet boxes shall be manufactured, sized and installed in accordance with CEC Article 314. Device Outlet: Installation of one or two devices at common location, minimum 4” square, minimum 1 1/2" deep. Single or 2 gang flush device plaster ring. Raco or equal.

D. Luminaire Outlet: minimum 4” square with correct plaster ring depth, minimum 1 1/2” deep with 3/8” luminaire stud if required. Provide proper depth plaster ring on bracket outlets and on ceiling outlets.

E. Construction: Provide galvanized steel interior outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Boxes shall be properly secured to the structure such that they are flush with the finish surface. Boxes shall be made structurally secure by means of the proper fastening devices.

F. Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, plaster rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

2.3 JUNCTION AND PULL BOXES

A. Construction: Provide galvanized sheet steel junction and pull boxes, with screw-on covers; of the type shape and size, to suit each respective location and installation; with welded seams and equipped with steel nuts, bolts, screws and washers.

B. Location:
1. Install junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
2. Install junction boxes and pull boxes as required to facilitate the installation of conductors and limiting the accumulated angular sum of bends between boxes, cabinets and appliances to 300 degrees.
3. Locations: Junction boxes shall be located only where necessary and only in equipment rooms, closets, and accessible attic and underfloor spaces. A horizontal distance of 24” shall separate outlet boxes on opposite sides of occupancy separation walls, fire-rated walls or partitions.
4. Labeling: Junction box covers shall be marked with indelible ink indicated the circuit numbers passing through the box.

2.4 CONDUIT FITTINGS

A. Requirements: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and plastic conduit bushings of the type and size to suit each respective use and installation.

B. Steel boxes may allow for field knock-out modifications, but shall in all other ways conform to code requirements.

2.5 FLOOR BOXES - SINGLE GANG

A. Construction: Deep cast iron fully adjustable before and after concrete pour with all required components for complete activation. Verify required components for application of service fittings, covers, monuments, and the like, attached to floor boxes.

B. Activations:
1. Flush: Provide brass duplex or single signal cover, hinged with set screw lock. Carpet or tile finish ring.
2. Monuments: Provide stainless steel monuments with power receptacle or data grommet as noted.
3. Coordinate specific application of systems as noted on Drawings.

2.6 FLOOR BOXES - MULTIPLE GANG

A. Construction: Deep cast iron, fully adjustable before and after pour. Equal to Walker/Wiremold RFB Series or Walker Omnibox multi-service floor box with carpet plates, and/or water resistant device covers. Verify color. Partition for different power or signal applications. Provide required power receptacle devices and signal grommets or receptacles as noted. Flange typeshall be compatible with floor covering for either carpet or vinyl as required and shall be brass type not polycarbonate.

B. Floor mounted boxes shall be water tight and cast iron when installed in grade level concrete slab floor, fully adjustable with interior and exterior leveling screws. Receptacle flange shall be brass with a duplex lift lid. Flange type shall be compatible with floor type. Before installation, coordinate exact location with Architect.

2.7 PUTTY PADS

A. Intumescent moldable firestop putty designed to protect electrical outlet boxes. Meets test requirements ASTM E 814 and UL 1479.

PART 3 EXECUTION

3.1 INSTALLATION

A. Conduit systems listed below are for use in installations where they are permitted to be used by CEC and/or other occupancy restrictions. The below installation methods do not intend to suggest that these materials be installed in conflict with any applicable code. Special attention to applications shall be made in building types such as wet location, hazardous locations, assembly occupancy and multi-story, but not limited to these. Requirements which are more restrictive than the CEC may be called for by the drawings and / or these specifications. These requirements must be adhered to. The Electrical Contractor shall be responsible to use the proper conduit system for the application. Exposed conduit is not allowed below ceilings or above slab of floor, without prior approval from Electrical Engineer. All conduits shall be concealed except in electrical and telecommunication rooms or where shown to be surface mounted. Exposed conduit (where allowed) shall be run square and plumb with building lines in an approved manner. Support roofmount conduits, where allowed, with minimum 12” wide approved rooftop supports (B-Line Durablok, or approved equal) unless otherwise detailed in roof requirements or as specified in roofing specification. Strap conduits to blocks with proper sized conduit straps. Spacing of support shall be a minimum as provided for in the CEC. All exposed conduit mounted below 8’ above finished grade shall be strapped at a minimum of 5’ spacing.

B. Electrical Non-Metallic Tubing (ENT) shall be installed in accordance with its listed application. Only listed cement shall be used for connectors, coupling, fittings requiring cement. Unless otherwise noted, ENT systems shall be color coded: Blue for branch and/or feeder power wiring, yellow for communications systems, and red for fire alarm and emergency power systems. Use only approved and listed accessories:
   1. Electrical Nonmetallic Tubing (ENT) is designed to replace EMT, flexible metal conduit or other raceway or cable systems, for installation in accordance with Article 362 of the National Electrical Code, Section 12-1500 of the CEC, other applicable sections of the Code, and local codes.
   2. Any ENT used shall be listed to the requirements of UL Standard UL 1653 in accordance with Article 362 of the NEC and Section 12-1500 of the CEC.
   3. Any ENT used shall meet the requirements of BI National Standard CAN/CSA-C22.2 No. 227.1-UL1653 and shall be Listed/Certified in accordance to the Electrical Codes.
   4. Carlon’s ENT shall be installed per the technical assessment prepared by fire cause analysis for use in 1hour and 2-hour rated construction.
   5. Penetration of fire rated walls, floors or ceilings shall use Classified Through-Penetration Firestop Systems described in the current Underwriters Laboratories Fire Resistance Directory.
   6. Fittings and outlet boxes shall be designed for use with ENT shall be listed. All fittings, boxes and accessories shall be from one manufacturer.
   7. Only Carlon ENT Blue cement recommended specifically for use with ENT and rigid nonmetallic fittings shall be used.
   8. Unless indicated differently on drawings, ENT systems shall be color coded: BLUE for branch and feeder circuit wiring, YELLOW for communications, and RED for fire alarm and emergency systems, or colors can designate different voltages.
   9. ENT, fittings, and accessories shall be manufactured by Carlon.
   10. ENT shall not be used or allowed in any application where not allowed by CEC Article 362.

C. Non-Metallic Rigid Conduit shall be used in concrete slabs, below concrete slabs on grade, or underground outside of a building slab or foundation. Maintain minimum depth requirements and cover with appropriate fill material. Conduit shall be heavy wall Schedule 40 or 80, rigid PVC only. Rigid utility P&C duct shall not be used in any application. Properly sized grounding conductors shall be installed per CEC article 250, in all non-metallic conduit branch circuit and feeder runs. PVC conduit shall be formed or field bent only with the use of properly approved bending tools such as to not decrease the internal bore of the conduit. All conduits shall be cut square and reamed of burrs. Approved and compatible glue shall be used on all PVC fittings to attain watertight joints.

D. Galvanized Rigid Steel (GRS) conduit shall be used where exposed less than 8'–0" above finished grade to 18" below finished grade and where subject to physical damage. Conduits shall be cut square and reamed to remove burrs and sharp edges. Strap conduit below 8' above grade at 5' intervals. Unless otherwise noted, threadless setscrew and threadless weathertight fittings may be used in lieu of threaded fittings. All threaded ends entering a junction box of any type shall require one locknut on the inside and one on the outside of the enclosure and be provided with a plastic bushing or grounding bushing where necessary for proper grounding. Where exposed to moisture, a watertight hub or other approved method shall be required. All conduits shall be stubbed up straight and uniform into junction boxes, panels, cabinets, etc., and shall be (GRS) properly supported and strapped. All GRS conduit located below grade, shall be tape wrapped.

E. Electrical Metallic Tubing (EMT) shall be used as allowed by code and as permitted by this specification. It shall not be in contact with soil or the concrete slab on the ground floor of any structure. Connectors and couplings shall be steel insulated set screw type where installed in indoor dry locations not subject to moisture. Where the potential for moisture is present, compression type weathertight fittings are required. One hole conduit straps are permitted from 1/2" to 1" and two hole conduit straps are required for size 1 1/4" and larger. EMT shall not be allowed in areas subject to severe physical damage. Install copper ground wire sized per CEC 250-122 in all EMT conduits.

F. Flexible conduit may be used where concealed in building construction or above dropped ceilings, but shall meet the following criteria: No individual circuit path from distribution panel to last device shall exceed a cumulative length of 6' of flexible conduit from start to end. Flexible conduit shall not exceed a total directional change of 270 bending degrees in any one run between conduit terminations. Squeeze type or Jake type steel flex fittings of a grounding type are required. Flexible conduit must be supported in accordance with CEC. Where exposed to the weather, moisture, or spray down flexible conduit shall be of the liquidtight type. Fittings shall be manufactured for use with liquidtight flexible conduit. All motor connections shall be made with liquidtight flex. Flexible conduit may not be used where exposed except for last 2' of equipment connection and unless otherwise noted or approved. A copper ground wire sized per CEC 250-122 shall be installed in all flexible conduit runs. Flexible conduit may not be used exposed. Weatherproof liquid tight conduit shall not be used at roof level for equipment connections with lengths exceeding 24" nor shall it be used to circumvent a rigid conduit systemin a horizontal direction. Connect recessed lighting fixtures to conduit runs with a maximum of 6' of flexible metal conduit extending from junction box to fixture.

G. Underground conduits and transition to above grade/slab shall be as follows:
1. PVC elbows 2" and smaller are allowed, or if top of elbow is minimum 18" BFG or below top of slab, otherwise GRS elbows are required.
2. GRS risers are required from elbow below grade to equipment (device, outlet, panel, cabinet, etc.) above grade.
3. GRS elbows/risers to be PVC coated or 10 MIL tape wrapped (1/2" lapped) to 3" above finish grade or top of slab.

H. Conduit Supports: Conduit runs may be supported by one-hole and two-hole straps or supports as manufactured by Unistrut, Minerallac, Caddy or equals. Supports may be fastened by means of anchors, shields, beam clamps, toggle bolts, or other approved methods appropriate for the application and size of conduit. Pipe nailers (J-hooks) may only be used for 1" conduit and smaller and only in wood frame construction. Conduit support methods are subject to review by the engineer and authority having jurisdiction for adequacy. Installations deemed inadequate shall be corrected by the contractor at no cost to the Owner.

I. Bends and offsets shall be made with approved tools for the type of conduit being utilized. Bends shall be made without kinking or destroying the smooth bore of the conduit. Parallel conduits shall be run straight and true with bends uniform and symmetrical. Minimum radii shall be per CEC 344-24.

J. Conduit Stub-outs below grade shall be capped with plastic cap, and identified by placing a pull box marked with correctly identified utility such as "Elec", "Tel", etc. Dimension for exact location on field record drawings. Provide lids for proper field application (i.e. traffic, incidental, pedestrian).

K. Conduit Seals - Where below grade conduits enter structure through slab or retaining wall of building or basement, seal the inside of each conduit as follows:
1. Provide damming material around conductors 3" into conduit. Polywater or equal.
2. Fill 3" of conduit with 3M #2123 sealing compound.
3. Wrap conductors where they exit the conduit with 3M #2229 "Scotch Seal" mastic tape. Lap tape to approximate diameter of the raceway and wrap outside of conduit opening with (minimum) one turn.
4. Use conduit sealing bushings type CSB (O-Z/Gedney) or equal.
5. Empty conduits shall be sealed with standard non-hardening duct seal compound and then capped to prevent entrance of moisture and gases and to meet fire resistance requirements.
6. Provide cable drip loop minimum 12" high.

L. Marker tape: Place marker tape at 12" below finish grade along and above buried conduits. Label tape "CAUTION: ELECTRICAL LINES BELOW" or similar wording.

M. Electrical and communications systems raceways routed underground shall not occupy the same trench as plumbing utilities such as sewer, water, storm drain, gas or other wet or dry gaseous utility system. A minimum of 12" of undisturbed earth is required. Where utilities must cross in closer proximity to each other due to physical constraints, 6" minimum crossing distances are allowed.

N. Conduits, routed below footings, slabs, grade beams, columns, and other structural elements shall be installed in strict compliance with structural details and criteria shown on structural plans. Clearances below structural elements and sleeves through structural elements must be carefully planned to avoid conflict and must be approved by the structural engineer if conflict arises.

O. All conduit or raceways passing through fire rated walls, floors, or ceilings shall be installed with a listed penetration method which protects the opening to the same rating as the assembly and is non hardening.

P. Cable runway shall be used in equipment rooms where shown on the plans. Ladder tray installations shall conform to the requirements of CEC Article 318. The contractor shall provide all mounting hardware, connectors and bracing as required and as recommended by the manufacturer for a complete system installation.

Q. Wire basket tray shall be used in all concealed spaces (above ceiling spaces, under buildings in access tunnels, below raised floors, etc.) unless otherwise noted. Wire basket tray installations shall conform to the requirements of CEC Article 318. The contractor shall provide all mounting hardware, connectors and bracing as required and as recommended by the manufacturer for a complete system installation. All cutting and bending of wire basket tray shall be per the manufacturer's recommendation using tools designed for that purpose. Cable loading shall not exceed the listing of the system and its support.

R. Location: Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.

S. Anchoring: Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.

T. Special Application: Provide weatherproof outlets for locations exposed to weather or moisture.

U. Knockout Closures: Provide knockout closures to cap unused knockout holes where blanks have been removed.

V. Mount outlet boxes, unless otherwise required by ADA, or noted on drawings, the following distances above the finished floor:
1. Receptacles, Telephone, TV & Data outlets. (measured to bottom of outlet box): +15".
2. Outlet above counter (measured to top of outlet box): +46".
3. Control (light) Switches. (measured to top of outlet box): +48".
4. Fire Alarm Manual Pull Stations, T-stats. (measured to top of outlet box): +48".
5. Fire Alarm Visuals: the lower of +80" to bottom of lens, or 6" below ceiling.
6. Other Outlets: As indicated in other sections of specifications or as detailed on drawings.

W. Coordinate all electrical device locations with the architectural floor plan and interior and exterior elevations to prevent mounting devices within elements that they may conflict such as cabinetry, mirrors, planters, etc.

X. Size outlet and junction boxes to minimum wire fill space requirements. Upsize box as required to allow ease of wire installation and device installation.

Y. Outlet and junction boxes in fire rated walls shall be gauged and spaced so as not to exceed the maximum penetration allowed by the assembly without compromising the fire rating. If a conflict arises relative to a specific condition, the contractor shall follow the requirements of the fire authority and ask for guidance from the design team. At no time should a larger box be installed prior to resolution of conflict.

END OF SECTION 26 05 33

SECTION 26 05 43 – UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Ducts in concrete-encased duct banks.
2. Handholds and handhole accessories.
3. Manholes and manhole accessories.

1.2 SYSTEM DESCRIPTION

A. Interconnected system of encased conduits, ducts, manholes and handholes to distribute power and telecommunications.

B. Conduit and duct routing, manhole, and handhole locations are shown in approximate locations unless dimensions are indicated. Route and locate to complete duct bank system.

C. Use concrete encased rigid steel or concrete encased rigid plastic conduits for all underground ducts.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Manholes.
2. Handholes.
3. Hardware.
4. Conduit and ducts, including elbows, bell ends, bends, fittings, and solvent cement.
5. Duct-bank materials, including spacers and miscellaneous components.
6. Warning tape. Detectable type.

B. Shop Drawings: Show fabrication and installation details for underground ducts and utility structures and include the following:

1. For manholes:

a. Duct sizes and locations of duct entries.
b. Reinforcement details.
c. Manholes cover design and engraving.
d. Step details.
e. Grounding details.
f. Dimensioned locations of cable rack inserts, pulling-in irons, and sumps.

C. Coordination Detailing Activity Drawings: Show duct profiles and coordination with other utilities and underground structures. Include plans and sections drawn to scale, and show all bends and location of expansion fittings.

D. Product Certificates: For concrete and steel used in underground precast manholes, according to ASTM C 858.

E. Product Test Reports: Indicate compliance of manholes with ASTM C857 and ASTM C858, based on factory inspection.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of manholes and handholes. Provide dimensions off of fixed elements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete units at Project site as recommended by manufacturer to prevent physical damage.

C. Arrange so identification markings are visible.

D. Lift and support precast concrete units only at designated lifting or supporting points.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving occupied facilities unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated.

1. Comply with Owner's power shut-down procedures.

2. Do not proceed with utility interruptions without Owner's Representative written permission.

1.7 COORDINATION

A. Coordinate layout and installation of ducts, manholes, and handholes with final arrangement of other utilities and site grading, as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances into manholes and handholes with final profiles of conduits as determined by coordination with other utilities and underground obstructions. Revise locations and elevations from those indicated as required to suit field conditions and to ensure duct runs drain to manholes and handholes, and as approved by an Owner Representative.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Manufacturers:

1. Underground Precast Concrete Utility Structures:

a. Jensen Precast.
b. Utility Vault Co.
c. Brooks

2. Frames and Covers:

a. Alhambra Foundry
b. Campbell Foundry Co.
c. East Jordan Iron Works, Inc.

2.2 DUCTS

A. Rigid Nonmetallic Conduit: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by the same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.3 HAND HOLES

A. Cast-Metal Boxes: Cast aluminum, with outside flanges and recessed, gasketed cover

for flush mounting and with nonskid finish and legend on cover. Unit, when buried, shall be designed to support AASHTO H10 loading for sidewalk and landscaped areas and HS20 for roadways, parking lots and loading docks.

B. Precast Handholes: Reinforced concrete, monolithically poured walls and bottom, with steel frame and access door assembly as the top of handhole. Duct entrances and windows shall be located near corners to facilitate racking. Pulling-in irons and other built-in items shall be installed before pouring concrete. Cover shall have nonskid finish and legend. Unit, when buried, shall be designed to support AASHTO H10 loading for sidewalk and landscaped areas and HS20 for roadways, parking lots and loading docks. Cover Legend: All underground pull box covers shall have the following cast-in or bead welded and galvanized identification label permanently affixed to the exterior:

1. "ELEC-LV" for electrical power circuits 600 volts or less.
2. "ELEC-HV" for electrical power circuits over circuits over 600 volts.
3. "COMM" for communications circuits.

2.4 PRECAST MANHOLES

A. Precast Units: Interlocking mating sections, complete with accessories, hardware, and features as indicated. Include concrete knockout panels for conduit entrance and sleeve for ground rod.

B. Entry way diameter: 36 inches minimum.

C. Design and fabricate structure according to ASTM C858.

D. Structural Design Loading: ASTM C857, Class A-16 (AASHTO HS20).

E. Base section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.

F. Riser Sections: 4-inch minimum thickness, and lengths to provide required depth.

G. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.

H. Steps: ASTM A615, deformed, 1/2-inch steel reinforcing rods encased in ASTM D4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches. Adjust to custom manhole locations.

I. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.

J. Joint Sealant: ASTM C990, bitumen or butyl rubber.

K. Protective Coating: Plant-applied, coal-tar, epoxy-polyamide paint 15-mil minimum thickness applied to exterior and interior surfaces.

L. Source Quality Control: Inspect structures according to ASTM C1037.

M. Access Ladder: Provide permanent metal access ladder.

2.5 ACCESSORIES

A. Duct Spacers: Rigid PVC interlocking spacers, selected to provide minimum duct spacings and cover depths indicated while supporting ducts during concreting and backfilling; produced by the same manufacturer as the ducts.

B. Manhole Frames and Covers: Comply with AASHTO loading specified for manhole; Ferrous frame 36 inch clear ID by 6 inch minimum riser with 4-inch-minimum width flange

and 38-inch-diameter cover.

1. All manhole and underground pullbox covers shall have the following cast-in or bead welded and galvanized identification label permanently affixed to the exterior:
   a. "ELEC-LV" for electrical power circuits 600 volts or less.
   b. "ELEC-HV" for electrical power circuits over circuits over 600 volts.
   c. "COMM" for communications circuits.
2. Cast iron with cast-in legend as indicated above subsection 1: Milled cover-to-frame bearing surfaces.
3. Manhole Frames and Covers: ASTM A48; Class 30B gray iron, 36-inch size, machine- finished with flat bearing surfaces.

C. Sump Frame and Grate: ASTM A48, Class 30B gray cast iron.

D. Pulling Eyes in Walls: Eyebolt with reinforcing-bar fastening insert 2-inch- diameter eye and 1-by-4¬inch bolt.
   1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.

E. Pulling and Lifting Irons in Floor: 7/8-inch- diameter, hot-dip-galvanized, bent steel rod; stress relieved after forming; and fastened to reinforced rod. Exposed triangular opening.
   1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.

F. Bolting Inserts for Cable Stanchions: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1- 1/4 inches minimum at base.
   1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

G. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.

H. Cable Stanchions: Hot-rolled, hot-dip-galvanized, T-section steel; 2-1/4-inch size; punched with 14 holes on 1-1/2-inch centers for cable-arm attachment.

I. Cable Arms: 3/16-inch- thick, hot-rolled, hot-dip-galvanized, steel sheet pressed to channel shape; 12 inches wide by 14 inches long and arranged for secure mounting in horizontal position at any location on cable stanchions.

J. Cable-Support Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.

K. Duct-Sealing Compound: Non-hardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and of adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

L. Warning Tape: Provide underground-line detectable warning tape specified under section "Identification for Electrical Systems."

2.6 CONSTRUCTION MATERIALS

A. Seal manhole section joints with sealing compound recommended by the manhole manufacturer.

B. Damp proofing: Comply with "Bituminous Damp proofing."

C. Mortar: Comply with ASTM C270, Type M, except for quantities less than 2.0 cu. ft. where packaged mix complying with ASTM C387, Type M, may be used.

D. Brick for Manhole Chimney: Sewer and manhole brick, ASTM C32, Grade MS.

E. Concrete: Use 3000-psi- minimum, 28-day compressive strength and 1-inch maximum aggregate size.

F. Provide red dye added to concrete during batching.

PART 3 - EXECUTION

3.1 APPLICATION

A. Underground Ducts for Electrical Cables Higher than 600V: Type EPC-40-PVC, concrete- encased duct bank.

B. Manholes: Underground precast concrete utility structures.

C. Manholes: Cast-in-place concrete.

3.2 EARTHWORK

A. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Soil compaction at all locations shall be as specified by civil and structural specifications.

B. Restore all areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary top soiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

C. Restore disturbed pavement.

3.3 CONDUIT AND DUCT INSTALLATION

A. Exercise care in excavating, trenching, and working near existing utilities. Locate any existing buried utilities before excavating.

B. Duct bank trench shall be shored, framed and braced for installing ducts. Frames, forms, and braces shall be either wood or steel. Variations in outside dimensions of the installed duct bank shall not exceed 2 inches on the vertical or the horizontal from the design. Remove forms and bracing after 24 hours and before backfilling.

C. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions. Duct banks shall be laid to a minimum grade slope of 4 inches per 100 feet. This slope may be from one manhole to the next or both ways from a high point between manholes, depending upon the contour of the finished grade.

D. Duct banks shall be installed so that the top of the concrete encasement shall be no less than 36 inches below grade or pavement for primary power. As a general rule, depths shall be a minimum of three feet, but not more than six feet.

E. Curves and Bends: Use manufactured 48 inches minimum elbows for stub-ups at equipment, and enclosures, and at building entrances. Use manufactured long sweep bends with a minimum radius of 4 feet minimum, both horizontally and vertically, at other locations. Manufactured long radius bends may be used in runs of 100 feet or less on approval from the Owner’s representative. Vertical feeder sweep into buildings shall be coated steel. Multiple conduit sweeps shall be concentric and maintain spacing throughout. Medium-voltage conduit sweeps shall be 12’ minimum radius sweeps.

F. Use solvent-cement joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.

G. Duct Entrances to Manholes and Handholes: Space end bells approximately 10 inches

o.c. for 5-inch ducts and vary proportionately for other duct sizes. Change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line. Grout end bells into manhole walls from both sides to provide watertight entrances. Where connection to bulkhead of duct bank is made to vaults or existing duct banks, the concrete encasement shall be doweled with on No. 4 reinforcement rod 36 inches long per conduit to the existing encasement.

H. Building Entrances: Make a transition from underground duct to rigid steel conduit 5 feet outside the building wall. Use fittings manufactured for this purpose. Follow the appropriate installation instructions below:

1. Concrete-Encased Ducts: Install reinforcement in duct banks passing through disturbed earth near buildings and other excavations. Coordinate duct bank with structural design to support duct bank at wall without reducing structural or watertight integrity of building wall. Expand duct bank at building entry to provide 6” spacing between sealing system sleeves. Coordinate sleeve placement with structural reinforcement bar placement.

2. Provide methane penetration EYS sealing fitting at each conduit penetration into building – both vertical and horizontal. Arrange so that sealant parts remain accessible.

3. Waterproofed Wall and Floor Penetrations: Install a watertight entrance-sealing device with sealing gland assembly on the inside. Anchor device into masonry construction

   with one or more integral flanges. Secure membrane waterproofing to the device to make permanently watertight. Seals shall be Link Seal Assembly with precast ‘CS” model – non-metallic sleeve by Link Seal or equal.

I. Concrete-Encased, Nonmetallic Ducts: Support ducts on duct spacers, spaced as recommended by manufacturer and coordinated with duct size, duct spacing, and outdoor temperature. Install as follows:

1. Separator Installation: Space separators 6’-0” O.C. to prevent sagging and deforming of ducts and secure separators to earth and to ducts to prevent floating during concreting. Stagger spacers approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

2. Duct joints in concrete may be placed side by side horizontally, but shall be staggered at least 6 inches vertically. Joints shall be made in accordance with manufacturer’s recommendations for the particular type of duct and coupling selected. In the absence of specific recommendations, plastic duct connections shall be made by brushing a plastic solvent cement on the inside of a plastic coupling fitting and on the outside of duct’s ends. The duct and fitting shall then be slipped together with a quick one- quarter turn to set the joint.

3. Concreting: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application. Pour each run of envelope between manholes or other terminations in one continuous operation. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope. At connection to manholes, dowel concrete encasement with on No. 4 reinforcing bar 36 inches long per duct.

4. Reinforcement: Reinforce duct banks where they cross disturbed earth and

where indicated.

5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.

6. Minimum Clearances between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.

7. Depth: Install top of duct bank at least 24 inches below finished grade in no traffic areas and at least 30 inches below finished grade in vehicular traffic areas, unless otherwise indicated.

J. Direct-Buried Ducts: Direct-Buried Ducts are for temporary construction only and only as determined and approved by the Owner. Support ducts on duct spacers, spaced as recommended by manufacturer and coordinated with duct size, duct spacing, and outdoor temperature. Install as follows:

1. Separator Installation: Space separators not more than 4 feet center-to-center along entire length of duct bank including top pipes.

2. Install expansion fittings as required.

3. Trench Bottom: Continuous, firm, and uniform support for duct bank. Prepare trench bottoms for pipes less than 6 inches in nominal diameter.

4. Backfill: Install backfill. After installing first tier of ducts, backfill and compact. Repeat backfilling after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, complete backfilling normally. Do not place backfill for a period of at least 24 hours after pouring of concrete.

5. Minimum Clearances between Ducts: 3 inches between ducts for like services and 6 inches between power and signal ducts.

6. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.

K. Warning Tape: Bury metal backed detectable warning tape approximately 12 inches above all concrete-encased duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank.

L. Stub-ups: Use rigid steel conduit for stub-ups to equipment. For equipment mounted on outdoor concrete bases, extend steel conduit a minimum of 5 feet from edge of base. Install insulated grounding bushings on terminations. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches of concrete. Galvanized steel conduits installed below grade shall be painted with two coats of Koppers Bitumastic paint before installing in ground.

M. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

N. Pulling Cord: Install 100-lbf- test nylon cord in all ducts, including spares. Identify opposite terminal points of duct.

O. Ductbanks shall be designed with 25% spare raceways for future use. In ductbanks with three (3) or less, provide one (1) spare conduit minimum.

3.4 MANHOLE AND HANDHOLE INSTALLATION

A. Elevation: Install manholes with rooftop at least 15 inches below finished grade. Install handholes with depth as required. Place and align precast manholes to provide horizontal tolerance of 2 inches in any direction and vertical alignment with not greater than 1/8 inch maximum tolerance for 6 foot of depth. Completed manhole shall be rigid, true to dimensions and alignment, and shall be watertight.

B. Drainage: Install drains in bottom of units where indicated. Coordinate with drainage provisions indicated. Sumps shall be knocked out at time of installation.

C. Access: Install cast-iron frame and cover.

1. Install precast collars and rings to support frame and cover and to connect cover with roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast- iron frame to chimney.

2. Set frames in paved areas and traffic ways flush with finished grade. Set other frames 1 inch above finished grade.

D. Waterproofing: Apply waterproofing to exterior surfaces of units after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole and hand hole chimneys after brick mortar has cured at least three days. Seal manhole section joints with sealing compound recommended by the manhole manufacturer. Penetration into manholes and/or boxes shall be sealed. Provide conduit duct plugs for unused terminator openings of spare conduits in manhole. Do not water seal top removable cover until cable pulling has been completed.

E. Damp proofing: Apply damp proofing to exterior surfaces of units after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, damp proof joints and connections and touch up abrasions and scars. Damp proof exterior of manhole and hand hole chimneys after brick mortar has cured at least three days.

F. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

G. Field-Installed Bolting Anchors: Do not drill deeper than 3-7/8 inches for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

H. Grounding: Install ground rod through floor in each structure with top protruding 6 inches above floor.

1. Seal floor opening against water penetration with waterproof nonshrink grout. Ground exposed metal components and hardware with bare-copper ground conductors. Train conductors neatly around corners. Use cable clamps secured with expansion anchors to attach ground conductors.

I. Precast Concrete Manhole Installation: comply with ASTM C 891.

1. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.

2. Unless otherwise indicated, support units on a 12” level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth. Provide a minimum 6-inch level base of ¾ inch crushed rock under manhole to ensure uniform distribution of soil pressure on floor.

3. Manholes below building floor shall have all earth work compacted to match compaction required by structural specifications.

3.5 FIELD QUALITY CONTROL

A. Testing: Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.

B. Grounding: Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance.

C. Duct Integrity: Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of the duct. If obstructions are indicated, remove obstructions and retest.

D. Correct installations if possible and retest to demonstrate compliance. Remove and replace defective products and retest.

END OF SECTION 26 05 43

SECTION 26 05 53 IDENTIFICATION OF ELECTRICAL SYSTEMS

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. Nameplates and warning signs where specified herein and as shown on contract documents including the following:
      a. Nameplates and warning signs permanently installed on all electrical equipment and devices including, but not limited to, the following items:
         1) Enclosures for transformers, switchboards, motor control, panels, pullboxes, cabinets, motors, generators, transfer switches.
         2) Enclosures for all separately enclosed devices including, but not limited to, disconnect switches, circuit breakers, contactors, time switches, control stations and relays, fire alarm panels and lighting control panel.
         3) Wall switches not within sight of outlet controlled.
         4) Special systems such as, but not limited to, telephone, fire alarm, warning and signal systems. Identification shall be at each equipment rack, terminal cabinet, control panel, annunciator and pullbox.
         5) Devices mounted within and part of equipment including circuit breakers, switches, control devices, control transformers, relays, indication devices and instruments.
   2. Conductor and Cable Identification.

B. Related Sections:
   1. Section 26 05 00: Common Work Results For Electrical.
   2. Section 26 05 19: Low-Voltage Electrical Power Conductors and Cables.

PART 2 PRODUCTS

2.1 EQUIPMENT LABEL DESIGNATIONS

A. Equipment labels indicating equipment designations both emergency and normal. Designation data per drawings or to be supplied with shop drawings approval.

B. Panelboard labels showing panel designation, voltage, phase and source.

C. Distribution panels, transformers, safety switches, transfer equipment, etc. Labels shall be per ANSI Z535.4 guidelines.

2.2 MATERIALS

A. For Labels: Three layer laminated plastic or micarta with engraved white letters over black background.

B. For Emergency Equipment: Use engraved white letters over red background.

C. For Warning Signs: Minimum 18 gauge steel with red lettering on white porcelain enamel

finish.

D. Arc flash labels shall be provided as required by CEC Article 70E.

E. Conductor tape number markers: TayMac MX4280 Series non-fading permanent adhesive.

2.3 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.

PART 3 EXECUTION

3.1 MOUNTING

A. Equipment labels shall be mounted by self-tapping, threaded screws and bolts, or by rivets. Adhesive types are not acceptable unless specifically noted in this section.

B. Conductor tape markers shall be consistently placed for ready conductor identification.

3.2 HEIGHTS ON LABELS

A. Panelboards, Switchboards and Motor Control Centers and Special Systems Enclosures: 1/4" identify equipment designation; 1/8” identify voltage rating and source.

B. Individual Circuit Breakers, Switches, and Motor Starters in Panelboards, Switchboards, and Motor Control Centers: 3/16” identify circuit and load served, including location of equipment.

C. Enclosed Circuit Breakers, Enclosed Switches, and Motor Starters: 3/16” identify load served.

D. Transformers: 3/16” identify equipment designation; 1/8” identify primary and secondary voltages, primary source and secondary load. Include location of primary source or secondary load if remote from transformer.

3.3 WARNING SIGNS

A. Warning signs shall be permanently mounted with cadmium plated steel screws or nickel-plated brass bolts.

B. Warning signs to read "DANGER - HIGH VOLTAGE", with letters 1 1/2" high, 3/16” stroke minimum.

C. Provide warning sign on all doors or immediately next to door for equipment rooms, enclosures or closets containing equipment energized above 150 volts to ground as per CEC, and/or as directed by the Architect. For interior finish spaces and interior doors, signage shall be coordinated and approved with the Architect in advance of installation.

D. Underground Warning Tape. Description: four (4) inch wide plastic tape, colored red with suitable warning legend describing buried electrical lines.

3.4 UNDERGROUND WARNING TAPE INSTALLATIONS:

A. 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.

B. Install line marker for underground wiring, both direct buried and in raceway

3.5 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.

3.6 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.

END OF SECTION 26 05 53

27 02 00 - GENERAL REQUIREMENTS FOR STRUCTURED CABLING SYSTEMS

CONDITIONS OF THE CONTRACT AND DIVISION 01, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Summary of Work:
   1. The Scope of Work covered by this document is to furnish and install the Structured Cabling Systems and Pathways and Spaces systems. This work will provide for the structured cabling system (SCS) for all Voice and Data systems. Work on this project will commence after the award of the bid to a successful bidder.

B. Telecommunications system shall include the following systems:
   1. Structured Cabling System (SCS) For Telecommunications Systems
   2. Pathways for Telecommunications Systems
   3. Grounding and Bonding System (GBS) For Telecommunications Systems
   4. Firestopping for Telecommunications Systems

1.2 ADDITIONAL REQUIREMENTS

A. Integration: Responsibility for overall telecommunications system integration and coordination of work among trades, subcontractors, and suppliers shall rest with Contractor named in construction contract issued by Owner's Representative. Work covered by this division of specifications shall be coordinated with related work indicated on drawings or specified elsewhere under project specifications. Work related to telecommunications system shall be performed under direct supervision of telecommunications system installer in a manner approved by product manufacturer.

B. Coordination of work: Contractor shall be responsible for coordination of work among project specification divisions and contractor/subcontractors involved in this project. This coordination of Work Includes following instructions provided the Construction Manager or General Contractor if project is managed by such. See section 1.4 for additional information.

C. General compliance requirements: Provide a complete and operable system in compliance with project drawings, specifications, referenced standards, applicable building codes, and Authority Having Jurisdiction (AHJ) requirements. Scope of this contract includes planning, design, materials, equipment, labor, configuration, programming, testing, startup and commissioning services, and documentation costs for complete and operable system that meets all requirements indicated on drawings or contained in specifications. Comply with all contract documents, specifications, drawings, manufacturer's instructions, and Owner and AHJ requirements. In case of conflict among applicable documents or standards, contractor shall notify owner's representative in writing of apparent conflict, and then comply with most stringent requirements unless otherwise directed in writing from owner's representative. Work Includes all items required for complete system whether or not identified in specification or drawings.

D. Information about general construction and architectural features and finishes all be derived from structural and architectural drawings and specifications only.

E. Architectural drawings will include size of MDF/IDF, the size of MDF should be 14X14, or min 12X12 and all IDF 10X10 or min 8X8.

F. Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete work.

G. SCS contractor shall be trained, certified and accredited by CommScope and will be required to provide a 25-year CommScope Extended Product Warranty and Application Assurance upon successful completion of the installation.

H. Work related to telecommunications system shall be installed by an SCS manufacturers authorized or certified trained installer and supervised an SCS manufacturers authorized or certified SCS Engineer. Owner reserves the right to review and approves any personnel assigned to this project in a supervisory or managerial role.

I. SCS contractor shall have had at least 10 years of experience with telecommunications projects. As part of the proposal, SCS installer shall submit at least three (5) comparable Project reference descriptions with reference contacts. Comparable projects shall equal or exceed size and complexity of work on drawings.

J. Complete and usable work: Refer to and comply with requirements in section 1.11 outlined below.

1.3 RELATED DOCUMENTS AND DRAWINGS

A. General: The project drawings and general conditions of Contract shall apply to this section.

B. Coordination: Coordinate with work specified in other sections and divisions of specifications.

C. Reference: Codes and standards as referenced in section 1.5 may define additional specifications or requirements not specifically called out within this division. However, contractor shall adhere to most stringent requirements as defined herein, or as defined by reference within section 1.5.

D. Architectural and Engineering specifications may have additional conditions or requirements that affect the work defined by this division of specifications. Contractor shall be responsible for the coordination of all conditions and other trade requirements that may impact schedule, scope of work, work progress, or other factors that may affect the overall ability for contractor to execute the requirements of this division of specifications.

1.4 CODES AND STANDARDS

A. General: All work, including but not limited to: Cabling, pathways, support structures, wiring, equipment, installation and workmanship shall comply with the latest editions of the requirements of the Authority Having Jurisdiction (AHJ), California Electrical Code, California Electrical Safety Code, all applicable local rules and regulations, equipment manufacturer's instructions, and the National Electrical Contractors Association (NECA) Standard of Installation. In case of discrepancy or disagreement between the documents noted above, the Contractor shall satisfy the most stringent requirements.

B. Other sections of this document contain References to Codes and Standards that are applicable to the section.

C. Insulated Cable Engineers Association (ICEA)

ANSI/ICEA S-80-576-2002, Category 1 & 2 Individually Unshielded Twisted-Pair Indoor Cables for Use in Communications Wiring Systems
ANSI/ICEA S-84-608-2002, Telecommunications Cable, Filled Polyolefin Insulated Copper Conductor
ANSI/ICEA S-90-661-2002, Category 3, 5, & 5e Individually Unshielded Twisted-Pair Indoor Cable for Use in General Purpose and LAN Communication Wiring Systems
ICEA S-102-700-2004, ICEA Standard for Category 6 Individually Unshielded Twisted-Pair

Indoor Cables for Use in LAN Communication Wiring Systems Technical Requirements, 2004

D. National Fire Protection Association (NFPA)

NFPA 70, California Electrical Code® (CEC®)
NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces,
NFPA 72, California Fire Alarm Code®
NFPA 75, Standard for the Protection of Electronic Computer/Data Processing Equipment
NFPA 76, Recommended Practice for the Fire Protection of Telecommunications Facilities
NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 101, Life Safety Code®
NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials
NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
NFPA 780, Standard for the Installation of Lightning Protection Systems
NFPA 5000™, Building Construction and Safety Code

E. Telecommunications Industry Association (TIA)

ANSI/NECA/BICSI 568-2006, Standard for Installing Telecommunications Systems
ANSI X3T9.5, Requirements for UTP at 100 Mbps
ANSI/TIA-526.7-A, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
ANSI/TIA-568.0-D, Generic Telecommunications Cabling for Customer Premises
ANSI/TIA-568.1-D, Commercial Building Telecommunications Cabling Standard
ANSI/TIA-568-C.2, Balanced Twisted-Pair Telecommunication Cabling and Components Standard
ANSI/TIA-568.3-D, Optical Fiber Cabling and Components Standard
ANSI/TIA-568-C.4, Broadband Coaxial Cabling and Components Standard
ANSI/TIA-569-D, Telecommunications Pathways and Spaces
ANSI/TIA-606-C, Administration Standard for Telecommunications Infrastructures
ANSI/TIA-862-B, Structured Cabling Infrastructure Standard for Intelligent Building Systems
ANSI/TIA-942-B, Telecommunications Infrastructure Standard for Data Centers
J-STD-607-A, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
T-526-14-C, Optical Power Loss Measurements of Installed Single mode Fiber Cable Plant
TIA-598-D, Optical Fiber Cable Color Coding
TIA-604.3-B, FOCIS 3—Fiber Optic Connector Intermateablility Standard, Type SC
TIA-604.10-B, FOCIS 10—Fiber Optic Connector Intermateablility Standard, Type LC
TIA TSB-125, Guidelines for Maintaining Optical Fiber Polarity Through Reverse-Pair Positioning
TIA-758-B, Customer-owned Outside Plant Telecommunications Infrastructure Standard
TSB-155-A, Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T

F. Other Reference Materials:
ANSI/NECA/BICSI-568-2006, Standard, Installing Commercial Building Telecommunications Cabling
BICSI Outside Plant Design Reference Manual (COOSP), current edition.
BICSI Electronic Safety and Security Reference Manual (ESSDRM), current edition
BICSI Information Transport Systems Installation Methods Manual (ITSIM), current edition
BICSI Network Design Reference Manual (NDRM), current edition
BICSI Telecommunications Distribution Methods Manual (TDMM), current edition
BICSI Wireless Design Reference Manual (WDRM), current edition
Institute of Electrical and Electronic Engineers (IEEE)

National Electrical Manufacturers Association (NEMA)
Underwriters Laboratories (UL) Cable Certification and Follow Up Program

1.5 ABBREVIATIONS, ACRONYMS AND DEFINITIONS

A. Abbreviations

ACD	Automatic Call Distribution
AFF	Above Finished Floor
AWG	American Wire Gauge
BICSI	Building Industry Consulting Services International
CAT5	Category 5 Copper Cable
CAT5e	Category 5e Copper Cable
CAT6	Category 6 Copper Cable
CAT6A	Category 6A Copper Cable
CDDI	Copper Distributed Data Interface
CMP	Communications Multipurpose Plenum: cable rating
CMR	Communications Multipurpose Riser: cable rating
EIA	Electronic Industries Association
ELFEXT	Equal-Level Far-End Crosstalk
FEXT	Far End Crosstalk
Gbps	Gigabits per second
HSM	High Speed Migration
HVAC	Heating, Ventilation, and Air Conditioning
IDF	Intermediate Distribution Frame - Termination frames, relay racks, and cable management
IEEE	Institute of Electrical and Electronics Engineers
IM	Information Management
ISDN	Integrated Services Digital Network
LAN	Local Area Network
Mbps	Megabits per second
MDF	Main Distribution Frame, consisting of carrier entrance rooms and head-end
MMF	Multi-mode fiber optics, 50 or 62.5-micron laser optimized core
MUTOA	Multi-User Telecommunications Outlet Assembly
NEXT	Near End Cross Talk
NRTL	Nationally Recognized Testing Laboratories
OSHA	Occupational Safety and Health Act
PBX	Private Branch Exchange: telephone switch
PDS	Premises Distribution Systems (See SCS)
PoE	Power over Ethernet (IEEE 802.3af)
POP	Point of Presence
PSACR	Power Sum Attenuation-to-Crosstalk Ratio
PSAFEXT	Power Sum Alien Far-End Crosstalk
PSAELFEXT	Power Sum Alien Equal Level Far-End Crosstalk
PSANEXT	Power Sum Alien Near-End Crosstalk
PSELFEXT	Power Sum Equal Level Far-End Crosstalk
PSNEXT	Power Sum Near-End Crosstalk
SCC	Security Command Center
SCS	Structured Cabling System, or Structure Connectivity System; a complete cabling system
SFF	Small Form Factor
SMF	Single-mode fiber optics, 8.3-micron core
TC	Telecommunications Closet
TE	Telecommunications Enclosure
TEF	Telecommunications Entrance Facility

TIA	Telecommunications Industry Association
TR	Telecommunications Room
TO	Telecommunications Outlet
UPS	Uninterruptible Power Supply
UTP	Unshielded Twisted Pair
VoIP	Voice over Internet Protocol
WAO	Work Area Outlet
WAN	Wide Area Network
WAP	Wireless Access Point

B. Definitions

Access Floor - A floor system that has removable floor panels.

Building Backbone Cabling – Cabling used to connect Floor Distributors (FD) or other local collection points to the Building Distributor (BD). Building backbone cabling typically carries aggregate traffic and, as such, impacts multiple network devices and users. Building backbone cabling may include either fiber optic or copper cabling or both.

Building Distributor (BD) – Termination point from which all building backbone cabling emanates and interconnection point for the network backbone. Commonly referred to as BDF in Americas, Main Comm Rooms in EMEA and Communication Room, IT Lab or IT Room in AsiaPac. Referred to as BD in international and European industry standards and Intermediate Cross-connect (IC) in American industry standards. There is one BD for each building and it feeds all FD's in the same building. The BD should be located so that all FD's served are within 300 cable meters (984 cable feet). All BD's are linked to the CD.

Campus Backbone Cabling – Cabling used to connect Building Distributors (BD) or other key network segments to the Campus Distributor (CD). With rare exceptions, campus backbone cabling carries aggregate traffic and typically impacts entire buildings worth of network devices and users and, as such, link redundancy with diverse routing is highly recommended. Campus backbone cabling almost exclusively consists of fiber optic cabling. Copper cabling may be used in short-distance (< 90m) applications. In such cases, lightning protection will usually be required by code.

Campus Distributor (CD) – Termination point from which all campus backbone cabling emanates and highest-level interconnection point for the network backbone. Commonly referred to as NOC in Americas and Main Comm Rooms in EMEA. Referred to as CD in international and European industry standards and Main Cross-connect (MC) in American industry standards. On smaller campuses, there is one CD for the campus. On larger campuses, there might be several CD's with each CD serving several buildings. Besides linking to each of the BD's it serves, the CD is also the network interconnection point for data center links and links to service providers.

Category 3 (Cat 3) – A category of transmission performance, defined in TIA standards, that specifies electrical properties up to 10 MHz. Cat 3 is the minimum performance grade permissible and is used typically for analog voice distribution.

Category 5e (Cat 5e) / Class D – A category/class of transmission performance that specifies electrical properties up to 155.5 MHz. Capable of supporting copper-based, four-pair Gigabit Ethernet (IEEE 802.3ab 1000BASE-T) applications. Category 5e is defined in TIA-568-C standard. Class D is defined in the ISO 11801 standard.

Category 6 (Cat 6) / Class E – A category/class of transmission performance that specifies electrical properties up to 250 MHz. Refer to the TIA- 568-C family of standards for more information on Category 6 and ISO/IEC 11801 for more information on Class E requirements. Also, refer to CENELEC EN50173.

Category 6A (Cat 6A) / Class EA – A category/class of transmission performance that specifies electrical properties up to 500 MHz and capable of supporting data applications operating at 10Gbps. Refer to the TIA-568-C family of standards for more information on Category 6 and ISO/IEC 11801 for more information on Class EA requirements.

Category 7 / Class F – Backward compatible with Class D/Category 5e and Class E/Category 6. Class F features even stricter specifications for crosstalk and system noise than Class E. To achieve this, shielding has been added for individual wire pairs and the cable as a whole.

Category 8 – Ratified by the TR43 working group under ANSI/TIA 568-C.2-1. It is defined up 2000 MHz and only for distances from 30 to 36m depending on the patch cords used. ISO is expected to ratify the equivalent in 2018 but will have 2 options: Class I channel, Category 8.1 cable and Class II channel, Category 8.2 cable. Category 8 is designed only for data centers where distances between switches and servers is short. It is not intended for general office cabling.

Certification – The testing and documentation of the transmission performance (e.g., Category 5e / Class D) of a permanent link or channel, based on sweep frequency (where applicable) testing of numerous parameters with results compared to a range of acceptable values. This project requires 100% certification (with documentation) of all permanent link cabling at the time of installation. Channel certification is optional and is the responsibility of the group using the channel.

Channel – The entire physical pathway between active equipment ports, inclusive of all patch cords, patch panels, jacks and cabling segments.

Class C – A category of transmission performance, defined in ISO and EN standards, that specifies electrical properties up to 16 MHz

Conduit - A raceway of circular cross-section.

Entrance Facility (EF) – Termination point of service provider cables that have entered the building and location of service demarcation point (MPOE) and interconnection point to the network. Commonly referred to as Telco Room in Americas, POP Room in EMEA and Building Entrance in AsiaPac. Referred to as Building Entrance Facility in international and European industry standards and Entrance Facility (EF) in American industry standards. The EF is linked to the CD, where present, or to the BD.

Floor Distributor (FD) – Termination point for horizontal cabling and interconnection point for network access. Commonly referred to as IDF in Americas and AsiaPac and as Sub Comms Room in EMEA. Referred to as Floor Distributor (FD) in international and European industry standards and Horizontal Cross-connect (HC) - FD quantities and locations are determined by building size and geometry so that all points served are within 90 cable meters (295 cable feet) of an FD. The FD feeds all Telecommunication Outlets (TO's) in its service zone. All FD's in a building are linked to the building's Building Distributor (BD) via backbone cabling.

Horizontal Cabling – Cabling used to connect individual work area outlets to local Floor Distributors (FD) or other collection points. Unlike backbone cabling, horizontal cabling does not typically carry aggregate traffic and, as such, impacts only single network devices or users. In buildings, horizontal cabling almost exclusively consists of copper cabling. Fiber optic cabling may be used where situations dictate but, unlike horizontal copper cabling, horizontal fiber optic cabling is not installed in advance as default building facilities. At this writing, horizontal copper cabling in many networks is capable of supporting Gigabit (1Gb/s) Ethernet applications as well as other applications of similar bandwidth.

Permanent Link – A stationary cabling segment, consisting of the permanently installed cable and the permanently affixed jack at both ends (typically at the outlet faceplate and closet patch panel, or on a patch panel on both ends). The concept assumes that, while patch cords might be disconnected or moved over time, the permanent cable and jacks will not be disturbed and the electrical characteristics of the permanent link will remain unaltered.

Plenum - A space within the building designed for the movement of environmental air; i.e., a space above a suspended ceiling or below an access floor.

Raceway - Any channel designed for holding wires or cables; i.e. conduit, electrical metal tubing, busways, wireways, ventilated flexible cableway.

Spine – also called a backbone, the main communications cables in an IDF.

1.6 PROJECT DRAWINGS

A. **General Drawing Specifications:** Detail and elevation drawings shall be D size (24” x 36”) with a minimum scale of 1/4” = 1’0" or larger. ER, TR and other enlarged detail floor plan drawings shall be D size (24” x 36”) with a minimum scale of 1/4” = 1’0" or larger. Building composite floor plan drawings shall be D size (24” x 36”) with a minimum scale of 1/8” = 1’ 0”.

B. **Building composite floor plans:** Provide building floor plans showing outlet locations and jack configuration, types of jacks, run distance for each jack cable, and cable routing/locations. Identify TO’s that, according to location and available pathway systems, require cable length greater than allowed by standards. Recommend alternatives for Owners Representative’s consideration.

C. **Telecommunications space plans/elevations:** Include enlarged floor plans of TRs indicating layout of equipment and devices, including receptacles and grounding provisions. Submit detailed plan views and elevations of telecommunications spaces showing racks, termination blocks, and cable paths.

D. **Logical Drawings:** Provide logical riser or schematic drawings for all systems. Include schematic symbol key.

1.7 SUBSTITUTIONS

A. **Substitution requests:** Substitution requests will be considered only if submitted to Owner’s Representative not less than 7 working days prior to project bid date. Acceptance or rejection of proposed substitution is at Owner’s Representatives sole discretion. No exceptions. Requests for substitutions shall be considered not approved unless approval is issued in writing by Owner’s Representative.

B. **Rejection:** For equipment, cabling, wiring, materials, and all other products indicated or specified as no substitutions or no alternates, Owner does not expect nor desire requests for substitutions and alternate products other than those specified. Owner reserves right for Owner’s Representative to reject proposed substitution requests and submissions of alternates without review or justification.

1.8 PRE-INSTALLATION MEETING

A. After award, convene a pre-installation meeting at least 14 calendar days prior to commencing SCS and related work. The meeting must be scheduled at least 14 days in advance. Require attendance of parties directly affecting work of this section, including other trades and utilities if necessary. Review conditions of operations, procedures and coordination with related work.

B. **Agenda:** Comply with following agenda specifications:

1. Tour, inspect, and discuss building conditions relating to telecommunications system cabling and equipment, coordination with Telephone Utility Company, Owner’s telecommunications system requirements, and coordination with existing conditions

and other work in contract.
2. Review exact location of each item within building construction, casework, and fixtures, and their requirements.
3. Review required submittals, both completed and yet to be completed.
4. Review drawings and specifications.
5. Review proposed equipment, cabling, and related work.
6. Review and finalize construction schedule related to telecommunications system and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
7. Review required inspections and testing.
8. Review cable routing and support provisions.

1.9 WARRANTY

A. Comply with additional requirements in contract general requirements and extended warranties required in other specification sections. Refer to all other Division 27 sections for specific additional warranty requirements that exceed or are in addition to those of this section.

B. **Contractor warranty:** Provide all services, materials and equipment necessary for successful operation of entire telecommunications system and SCS system for a period of one year after system acceptance. Scope of warranty includes all equipment, devices, wiring, accessories, software, hardware, installation, programming, and configuration required to maintain a complete and operable system. Provide manufacturer's published recommended preventative maintenance procedures during warranty period. This shall apply to all items except those specifically excluded, or items wherein a longer period of service and warranty is specified or indicated. All warranties shall be effective for one year, minimum, from date Certificate of Final Acceptance is issued. Use of systems provided under this section for temporary services and facilities shall not constitute final acceptance of work nor beneficial use by Owner and shall not institute warranty period. The warranty shall cover repair or replacement of defective materials, equipment, workmanship, and installation that may be incurred during this period. Warranty work is to be done promptly and to Owner's satisfaction. In addition, warranty shall cover correction of damage caused in making necessary repairs and replacements under warranty. Additional warranty responsibilities are:

1. Obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's designated name. Replace material and equipment that require excessive service during guarantee period as determined by Owner.
2. Provide 2-business day service beginning on date of Substantial Completion and lasting until termination of warranty period. Service shall be at no cost to Owner. Service can be provided by installing contractor or by a separate service organization. Choice of service organization shall be subject to Owner's approval. Submit name and a phone number that will be answered on a 24-hour basis each day of week, for duration of service.
3. Submit copies of equipment and material warranties to Owner before final acceptance.
4. At end of warranty period, transfer manufacturers' equipment and material warranties still in force to Owner.
5. If warranty work problems cannot be corrected immediately to Owner's satisfaction, advise Owner in writing, describing efforts to correct situation, and provide analysis of cause for problem. If necessary to resolve problem, provide at no cost services of manufacturer's engineering and technical staff at site in a timely manner to analyze warranty issues, and develop recommendations for correction, for review and approval by Owner.

C. **Owner's rights:** This section shall not be interpreted to limit Owner's rights under applicable codes and under this Contract.

D. **Pathways Material and Installation warranty:** Provide all services, materials and equipment necessary to warrant the installation and performance of all pathway materials for a period of one year after beneficial use. Scope of warranty includes all equipment, devices, installation and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period.

E. **Grounding and Bonding Material and Installation warranty:** Provide all services, materials and equipment necessary for successful operation of GBS for a period of one year after beneficial use. Scope of warranty includes all equipment, devices, installation and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period.

F. **Firestopping Material and Installation warranty:** Provide all services, materials and equipment necessary to warrant the performance of all Firestopping material for a period of one year after beneficial use, or longer if required by the local AHJ. Scope of warranty includes all equipment, devices, installation and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period

G. **SCS Manufacturer Extended Warranty**

1. SCS Systems will be covered by a two-part certification program provided by a single manufacturer and that manufacturer's certified vendor. Manufacturer shall administer a follow-on program through the Vendor to provide support and service to the purchaser. The first part is an assurance program, which provides that the certified system will support the applications for which it is designed, during the 25-year warranty of the certified system.
2. The second portion of the certification is a 25-year warranty provided by the manufacturer and the vendor on all products within the system (cords, telecommunications outlet/connectors, cables, cross-connects, patch panels, etc.).
3. If the certified system ceases to support the certified application(s), whether at the time of cutover, during normal use or when upgrading, the manufacturer and vendor shall commit to promptly implement corrective action.
4. Documentation proving the cabling system's compliance to the End-to-End Link Performance recommendations, as listed in ANSI/TIA-568-C shall be provided by the Vendor prior to the structured cabling system being installed.
5. The cabling system must conform to the current issue of industry standard TIA-568. All performance requirements of this document must be followed. As well, workmanship and installation methods used shall be equal to or better than that found in the BICSI (Building Industry Consulting Service International) ITSIM manual.
6. Purchaser demands strict adherence to the performance specifications listed in ANSI/TIA-568-C series standards.
7. Manufacturer shall maintain ISO Quality Control registration for the facilities that manufacturer the product used in this cabling system.

1.10 COMPLETENESS OF WORK

A. **Complete and usable work:** The contractor is responsible for providing complete and usable work per contract documents. All materials and equipment shall be provided with all accessories and additional work required for field conditions, as well as additional work and accessories required for complete, usable, and fully functional construction and systems, even if not explicitly specified or indicated. Telecommunications system in this Contract shall be provided as complete and operable systems in full compliance with requirements on drawings and specification requirements. Drawings are diagrammatic and specifications are performance-based, and Contractor shall provide all work required to comply with drawings and specifications, even if not explicitly indicated or specified. Contractor shall be responsible for coordinating installation of electrical systems with all field conditions and work of other

trades. Minimum clearances and work required for compliance with NFPA 70, California Electrical Code® (CEC®), and manufacturer's instructions shall be provided. Comply with additional requirements indicated for access and clearances. Contractor shall verify all field conditions and dimensions that affect selection and provision of materials and equipment, and shall provide any disassembly, reassembly, relocation, demolition, cutting and patching required to provide work specified or indicated, including relocation and reinstallation of existing wiring and equipment. Contractor shall protect from damage resulting from Contractor's operations existing facility, equipment, and wiring. Extra charges for completion and contract time extension will not be allowed because of field conditions or additional work required for complete and usable construction and systems. Comply with additional requirements indicated for access and clearances.

B. **Drawings and specifications form complementary requirements:** Provide work specified and not shown, and work shown and not specified as though explicitly required by both. Except where explicitly modified by a specific notation to contrary, it shall be understood that indication or description of any item, in drawings or specifications or both, carries with it instruction to furnish and install item, provided complete.

C. **Terms:** As used in this specification: Provide means furnish and install. Furnish means "to purchase and deliver to project site complete with every necessary appurtenance and support," and install means "to unload at delivery point at site and perform every operation necessary to establish secure mounting and correct operation at proper location in project."

D. **Authority approvals:** Give notices, file plans, obtain permits and licenses, pay fees, and obtain necessary approvals from authorities that have jurisdiction as required to perform work per all legal requirements and with Specifications, Drawings, Addenda and Change Orders, all of which are part of Contract Documents.

E. **Supplementary items:** Provide supplementary or miscellaneous items, appurtenances, devices and materials necessary for a sound, secure and complete installation. Examine project drawings and other Sections of specifications for section with work of other Sections and provide a complete and fully functional installation. Refer to all other drawings and other specifications sections that indicate types of construction in which work shall be installed and work of other sections with which work of this section must be coordinated

F. **Quantities:** Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete work.

1.11 PROJECT CONDITIONS

A. **Field verification:** Carefully verify location, use and status of all material, equipment, and utilities that are specified, indicated, or deemed necessary for removal. Verify that all materials, equipment, and utilities to be removed are completely inactive and will not be required or in use after completion of project. Replace with equivalent any material, equipment and utilities that were removed by Contractor that are required to be left in place.

B. **Existing utilities:** As applicable, do not interrupt utilities serving facilities occupied by Owner or others unless permitted under following conditions and then only after arranging to provide temporary utility services per requirements indicated:

1. Notify owner in writing at least 14 days in advance of proposed utility interruptions. Do not proceed with utility interruptions without Owner's written permission.
2. Equipment installation:
    a. Determine suitable path for moving unit substation into place; consider Project conditions.
    b. Verify clearance requirements and locate equipment to meet installation tolerances.

c. Revise locations and elevations from those indicated to those required to suit Project.

1.12 DELIVERY, STORAGE AND HANDLING

A. Contractor shall be responsible for the deliveries, storing and handling of all materials relative to the SCS systems, including materials supplied by others that are part of the SCS installation contract. Material shall be stored and protected per manufacturer's instructions. Contractor shall be responsible for the security of all material during installation. For all material provided by contractor, or delivered to contractor on site, contractor assumes full responsibility and liability for any material shortages, damage or loss due to storage and handling methods.

1.13 PERMITS AND INSPECTIONS

A. All telecommunications systems shall meet or exceed the latest requirements of all national, state, county, municipal, and other authorities exercising jurisdiction over the telecommunications systems and the Project.

B. Contractor shall obtain and pay for all licenses, permits, and inspection fees required by local agencies and/or other agencies having jurisdiction.

C. Contractor agrees to furnish any additional labor or material required to comply with all local and other agencies having jurisdiction at no additional cost.

D. Contractor shall obtain certificates of inspection and approval from all authorities having jurisdiction, and forward copies of same to Owner's Representative prior to request for Project acceptance inspections, completion inspections, substantial completion inspections, and acceptance testing/demonstrations.

E. All required permits and inspection certificates shall be made available at the completion of the telecommunications system installation and commissioning.

F. Any portion of the telecommunications work which is not subject to the requirements of an electric code published by a specific AHJ shall be governed by the California Electrical Code and other applicable sections of the California Fire Code, as published by the National Fire Protection Association (NFPA).

1.14 EXAMINATION

A. Prior to submitting a proposal, Contractor shall examine site, review Project drawings and specifications, and determine exact extent of work required. Contractor shall include in their proposals all materials, labor, and equipment required to complete required work indicated. Work that is necessary to obtain complete and usable Project as specified herein shall be included in Contractor's proposal, even if not indicated or specified.

B. **Bidders' questions:** Should bidders have questions as to intent of drawings and specifications, quality of materials to be used, and work to be performed, questions shall be submitted in writing to Owner's Representative in manner dictated by Owner's Representative. All answers and clarifications to drawings and specifications will be issued in writing.

C. Extra payment will not be allowed for claims for due to unfamiliarity with work to be performed by other trades, existing conditions at job site, local or state laws and codes, and alterations due to field conditions.

1.15 ADDITIONAL COSTS

A. Project acceptance inspections, completion inspections, substantial completion inspections,

and acceptance testing/demonstrations shall be conducted after verification of system operation and completeness by Contractor.

B. **Inspections and testing:** For Project acceptance inspections, final completion inspections, substantial completion inspections, and/or testing/demonstrations that require more than one site visit by Owner's Representative or Architect/Engineer to verify Project compliance for same material or equipment, Owner reserves right to obtain compensation from Contractor to defray cost of additional site visits that result from Project construction or testing deficiencies / incompleteness, incorrect information, or non-compliance with Project provisions. Owner's Representative will notify Contractor of hourly rates and travel expenses for additional site visits, and will issue an invoice to Contractor for additional site visits. Payment of additional site visit costs by Contractor is required within 30 days of invoicing. Owner reserves right to deduct additional costs defined herein that are indicated on past due invoices from Project amount due Contractor.

C. **Exclusions:** Contractor shall not be eligible for extensions of Project schedule or additional charges resulting from additional site visits that result from Project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions.

PART 2 – EXECUTION

2.1 GENERAL REQUIREMENTS

A. Sequence, coordinate, and integrate various elements of telecommunications system, materials, and equipment. Comply with following requirements as a minimum.

B. Coordinate systems, equipment, and materials installation with other building components.

C. Verify all dimensions by field measurements.

D. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for wiring, cabling, and equipment installations.

E. Coordinate installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

F. Sequence, coordinate, and integrate installations of materials and equipment for efficient flow of Work. Give particular attention to large equipment requiring positioning prior to closing in building.

G. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide maximum headroom and access for service and maintenance as possible.

H. Coordinate connection of materials, equipment, and systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

I. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by Contract Documents, recognizing that portions of Work are shown only in diagrammatic form. In case of conflict among individual system requirements, request direction in writing from Owner's Representative.

J. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed in both exposed and un-exposed spaces.

K. Install cabling, wiring, and equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

L. Provide access panel or doors where units are concealed behind finished surfaces.

M. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

N. Comply with all requirements and work indicated on drawings.

O. Avoid interference with structure and with work or other trades, preserving adequate headroom and clearing doors and passageways to satisfaction of Owner and per code requirements.

P. Install equipment and cabling/wiring to properly distribute equipment loads on building structural members provided for equipment support under other Sections. Roof-mounted equipment shall be installed and supported on structural steel or roof curbs as appropriate.

Q. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs as necessary for floor, wall and ceiling mounting of equipment as required.

R. Provide steel supports and hardware for proper installation of hangers, anchors, guides, and other support hardware.

S. Obtain and analyze catalog data, weights, and other pertinent data required for proper coordination of equipment support provisions and installation.

T. Structural steel and hardware shall conform to ASTM standard specifications. Use of steel and hardware shall conform to requirements of AISC Code of Practice: Section Five.

U. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly that would void warranty.

2.2 EQUIPMENT INSTALLATION

A. Install equipment per manufacturer's written instructions. Install equipment level and plumb. Install wiring and cabling between equipment and all related devices.

B. **Mounting:** If neither the Owner's Instructions nor the individual section call out the required hardware mounting, use the following.

1. For equipment at walls, bolt units to wall or mount on structural steel channel strut bolted to wall

2. For equipment not at walls, provide freestanding racks fabricated of structural steel members and slotted structural steel channel strut

3. Use feet consisting of 0.25-inch thick steel plates, 6 square inch, bolted to floor

4. Use feet for welded attachment of vertical posts not over 3 feet on center

5. Connect posts with horizontal U channel steel strut and bolt control equipment to channels

C. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally using methods and materials as recommended by manufacturer.

D. Connections: Tighten wiring connectors, terminals, bus joints, and mountings, to include lugs, screws and bolts per equipment manufacturer's published torque tightening values for equipment connectors. In absence of published connection or terminal torque values, comply with torque values specified in UL 486A and UL 486B.

2.3 CUTTING AND PATCHING

A. Perform cutting and patching per contract general requirements. In addition, following requirements apply:

1. Perform cutting, fitting, and patching of electrical equipment and materials required to uncover existing infrastructure to provide access for correction of improperly installed existing or new Work.

2. Remove and replace defective Work.

3. Remove and replace Work not conforming to requirements of Contract Documents.

4. Remove samples of installed Work as specified for testing.

5. Install equipment and materials in existing structures.

B. **Demolition and removal:** Cut, remove, and legally dispose of selected equipment, components, and materials as indicated, including but not limited to removal of material, equipment, devices, and other items indicated to be removed and items made obsolete by new Work. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.

C. **Protection of work:** Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. During cutting and patching operations, protect adjacent installations. Patch finished surfaces and building components using new materials specified for original installation and experienced installers.

2.4 PENETRATIONS AND SLEEVES

A. Coordinate work with other sections. SCS Installation Contractor shall be responsible for the provision of cabling sleeves and conduits unless specifically provided by the Electrical Contractor. SCS Installation Contractor shall coordinate with Electrical Contractor to determine exact requirements.

B. When required, set sleeves in forms before concrete is poured. Provide core drilling as necessary if walls are poured or otherwise constructed without sleeves and wall penetration is required. Do not penetrate structural members. Provide sleeves and packing materials at all penetrations of foundations, walls, slabs (except on-grade), partitions, and floors. Sleeves shall meet requirements of pertinent specifications. Lay out penetration and sleeve openings in advance, to permit provision in work. Set sleeves and conduit in forms before concrete is poured. Provide remedial work where sleeves and conduits are omitted or improperly placed.

C. Sleeve fill: Sleeves that penetrate outside walls, basement slabs, footings, and beams shall be waterproof.

1. Fill slots, sleeves and other openings in floors or walls if not used.

2. Fill spaces in openings after installation of conduit or cable.

3. Fill for floor penetrations shall prevent passage of water, smoke, fire, and fumes.

4. Fill shall be fire resistant in fire floors and walls, and shall prevent passage of air, smoke and fumes.

5. Sleeves through floors shall be watertight and shall extend 2 inches above floor surface.

6. Where raceways passing through openings are exposed in finished rooms, finishes of filling materials shall match and be flush with adjoining floor, ceiling, and wall finishes.

D. Conduit sleeves:

1. Annular space between conduit and sleeve shall be at least 1/4 inch.

2. Sleeves shall not be provided for slabs-on-grade unless specified or indicated otherwise.

3. For sleeves through rated fire walls and smoke partitions, comply with requirements for firestopping.

E. Supports: Do not support piping risers or conduit on sleeves.

F. Future use: Identify unused sleeves and slots for future installation

2.5 CORE DRILLING

A. Core drilling shall be avoided where possible. Where core drilling is unavoidable, locate all required openings prior to coring.

B. Coordinate openings with other trades and utilities and prevent damage to structural reinforcement.

C. Thoroughly investigate existing conditions in vicinity of required opening prior to coring.

D. Set sleeves prior to installation of structure for passage of pipes, conduit, ducts, etc. Protect all areas from damage.

2.6 CLEANING

A. Contractor is responsible for cleanup of debris daily. Cost of cleanup is the responsibility of the Contractor.

B. During progress of work, remove equipment and unused material. Put building and premises in neat and clean condition. Perform cleaning and washing required to provide acceptable appearance and operation of equipment to satisfaction of Owner's Representative.

C. After completion of Project, clean exterior surface of all equipment, including concrete residue, dirt, and paint residue. Final cleaning shall be performed prior to Project acceptance by Owner's Representative.

2.7 ACCESS AND ACCESS PANELS

A. Provide access to materials and equipment that require inspection, replacement, repair or service. Provide access panels and/or doors as required to allow service of all equipment components. Provide access panels where items installed require access and are concealed in floor, wall, furred space or above ceiling. Ceilings consisting of lay-in or removable splined tiles do not require access panels. Locations of equipment requiring access shall be noted on record drawings. Access panels shall have same fire rating classification as surface penetrated.

B. **Coordination:** Coordinate and prepare a location, size, and function schedule of access panels required to fully service equipment and deliver to Owner.

C. **Construction:** Panels shall be at least 12 inches by 12 inches and located to provide optimum access to equipment for maintenance and servicing. Verify access panel locations and construction with Owner's Representative.

2.8 START UP AND OPERATIONAL TESTING

A. Owner maintains right to have access to entire project site to prepare facility for occupancy and operation. Completion of startup and field testing shall be accomplished as a prerequisite for substantial completion. Operate and maintain systems and equipment until final acceptance by Owner. All guarantees and warranties shall not begin until final acceptance of systems and equipment by Owner. Acceptance requires, at a minimum, complete systems startup and testing.

2.9 SPECIAL RESPONSIBILITIES AND INFORMATION

A. **Coordination of information:** Cooperate and coordinate with work of other sections in executing work of this section. Perform work such that progress of entire project, including work of other sections, shall not be interfered with or delayed. Provide information as requested on items furnished under this section, which shall be installed under other sections. Obtain detailed installation information from manufacturers of equipment provided under this section.

B. **Information gathering:** Obtain final rough-in dimensions or other information as needed for complete installation of items furnished under other sections or by Owner. Keep fully informed as to shape, size and position of openings required for material or equipment to be provided under this and other sections. Give full information so that openings required by work of this

section may be coordinated with other work and other openings and may be provided for in advance. In case of failure to provide sufficient information in proper time, provide cutting and patching or have same done, at no expense to Owner.

C. **Housekeeping pads:** Provide information as requested as to sizes, number and locations of concrete housekeeping pads necessary for floor mounted equipment.

D. **Maintenance of equipment and systems:** Maintain equipment and systems until Final Acceptance. Ensure adequate protection of equipment and material during delivery, storage, installation and shutdown and during delays pending final test of systems and equipment because of seasonal conditions.

E. **Use of premises:** Use of premises shall be restricted as directed by Owner's Representative and as required below:

1. **Cleaning and rubbish removal:** Remove and dispose of dirt and debris and keep premises clean. During progress of work, remove equipment and unused material. Put building and premises in neat and clean condition and do cleaning and washing required to provide acceptable appearance and operation of equipment, to satisfaction of Owner's Representative.

2. **Rubbish Removal:** Provide for the removal from the site of all spoils, debris, boxes, packaging, crates, and trash generated from the work.

3. **Storage:** Store materials maintaining an orderly, clean appearance. If stored on site in open or unprotected areas, all equipment and material shall be kept off ground by means of pallets or racks and covered with tarpaulins.

F. Protection of fireproofing:

1. Clips, hangers, clamps, supports and other attachments to surfaces to be fireproofed shall be installed, if possible, prior to start of spray fire proofing work.

2. Conduits and other items that would interfere with proper application of fireproofing shall be installed after completion of spray fire proofing work.

3. Patching and repairing of fireproofing due to cutting or damaging to fireproofing during course of work specified under this section shall be performed by installer of fireproofing and paid for by section responsible for damage and shall not constitute grounds for an extra to Owner.

G. **Temporary utilities:** Refer to contract general requirements regarding requirements.

H. **Movement of materials:** Unload materials and equipment delivered to site. Pay costs for rigging, hoisting, lowering and moving equipment on and around site, in building or on roof.

2.10 DIVISION OF WORK

A. Division of work responsibility matrix at the end of this section is for Contractor's reference to clarify roles of various manufacturers, installers, subcontractors, and trades involved in telecommunications system Project.

B. Contractor holding contract with Owner is responsible for coordinating work of all subcontractors to provide a complete and usable Project complying with contract provisions of Project documents.

C. Failure to coordinate work by subcontractors and suppliers will not be considered justification for additional compensation or extension of schedule.

Division of work resonsibility chart						
Spec. section	System	Contractors				Remarks
		Gen	Elec	Mec	Telecom	
25 xx xx	Building Automation System (BAS)	1	C	C	C	BAS low voltage cabling by Division 15 uses telcom cable tray.
21 xx xx	Fire Detection And Alarm System (FDAS)	1	C	C	C	Completely separate cabling system and raceways by Division 16
26 xx xx	Electrical wiring (line voltage)	1	2,W	C	C	Completely separate cabling system and raceways by Division 16
26 xx xx	Poke-through fittings and floor boxes	1	2, E	C	C	Telcom to provide data jacks and A-V connectors
26 xx xx	Cable tray	1	2, E	C	C	Comply with Section 27 05 28
26 xx xx	Electrical raceways	1	2, E	C	C	Comply with Section 27 05 28
27 02 00	General requirements for telecommunications system	2	C	C	1	
27 10 00	Structured Cabling System (SCS) for telecommunications systems		C	C	1, E, W	
27 05 28	Pathways for telecommunications systems	1	2, P	C	1	
27 05 26	Grounding and Bonding System (GBS) for telecommunications systems	1	2, G	C	1	
27 05 32	Firestopping for telecommunications systems		2, FP	C	1, FC	

1 = primary contractual responsibility
2 = secondary responsibility
3 = tertiary responsibility
C = coordination of work responsibility
E = provision of specified equipment and devices
W = provision of specified system wiring/cabling
P = provision of specified system pathways/conduits
S = provision of specified system spaces
FP = provision of specified firestopping for pathways
FC = provision of specified firestopping for cabling

END OF SECTION 27 02 00

27 05 26 – GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

CONDITIONS OF THE CONTRACT AND DIVISION 01, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.

B. This section includes the minimum requirements for the equipment and cable installations in communications equipment rooms (Telecommunications Closets).

C. Included in this section are the minimum composition requirements and installation methods for the following:

1. Grounding Electrode System
2. Busbars
3. Bonding accessories

1.2 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

B. Strictly adhere to all Building Industry Consulting Service International (BICSI) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

C. Material and work specified herein shall comply with the applicable requirements of the current revision of the following:

ANSI/TIA-568 Commercial Building Telecommunications Cabling Standard
ANSI/TIA-569 Telecommunications Pathways and Spaces
ANSI/TIA-606 Administration Standard for the Telecommunications Infrastructure
BICSI – Telecommunications Distribution Methods Manual
J-STD-607-A Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
NFPA 70 – California Electric Code

1.3 SUBMITTALS

A. Provide product data for the following:

Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

PART 2 – PRODUCTS

2.1 GROUNDING ELECTRODE SYSTEM

A. When required the Grounding Electrode System shall meet the following:

1. Active grounding system constantly replenishing moisture into the soil
2. Provide low resistance to ground
3. Provide season to season stability
4. Be maintenance-free for 30 years
5. Contain no hazardous materials or chemicals

2.2 WALL MOUNT BUSBARS

A. Telecommunications Main Grounding Busbar (TMGB)

1. Telecommunications Main Grounding Busbar (TMGB) shall be constructed of .25” (6.4 mm) thick solid copper bar.
2. The busbar shall be 4” (100 mm) high and 20” (510 mm) long and shall have 30 attachment points (two rows of 15 each) for two-hole grounding lugs.
3. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 27 lugs with 5/8” (15.8 mm) hole centers and 3 lugs with 1” (25.4) mm) hole centers.
4. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4” (100 mm) standoff from the wall.
5. The busbar shall be UL Listed as grounding and bonding equipment.

B. Telecommunications Grounding Busbar (TGB)

1. Telecommunications Grounding Busbar (TGB) shall be constructed of .25” (6.4 mm) thick solid copper bar.
2. The busbar shall be 2” (50 mm) high and 12” (300 mm) long and shall have 9 attachment points (one row) for two-hole grounding lugs.
3. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 6 lugs with 5/8” (15.8 mm) hole centers and 3 lugs with 1” (25.4 mm) hole centers.
4. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4” (100 mm) standoff from the wall.
5. The busbar shall be UL Listed as grounding and bonding equipment.

2.3 BONDING ACCESSORIES

A. Two Mounting Hole Ground Terminal Block

1. Ground terminal block shall be made of electroplated tin aluminum extrusion.
2. Ground terminal block shall accept conductors ranging from #14 AWG through 2/0.
3. The conductors shall be held in place by two stainless steel set screws.
4. Ground terminal block shall have two 1/4” (6.4 mm) holes spaced on 5/8” (15.8 mm) centers to allow secure two-bolt attachment to the rack or cabinet.
5. Ground terminal block shall be UL Listed as a wire connector.

B. Compression Lugs

1. Compression lugs shall be manufactured from electroplated tinned copper.
2. Compression lugs shall have two holes spaced on 5/8” (15.8 mm) or 1” (25.4 mm) centers, as stated below, to allow secure two bolt connections to busbars.
3. Compression lugs shall be sized to fit a specific size conductor, sizes #6 to 4/0, as stated below.
4. Compression lugs shall be UL Listed as wire connectors.

C. Antioxidant Joint Compound

1. Oxide inhibiting joint compound for copper-to-copper, aluminum-to-aluminum or aluminum-to-copper connections.

D. C-Type, Compression Taps

1. Compression taps shall be manufactured from copper alloy.
2. Compression taps shall be C-shaped connectors that wrap around two conductors forming an irreversible splice around the conductors; installation requires a hydraulic crimping tool
3. Compression taps shall be sized to fit specific size conductors, sizes #2 AWG to 4/0, as stated below.
4. Compression taps shall be UL Listed.

E. Pedestal Clamp with Grounding Connector

1. Pedestal clamp shall be made from electroplated tinned copper or bronze. Installation hardware will be stainless steel.
2. Pedestal clamps shall be sized to fit a specific size conductor, size #6 and/or 2/0, as stated below.
3. Pedestal clamp installation hardware shall be sized to attach to round and/or square raised access floor pedestals that are 1-1/8” to 1-3/4” in diameter, as stated below.
4. Pedestal clamp shall provide straight (in-line) or cross (intersection) support for up to two conductors.
5. Pedestal clamp shall be UL Listed as grounding and bonding equipment.

F. Pipe Clamp with Grounding Connector

1. Pipe clamp shall be made from electroplated tinned bronze. Installation hardware will be stainless steel.
2. Pipe clamp shall be sized to fit up to two conductors ranging in size from #6 to 250 MCM; conductors must be the same size.
3. Pipe clamp installation hardware shall be sized to attach to pipes, sizes 1” to 6” (.75” to 6.63” in diameter), as stated below.
4. Pipe clamp shall be UL Listed as grounding and bonding equipment.

G. Equipment Ground Jumper Kit

1. Kit includes one 24” L insulated ground jumper with a straight two-hole compression lug on one end and an L-shaped two-hole compression lug on the other end, two plated installation screws, an abrasive pad and a .5 once tube of antioxidant joint compound.
2. Ground conductor is an insulated green/yellow stripe #6 AWG wire
3. Lugs are made from electroplated tinned copper and have two mounting holes spaces .5” to .625” apart that accept 1/4” screws.
4. Jumper will be made with UL Listed components.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Outdoor grounding and bonding connections.

1. All outdoor grounding and bonding (earthing) connections shall be accomplished using

exothermic welding.

B. Wall-Mount Busbars
   1. Attach busbars to the wall with appropriate hardware according to the manufacturer's installation instructions.
   2. Conductor connections to the TMGB or TGB shall be made with two-hole bolt-on compression lugs sized to fit the busbar and the conductors.
   3. Each lug shall be attached with stainless steel hardware after preparing the bond per manufacturer recommendations and treating the bonding surface on the busbar with antioxidant to help prevent corrosion at the bond.
   4. The wall-mount busbar shall be bonded to ground as part of the overall Telecommunications Bonding and Grounding System.

C. Rack-Mount Busbars and Ground Bars
   1. When a rack or cabinet supports active equipment or any type of shielded cable or cable termination device requiring a ground connection, add a rack-mount horizontal or vertical busbar or ground bar to the rack or cabinet. The rack-mount busbar or ground bar provides multiple bonding points on the rack for rack and rack-mount equipment.
   2. Attach rack-mount busbars and ground bars to racks or cabinets per the manufacturer's installation instructions.
   3. Bond the rack-mount busbar or ground bar to the room's TMGB or TGB with appropriately sized hardware and conductor.

D. Ground Terminal Block
   1. Every rack and cabinet shall be bonded to the TMGB or TGB.
   2. Minimum bonding connection to racks and cabinets shall be made with a rackmount two-hole ground terminal block sized to fit the conductor and rack and installed per manufacturer recommendations.
   3. Remove paint between rack/cabinet and terminal block, clean surface and use antioxidant between the rack and the terminal block to help prevent corrosion at the bond.

E. Pedestal Clamp
   1. At minimum, bond every sixth raised access floor pedestal with a minimum #6 AWG conductor to the TMGB or TGB using a pedestal clamp sized to fit the pedestal and the conductor and installed per the manufacturer's recommendations.
   2. If pedestal clamps are used to construct a signal reference grid, bond the signal reference grid to the TMGB or TGB and bond each rack and/or cabinet to the signal reference grid using a compression tap or similar non-reversible bonding component sized to fit both conductors.
   3. Remove paint between the pedestal and pedestal clamp, clean surface and use antioxidant between the pedestal and the clamp to help prevent corrosion at the bond.
   4. Remove insulation from conductors where wires attach to the pedestal clamp.

F. Pipe Clamp
   1. Bond metal pipes located inside the data center computer room with a minimum #6 AWG conductor to the TMGB or TGB using a pipe clamp sized to fit the pipe and the conductor and installed per the manufacturer's recommendations.
   2. Remove paint between the pipe and pipe clamp, clean surface and use antioxidant between the pipe and the clamp to help prevent corrosion at the bond.
   3. Remove insulation from conductors where wires attach to the pipe clamp.

G. Equipment Ground Jumper Kit
   1. Bond equipment to a vertical rack-mount busbar or ground bar using ground jumper per the manufacturer's recommendations.
   2. Clean the surface and use antioxidant between the compression lugs on the jumper

and the rack-mount busbar or ground bar to help prevent corrosion at the bond.

END OF SECTION 27 05 26

27 05 28 – PATHWAYS FOR COMMUNICATIONS SYSTEMS

CONDITIONS OF THE CONTRACT AND DIVISION 01, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.

B. Install empty raceway system, including underfloor and overhead distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cable troughs, service poles, miscellaneous and positioning material to constitute complete system, as indicated for distribution of Telecommunications wiring which includes cables for Data, Voice, Video, Audio, Security and future signal requirements.

C. The location at which all new telecommunications wiring will terminate is called a Telecom Outlet (TO). There are several styles of outlets:

1. New construction
2. Existing construction typical
3. Existing construction variations
4. Data/Voice (VOIP)

D. Furnish and install split channel raceway and outlet boxes as specified in the Drawings and as specified herein.

E. Furnish and install conduit stubs in walls and floors for cable routes.

1.3 REFERENCES

ANSI/TIA-568 Commercial Building Telecommunications Cabling Standard
ANSI/TIA-569 Telecommunications Pathways and Spaces
ANSI/TIA-606 Administration Standard for the Telecommunications Infrastructure
ANSI C80.1 Rigid Steel Conduit - Zinc Coated
ANSI C80.4 Fittings for Rigid Metal Conduit
ANSI/NFPA 70/318 – California Electric Code – Cable Trays
ANSI/NFPA 70/770 – California Electric Code – Optical Fiber Cables and Raceways
ASI/NFPA 70/250 - California Electric Code – Ground and Bonding
ASTM A 510 - Specifications for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
ASTM B 633 - Specifications for Electrodepositing Coatings of Zinc on Iron and Steel, Sections SC2 and SC3
ASTM A653 - Specifications for Steel Sheet, Zinc-Coated (Galvanized) by Hot Dip Process
ASTM A123 - Specifications for Zinc (Hot Galvanized) Coatings on Iron and Steel
ASTM – A276-06 Standard Specification for Stainless Steel Bars and Shapes
ASTM A580/A580M-06 Standard Specification for Stainless Steel Wire
BICSI Electronic Safety and Security Reference Manual (ESSDRM), current edition
BICSI Information Transport Systems Installation Methods Manual (ITSIM), current edition
BICSI Network Design Reference Manual (NDRM), current edition
BICSI Telecommunications Distribution Methods Manual (TDMM), current edition
BICSI Wireless Design Reference Manual (WDRM), current edition
CANSI/NFPA 70/645 – California Electric Code – Information Technology Equipment
NEMA VE 2-2006 Cable Tray Installation Guidelines

NEMA VE-1/CSA C22.2 No 126 1-02 Metal Cable Tray Systems
UL and cUL E209183

1.4 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

B. Strictly adhere to all Building Industry Consulting Service International (BICSI) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

C. Assure that the "as installed" system is correctly and completely documented including engineering drawings, manuals, and operational procedures in such a manner as to support maintenance and future expansion of the system.

D. Material and work specified herein shall comply with the applicable requirements of the current revision of the following:

ANSI/TIA-568 Commercial Building Telecommunications Cabling Standard
ANSI/TIA-569 Telecommunications Pathways and Spaces
ANSI/TIA-606 Administration Standard for the Telecommunications Infrastructure
BICSI – Telecommunications Distribution Methods Manual
J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
NFPA 70 – California Electric Code
NFPA 70B, “Recommended Practice for Electrical Equipment Maintenance” pertaining to cable tray systems.

1.5 SUBMITTALS

A. Product Data: For features, ratings, and performance of each component specified.

B. Submit manufacturer’s instructions for storage, handling, protection, examination, preparation, operation, and installation of products. Include application conditions or limitations of use stipulated by any product testing agency. Submit for the following:

1. Wall Boxes
2. Raceway
3. Conduit
4. Conduit Bushings

C. Shop Drawings:

1. Component List: List manufacturer, part number, and quantity of each component.
2. Include dimensioned plan and elevation views of equipment rooms, labeling each individual component. Show raceway assemblies, method of field assembly, workspace requirements, and access for cable connections.

1.6 DELIVERY, STORAGE AND HANDLING

A. **Delivery:** Deliver materials to site in manufacturer’s original un-opened containers and

packaging, with labels clearly indication manufacturer and material.

B. **Storage:** Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.

C. **Handling:** Protect materials and finishes during handling and installation to prevent damage.

PART 2 – PRODUCTS

2.1 TELECOM OUTLETS (TO)

A. New construction TO consists of one (1) 4-11/16" square by 2-1/8" deep flush mounted box. Each outlet box shall have a EMT conduit stubbed above the drop ceiling or extended into the hallway cable tray. Conduits size is as follows:

1. For Outlets with 3 or less cables, use a 1" EMT conduit
2. For Outlets with 3-6 cables, use a 1.25" EMT conduit
3. For all other sizes, calculate fill ratio at 40% for proper sized conduit

B. Existing surface-mounted construction TO typically consists of surface-mounted raceway including base, cover, end fitting, entrance end fitting, and (2) 1" EMT conduits stubbed out top of entrance end fitting to above ceiling or out to nearest hallway distribution system. Size of the raceway is site dependent based on number of conductors to be installed.

C. The intent of the installation of the TOs which consist of the raceway is as follows:

1. Where ceilings are accessible, the raceway and entrance end fitting shall extend above the ceiling and the conduits installed above the ceiling in the room to the nearest hallway distribution system.
2. Where ceilings are partially accessible, or if the Drawings and/or Specifications indicate installation of access panels, the raceway shall extend above the ceiling and the conduits installed above the ceiling in the room to the nearest hallway distribution system.
3. Where ceilings are inaccessible or no ceilings exist, the raceway shall extend up as close to the ceiling as practical to allow installation of conduits as high as possible to the nearest hallway distribution system.

2.2 HORIZONTAL DISTRIBUTION SYSTEM

A. Conduit System (Renovations only, where conduit exists)

1. Provide conduits secured to wall above corridor ceilings as shown on the Drawings or as specified herein for installation of telecommunications cables. Any exposed conduit shall be painted to match surface.
2. Corridor conduits shall be 4" EMT, furnished in 10 foot lengths wherever possible, with no sharp edges, reamed as necessary, evenly supported at two locations per 10-foot section spacing. Conduits shall be sized and quantified to account for handling cables in all TO conduits at 40% fill back to the TR and/or ER rooms. Verify size prior to installation. Bushings and/or connectors on ends of EMT are required.
3. All conduits shall be installed stacked and attached to walls unless conditions exist which prohibit this type of installation. When this condition exists, mount conduits side-by-side supported with 3/8" rod attached to building structure utilizing unistrut channel to form a trapeze. Double nut the top and bottom at the unistrut. Utilize conduit clamp to secure conduits to unistrut.
4. Provide measured pull line in each conduit rated at 1200 lbs. minimum. Increments must be in 12" steps.

5. Grounding of conduits is not required per CEC #250-33, Exception No. 2. shall be painted except conduit above suspended ceilings or in mechanical, electrical or telecommunication rooms. Color to match that of surface installed upon or as directed by Owner's Representative. Coordinate with other trades prior to painting.
6. Provide restorable fire stops inside and around conduits as recommended by UL1479 or ASTM E814 for all conduits penetrating fire-rated construction. Fire rated construction to be verified with AHJ. See Section 27 05 32 for more firestopping information.

B. Corridor Cable Tray System

1. Complete wall mounted or suspended aluminum cable tray system and necessary accessories shall be provided as shown on plans. Install entire cable tray system in accordance with manufacturer's minimum installation practices and all local governing codes.
2. Coordinate installation of cable tray with other trades to allow a minimum of 12" above, 12" in front, and 12" below of clearance from piping, conduits, ductwork, etc. Allowance must be provided for access to the tray with reasonable room to work. Obstructions to the tray must be minimized and cannot block more than 6 feet of the tray at any point in the run.
3. Submittal drawings, in the form of 8 ½"x 11" catalog cut sheets, shall be provided for the following items: cable tray, fittings, accessories and load data.
4. Cable tray shall not be loaded beyond 60% of manufacturer's recommended load capacity.
5. Install wall mounted cable tray on both sides of hallway as shown on drawings and where applicable.
6. Where a new cable tray distribution system encounters a wall, install sufficient 4" EMT sleeves through the wall so cabling does not exceed 20% fill.
7. Where cable tray is exposed below ceiling, install the appropriate solid bottom inserts to conceal cables.
8. Install cable tray dropouts where large quantities of cables exit the distribution system.
9. Cable tray must be sized to facilitate sufficient growth capacity for migration cable plant to coexist in same tray as existing cable plant, wherever possible.
10. Manufacturer of cable tray in corridors and telecom rooms shall be:

C. Telecommunication Room Cable Tray System

1. TR cable tray shall completely wrap all walls within the room. Cable tray shall extend over all equipment frames.
2. Cable tray shall be a minimum width of 2" high x 12" wide. Cable tray may be sized upwards if fill ratio requirements need to be met based on cable quantities.
3. Manufacturer of tubular ladder type cable tray in telecommunication rooms shall be CommScope.
4. Cable tray shall be 12-inch cable runway.
5. Rectangular steel tubing cross members welded at 12-inch intervals. Finish in black enamel. CommScope, Part Number CR-SLR-10L-12W (760085647) or equivalent.
    a. 12-inch Wall Angle Assembly Kit – CommScope Part Number CR6-12WRSK (760084145) or equivalent.
    b. 3-inch Channel Rack–To-Runway Mounting Plate - CommScope Part Number CRR2RRMK (760084053) or equivalent.
    c. End Closing Tube - CommScope Part Number CRPECK (760084012) or equivalent.
    d. Corner Clamp - CommScope Part Number CRTJSK (760084046) or equivalent (2 required per End Closing Tube to complete assembly).

D. All open pathway/trays shall be installed a minimum of six (6) inches away from any light

fixture or other source of EMI (Electromagnetic Interference).

E. All pathways shall be grounded per CEC Article 250.

F. Provide external grounding strap at expansion joints, sleeves and crossover and at other locations where pathway/tray continuity is interrupted.

G. Support all pathways from building construction. Do not support pathways from ductwork, piping, or equipment hangers.

H. Install cable tray level and straight unless noted on the construction drawings.

2.3 STATION CONDUITS

Station conduit is defined as conduit that originates at the TO and rises within the walls or is exposed from a raceway and extends up into the drop ceiling or over to the hallway distribution system.

A. Provide station conduits from TOs to above the drop ceiling or extend over to the hallway distribution systems consisting of 1” EMT minimum or appropriate size as shown on the Drawings or as specified herein for installation of telecommunications cables.

B. Provide an insulating press fit bushing on all telecommunications conduits including interconnecting nipples and stub to distribution system. To prevent conflicts with other cables or conduits to cable tray, the conduit shall be stubbed not less than 6" above or below conduit/cable tray center line. Where space permits, every effort shall be made to bend station conduits down such that the flow of installed cables promotes the minimum length back to the TR and the least amount of bends in the cables. Bushings must be rated to be used in an environmental air handling space (Plenum).

C. Manufacturer of insulating bushing on all telecommunication conduits shall be:

D. Provide measured pull line in 12” increments in each empty conduit to hallway distribution system.

E. Indelibly mark station conduit at hallway distribution end with Room # that conduit serves.

F. The use of 90-degree electrical pulling elbows is prohibited.

G. Do not include more than two 90-degree bends between pulling points when installing station conduit runs. If the path of the station conduits requires more than 180 degrees of total bends, installation of an appropriate sized junction box is required. See section 2.4 for junction box requirements.

H. Place an appropriate sized junction box in each individual station conduit run that exceeds 100 feet in length.

I. The use of a third bend in a conduit is only acceptable if:

1. The total conduit run is reduced by 15%.
2. The conduit size is increased to the next trade size.
3. One of the bends is located within 12” of the cable feed end.

2.4 JUNCTION BOX REQUIREMENTS FOR STATION CONDUITS

A. If the station conduit route exceeds the 180 degree of total bends limitation, an appropriate

sized junction box is required within a straight section of the conduit run.

B. Each station conduit run requires a separate junction box. The sharing of a junction box by multiple conduits is prohibited.

C. A junction box shall not be used in place of a bend. All junction boxes in station conduit paths shall be installed within a straight section of the conduit run.

2.5 SERVICE ENTRANCE CONDUITS

A. Minimum of (4) 4” IMC conduits shall be installed from the nearest utility tunnel on outside of the building as shown on the Drawings. Terminate entrance conduits entering ER rooms from below grade to extend 4" above finished floor. Location of entrance conduits shall be within 12” of room corners.

B. Terminate entrance conduits entering ER rooms from above ceiling height to extend 4" below finished ceiling or 12” above cable tray.

C. Terminate entrance conduits entering an ER rooms from below ceiling height to extend 4" into the room.

D. Entrance conduits shall be continuous into the building and to the ER. Securely fasten all entrance conduits to the building to withstand any cable placing operation. Do not include more than two 90-degree bends between pulling points when installing entrance conduits.

E. On exterior wall penetrations, seal both sides of the wall around outside of conduit with hydraulic cement to prevent water from entering the building. Seal the inside of the conduit on both sides with conduit plugs, water plugs, or duct sealer to prevent water, vapors, or gases from entering the building.

2.6 PATHWAY REQUIREMENTS FOR ENTRANCE CONDUITS

A. If the entrance conduits exceed the 180 degree of total bends limitation, an appropriately sized junction box, manhole, or handhole is required.

B. As-built drawings of entrance conduit path required to be submitted to Owner’s Representative before covered with soil.

2.7 RISER CONDUITS

Riser conduits shall only be used when noted on the Construction Documents for special applications only. As a rule, riser conduits are not required for the riser system. However, when required:

A. Minimum of (2) 4” conduits shall be installed between the ER room and each TR room as shown on the Drawings.

B. Conduits entering ER and TR rooms shall be reamed or bushed and terminated not more than 4" from entrance wall and within 12” of room corners.

C. Conduits entering ER and TR rooms from below floor shall be terminated not more than 4" above finished floor.

D. Conduits for riser cables shall be continuous and separate from all other conduit or enclosed raceway systems. Do not include more than two 90-degree bends between pulling points when installing riser conduits. Where junction boxes are required, locate in accessible areas, such as

above suspended ceilings in hallways.

E. Conduits shall not be less than 4" trade size and be equipped with a measured pull line at 12” increments rated at a minimum 1200-pound test.

F. Provide restorable fire stops inside and around conduits as recommended by UL1479 or ASTM E814 for all conduits penetrating fire-rated construction. Fire-rated construction to be verified with AHJ.

G. Provide an insulating press fit bushing on all telecommunications riser conduits. Bushings must be rated to be used in an environmental air handling space (Plenum).

1. Manufacturer of insulating bushing on all telecommunication conduits shall be Arlington or equal.

H. Riser conduits shall not be used for the distribution of horizontal cables.

2.8 FIRESTOPPING

A. In all buildings, floor/ceiling assemblies, stairs, and elevator penetrations must be sealed with a 2-hour fire stop assembly at a minimum, unless otherwise noted.

B. Contact Owner’s Representative to identify walls which are fire-rated construction. Walls must be sealed with a 2-hour fire stop assembly at a minimum.

C. Communication pathways requiring fire stopping shall utilize removable/re-usable fire stopping putties for ease of Moves, Adds, and Changes.

D. All fire stopping penetrations shall conform to the recommended practices listed in UL1479 or ASTM.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. The intention of the telecommunications conduits is to provide a route between ER and TR rooms, routes from the TRs throughout building floors to hallways, and routes from hallway distribution systems into rooms to individual TOs for telecommunications cabling.

B. Installation of new pathways shall not interfere with existing pathways in such a way that installation of new cables within the existing pathway is made more difficult.

3.2 EXAMINATION

A. Examine areas to receive cable management system. Notify the Owner’s Representative of conditions that would adversely affect the installation or subsequent utilization of the system.

B. Do not proceed with installation until unsatisfactory conditions are corrected.

3.3 INSTALLATION

A. Install in accordance with recognized industry practices, to ensure that the equipment complies with requirements of the CEC, and applicable portions of NFPA 70B and NECA "Standards of Installation" pertaining to general electrical installation practice.

B. Coordinate installation with other trades.

C. Field verification is required before installation.

D. Install cable management system at locations indicated on the drawings and in accordance with manufacturer's instructions.

END OF SECTION 27 05 28

27 05 29 – HANGARS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

CONDITIONS OF THE CONTRACT AND DIVISION 01, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the system of non-continuous cable supports as described in this specification. Installation of hangers and supports should not rely on existing building structure. Installers should develop cable pathways independent of other trades.

1.2 SUBMITTALS

A. Submit product data on non-continuous cable support devices, including attachment methods. Product data to include, but not limited to materials, finishes, approvals, load ratings, and dimensional information.

1.3 QUALITY ASSURANCE

A. Non-continuous cable supports, and cable support assemblies shall be listed by Underwriters Laboratories for both Canadian and US standards (cULus).

B. Non-continuous cable supports shall have the manufacturers name and part number stamped on the part for identification.

C. Manufacturer: Company specializing in manufacturing products specified in this section with a minimum of five years documented experience in the industry, and certified ISO 9000.

D. Cable hangers and supports should be non-conductive.

1.4 COORDINATION

A. Coordinate the installation of hangers, supports and cables with other trades.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with these specifications, non-continuous cable supports shall be as manufactured by: Chatsworth Products Inc. (CPI), Panduit, Unistrut, nVent, Eaton, Erico, CE-AS.

2.2 REFERENCES

ANSI/TIA-568 Commercial Building Telecommunications Cabling Standard
ANSI/TIA-569 Telecommunications Pathways and Spaces
ASTM B633 Standard Specification for Electro-Deposited Coatings of Zinc on Iron and Steel
ASTM B 695-90 Standard Specification for coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A924/A924M Standard Specification for General Requirements for Steel

Sheet, Metallic-Coated by the Hot-Dip Process
ASTM A109 Standard Specification for Steel, Strip, Carbon, Cold-Rolled
ASTM A167 Standard Specification for Stainless and heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A480/A480M Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
ASTM A568 Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy Hot-Rolled and Cold-Rolled
A653 G60-Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip process
ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
ASTM A682 Standard Specification for Steel, Strip, High-Carbon, Cold-Rolled, Spring Quality
ASTM A879 Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
ASTM B117 Standard Method of Salt Spray (Fog) Testing
ASTM D610 Standard Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces
UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
NFPA 70 California Electrical Code®

2.3 NON-CONTINUOUS CABLE SUPPORT SYSTEMS

A. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed

B. Non-continuous cable supports shall have flared edges to prevent damage while installing cables

C. Non-continuous cable supports sized 1-5/16” and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces

D. Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments

E. Stainless Steel non-continuous cable supports are intended for indoor and outdoor use in non-corrosive environments or where only mildly corrosive conditions apply.

2.4 FINISHES

ASTM B633 Standard Specification for Electro-Deposited Coatings of Zinc on Iron and Steel
ASTM B695 Standard Specification for coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

Non-continuous cable supports used where only mildly corrosive conditions apply shall be stainless steel, AISI type 304.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation and configuration shall conform to the requirements of the current revision levels of TIA Standards 568 and 569, NFPA 70 (California Electrical Code), applicable local codes, and to the manufacturer's installation instructions.

B. Do not exceed load ratings specified by manufacturer.

C. Adjustable non-continuous support sling shall have a static load limit of 100 lbs.

D. Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.

E. Locate pathways per Telecommunications Drawings.

END OF SECTION 27 05 29

27 05 33 - CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

CONDITIONS OF THE CONTRACT AND DIVISION 01, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 OUTLETS

A. Each data outlet in a wall shall be served by at least one 27 mm (1 in.) conduit and a double-gang deep device box with a single-gang mud ring.

B. All outlet conduits shall be stubbed into accessible ceiling space.

C. All outlet conduits shall have burrs and any other abrasive elements removed and an insulating bushing shall be installed on both ends.

D. No section of conduit shall be longer than 30 m (100 ft.) between pull points.

E. No more than 180 degrees of conduit bends shall be permitted between pull points.

F. The minimum inside radius for any bend of an outlet conduit shall be six times the inside diameter of that conduit.

1.2 CONDUITS

A. Electric metallic tubing: Comply with UL 797. Tubing shall have hot dipped galvanized exterior, enamel-coated interior.

B. Flexible conduit shall not be used in lieu of conduit bends and offsets.

C. PVC conduit: Comply with UL 651, listed for use with 90 degrees C conductors operating at 90 degrees C.

1.3 STANDARDS COMPLIANCE

A. General standards: Comply with current revision of TIA-569 as amended.

1.4 SUBMITTALS

A. Provide product data for the following:

1. Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.5 COORDINATION

A. Coordinate installation of labels with other trades.

B. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products will not be installed. Store materials in original cartons and in a clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage.

PART 2 – PRODUCTS

2.1 APPROVED PRODUCTS

A. Dry location device boxes:
   1. Manufacturer shall be:
   2. Equivalent products by other manufacturers may be used where approved in writing by Owner's Representative.

B. Wet location boxes:
   1. Manufacturer shall be:
   2. Equivalent products by other manufacturers may be used where approved in writing by Owner's Representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation and configuration shall conform to the requirements of the current revision levels of TIA Standards 568 and 569, NFPA 70 (California Electrical Code), applicable local codes, and to the manufacturer’s installation instructions.

B. Install conduits using techniques, practices, and methods that are consistent with Category 6 or higher requirements and that supports Category 6 or higher performance of completed and linked signal paths, end to end.

C. Follow manufacturer’s recommendations for allowable fill capacity for each size non-continuous cable support.

END OF SECTION 27 05 33

27 05 53 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

CONDITIONS OF THE CONTRACT AND DIVISION 01, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section includes the minimum requirements for the Identification and labeling of the Communications Systems for the project as outlined in the Bid Documents.

1.3 WORK INCLUDES

A. Work covered by this Section shall consist of furnishing labor, equipment and materials necessary for the labeling of the telecommunications infrastructure as described on the Drawings and/or required by these specifications.

1.4 SUMMARY

A. Administration of the telecommunications infrastructure includes documentation of cables, termination hardware, patching and cross-connection facilities, conduits, other cable pathways, Telecommunications Rooms, and other telecommunications spaces. All facilities shall apply and maintain a system for documenting and administering the telecommunications infrastructure.

B. The owner maintains a campus wide labeling scheme for voice and data outlets and patch panels.

C. Industry Labeling Standards and Conventions shall be used unless otherwise stated in the bid documents or by the Owner’s Representative.

D. Telecommunications Infrastructure Records must be maintained in a computer spreadsheet, or in a computer database. Paper records are encouraged but are optional. A cable record is prepared for each backbone cable. The record will show the cable name and must describe the origin point and destination point of the cable. The cable record will record what services and/or connections are assigned to each cable pair or strand. An equipment record is prepared for services distributed from a certain piece of equipment, such as a router, or a system such as the telephone system PBX.

E. Installer shall maintain accurate, up-to-date Installation or Construction Drawings. At a minimum, the Installation Drawings shall show pathway locations and routing, configuration of telecommunications spaces including backboard and equipment rack configurations, and wiring details including identifier assignments.

F. Installer shall provide a complete and accurate set of as-built drawings. The as-built drawings shall record the identifiers for major infrastructure components including; the pathways, spaces, drop numbering and wiring portions of the infrastructure which may each may have separate drawings if warranted by the complexity of the installation, or the scale of the drawings.

1.5 QUALITY ASSURANCE

A. All labels shall be installed in a neat and workmanlike manner. All methods of labeling that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative.

B. Labels shall be of the quality and manufacture indicated. The labels and labeling equipment specified are based upon the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

C. Strictly adhere to all Building Industry Consulting Service International (BICSI) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data labeling.

D. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

TIA-606-C Administration Standards for Telecommunications Infrastructure
TIA-569 Telecommunications Pathway and Spaces
TIA-568 Telecommunications Cabling Standard
BICSI Telecommunications Distribution Methods Manual
UL 969 - UL Standard for Safety for Marking and Labeling Systems

1.6 SUBMITTALS

A. Provide product data for the following:

1. Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.7 COORDINATION

A. Coordinate installation of labels with other trades.

B. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products will not be installed. Store materials in original cartons and in a clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage.

PART 2 – PRODUCTS

2.1 LABELS

A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969

B. Shall be preprinted or computer printed type. Handwritten labels are not acceptable

C. Where insert type labels are used provide clear plastic cover over label

D. Outside plant labels shall be totally waterproof even when submerged

E. Equipment Room Copper, Fiber, and Coax Backbone Cable Labels

F. Equipment Room Copper, Fiber, and Coax Horizontal Cable Labels

G. Work Area Copper, Fiber, and Coax Riser Cable Labels

H. Patch Panel Labels

PART 3 - EXECUTION

3.1 IDENTIFICATION AND LABELING

A. The size, color, and contrast of all labels should be selected to ensure that the identifiers are easily read. Labels should be visible during the installation of and normal maintenance of the infrastructure.

B. Labels should be resistant to the environmental conditions at the point of installation (such as moisture, heat, or ultraviolet light), and should have a design life equal to or greater than that of the labeled component.

C. All labels shall be printed or generated by a mechanical device.

3.2 TELECOMMUNICATION IDENTIFIERS

A. Outside Plant cabling shall be clearly marked using permanent means. Outside plant shall use the following system of numbering and labeling:

1. Fiber Optic:
   a. Identify: far-end building name, building number, fiber-type and strand-count
   b. Label at entrance and exit points of tunnel system and at conduit entry points between 12 inches and 36 inches from the conduit or at closet point that is clearly visible and long cable length in tunnel at 200-foot intervals.
   c. Label at termination panels at both ends

2. Copper:
   a. Identify: far-end building name, building number and strand-count
   b. Label at entrance and exit points of tunnel system and at conduit entry points between 12 inches and 36 inches from the conduit or at closet point that is clearly visible and long cable length in tunnel at 200-foot intervals

B. Riser cabling shall be clearly marked using permanent means. Riser cabling shall use the following system of numbering and labeling:

1. Fiber Optic:
   a. Identify: far-end EF / ER / TR, fiber-type and strand-count.
   b. When small facilities are fed from a primary location and treated as an ER, riser shall be labeled similar to Outside Plant Fiber Optic

2. Copper:
   a. Identify: far-end EF / ER / TR and pair-count
   b. Termination points shall be labeled as to actual pair at every fifth (5th) pair-point.

3.3 LABELING PROCEDURES

A. To be consistent with ANSI/TIA standards and industry practices, it is important that both labeling and color coding be applied to all telecommunications infrastructure components. Labeling with the unique identifier will identify a particular component. Proper color coding will quickly identify how that component is used in the overall telecommunications infrastructure of the facility.

B. Visibility and durability:

1. The size, color, and contrast of all labels should be selected to ensure that the identifiers are easily read. Labels should be visible during the installation of and normal maintenance of the infrastructure.
2. Labels should be resistant to the environmental conditions at the point of installation

(such as moisture, heat, or ultraviolet light), and should have a design life equal to or greater than that of the labeled component.

3. Labels are generally of either the adhesive or insert type. All labels must be legible, resistant to defacement, and maintain adhesion to the application surface.
4. Outside plant labels shall be totally waterproof, even when submerged.
5. Labels applied directly to a cable shall have a clear vinyl wrapping applied over the label and around the cable to permanently affix the label.
6. Other types of labels, such as tie-on labels, may be used. However, the label must be appropriate for the environment in which it is used and must be used in the manner intended by the manufacturer.

C. Mechanical generation

1. All labels shall be printed or generated by a mechanical device.
2. Handwritten labels are NOT acceptable.

END OF SECTION 27 05 53

SECTION 27 10 00 – CATEGORY 6A STRUCTURED CABLING SYSTEM (SCS)

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 RELATED WORK

A. 26 05 00 – Grounding and Bonding
B. 26 05 29 – Electrical Hangers and Supports
C. 26 05 33 – Raceway and Boxes

1.3 DESCRIPTION

A. Summary of Work:
   1. Provide a complete and tested Category CAT6A cable distribution system for data interconnections (Local Area Network). The data distribution system shall include fully terminated unshielded twisted pair cables, raceways, conduit, UTP termination devices, data communications outlets, patch panels, patch cables, network racks, and other incidental and miscellaneous premises wiring system hardware as required for a complete and usable system. The installation shall comply with all applicable codes and standards in effect at the job site and as indicated in the Drawings and Specifications.
   2. Provide and install (1) 6-strand multi-mode fiber-optic cable from the MDF to each IDF.
   3. Provide and install building entrance terminals as required.

1.4 QUALITY ASSURANCE

A. Acceptable manufacturers:
   1. The equipment/products described herein and furnished per these specifications shall be the product of one manufacturer. All references to model numbers and other detailed descriptive data is intended to establish standards of design performance, and quality, as required
   2. The approved manufacturers shall provide a complete Category 6A solution with a 25-year performance warranty.
   3. Acceptable product connectivity and cable shall be Uniprise by CommScope. Only the manufacturers listed in this paragraph will be accepted.
   4. All products shall be Category 6A compliant. NO EXCEPTIONS.

B. Installer Qualifications:
   1. The Data Cable System Installer shall be licensed and shall meet all applicable regulations of the State of California and Department of Labor insofar as they apply to this type of system. The proposer shall be a firm normally employed in the low voltage and data cabling industry and shall provide a reference list of ten (10) similar size, Category 6A, projects and contact names confirming successful Category 6A premises wiring system installations.
   2. The SCS Installer shall be a certified CommScope/Corning Uniprise and in good standing in the Partner Program, local area, integrator and must be able to provide the manufacturer's maximum available warranty on the entire SCS. The contractor's certification must have been obtained and held within 75 miles of the project's location.
   3. The installing contractor must have a full-time employed RCDD (Registered

Communications Distribution Designer) on staff. Current RCDD certification shall be provided in the product submittals.

4. All individuals installing the SCS 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.
5. The proposing contractor and the installing contractor must be the same company. No subcontractor to the proposing SCS contractor will be allowed for any portion of the SCS scope of work.

C. Pre-Construction Meeting:
1. The successful Contractor shall attend a mandatory pre-construction meeting with the project's consultant and individuals deemed necessary by the Owner's representative prior to the start of the work. No SCS work shall begin prior to this meeting.

D. Acceptance:
1. The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

E. Warranty:
1. The selected system installer shall be a CommScope/Corning Uniprise, certified contractor and hold current certification. Contractor shall provide an end-to-end performance warranty of not less than twenty (25) years on all products installed. The proposer shall provide current certification documentation. The performance warranty shall be issued by the manufacturer and shall warrant that ALL Category 6A cable links have been tested bi-directionally (end to end) using a Level 2 tester, per TSB-67, and that all test results conform to the most current TIA/EIA-568-C and/or TSB-67 Link values.
2. The warranty will also cover multimode fiber optic cabling. Performance testing shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, method B.
3. The warranty will stipulate that all products used in this installation meet the prescribed mechanical and transmission specifications for such products as described in ISO/IEC 11801, ANSI/TIA/EIA-568-A, or EN 50173. Quality and workmanship evaluation shall be solely by the Owner/Designer and designated representatives.

1.5 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
1. Latest Local Codes and Amendments
2. 2022 California Electrical Code

B. Other References:

1.	TIA/EIA-568-C	Commercial Building Telecommunications Wiring Standard
2.	EIA/TIA-569	Commercial Building Standard for Telecommunication Pathways and Spaces.
3.	TIA/EIA-606	The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
4.	TIA/EIA-607	Commercial Building Grounding and Bonding Requirements for Telecommunications.

5.	EIA/TIA 455-A	Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices and Other Fiber Optic Components.
6.	TIA/EIA TSB 67	Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
7.	TIA/EIA TSB 72	Centralized Optical Fiber Cabling Guidelines
8.	ISO/IEC 11801	Generic Cabling Standard
9.	EN 50173	Generic Cabling Standards for Customer Premises
10.	ANSI/EIA/TIA 526-14	Optical Power Loss Measurements of Installed Multimode Fiber Cable Plan.

C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

1.6 ABBREVIATIONS

A. The following abbreviations are used in this document:

DC	Direct Current
IDF	Intermediate Distribution Frame
MDF	Main Distribution Frame
PBX	Private Branch Exchange
UTP	Unshielded Twisted Pair

1.7 SUBMITTALS

A. Project Initiation:

1. Within fourteen (14) days of Notice to Proceed, the data network system installer shall furnish the following in a single consolidated submittal:
   a. Permits: The Contractor shall obtain all required permits and provide copies to the Owner/Architect/Engineer.
   b. Product Literature: Complete manufacturer's product literature for all cable, patch panels, cross-connect blocks, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be provided.
   c. Construction Schedule: A time-scaled Construction Schedule, using PERT/CPM, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
   d. Testing: Proposed Contractor Category 6A UTP cable test result forms, fiber optic cable test result forms and a list of instrumentation to be used for systems testing.
   e. Specification Compliance: A letter shall be provided stating, by section and subsection, that the SCS installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. NO DEVIATIONS SHALL BE ACCEPTABLE UNTIL THEY HAVE BEEN ACCEPTED BY THE PROJECT'S TECHNOLOGY CONSULTANT.

f. Certifications: The contractor shall submit all of the following certifications and the certifications must contain dates which are valid from the date of proposal and not expire any sooner than 12 months after substantial completion of the project.
   1) BICSI RCDD Certification: This certification must be held by an on-staff, full-time employee of the SCS installer. The holder must be staffed out of the office that is located within 75 miles of the projected.
   2) Proposed Manufacturer's Strategic Partner Certification: This certification have been obtained by the SCS installer's office that is located within 75 miles of the project and shall be a company certification, not and individual certification.
   3) Proposed Manufacturer's Installer Certification: This certification must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.
   4) Fiber Optic Technician Certification: This certification must be held by the on-staff/on-site individual that is supervising the fiber optic installation and performing the fiber optic terminations and testing.

B. Shop Drawings:
   1. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
      a. Proposed circuit routing and circuit grouping plan prepared by a BICSI certified RCDD (Registered Communications Distribution Designer). The RCDD certification must be current. Identifiable, separate routing shall be shown for both the station cabling and the MDF-to-IDF tie cabling.
      b. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
         1) Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
         2) Location of sleeved wall pass-thru
         3) Size of sleeve at each location installed
         4) Quantity of cable passing through each sleeve
         5) Location of drops in each room (quantity or labeling of drops are not required in the submittal plans. Labeling shall be provided in the closeout plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)
         6) Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.
      c. Drawing Compliance: A letter shall be provided stating that the SCS installer complies with the ENTIRE project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. NO DEVIATIONS SHALL BE ACCEPTABLE UNTIL THEY HAVE BEEN ACCEPTED BY THE PROJECT'S TECHNOLOGY CONSULTANT.

C. Close-out Procedures:
   1. Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance. The close out submittals shall include:

a. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
b. Provide complete test reports for all cabling and devices that comprise system as outlined in this document.
c. Include the Name, address, and telephone of the authorized factory representative with a 24-hour emergency service number.
d. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed, a list of recommended spare parts.
e. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
f. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the structure cabling system from the original approved shop drawings. Drawings shall consist of a scaled plan of each building showing the placement of each individual item of the technical cabling system equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
g. As-built Drawings shall include cable pathways, camera locations with correct labeling and MDF/IDF locations. The as-built drawings shall be prepared using AutoCad 2013 or later. Provide the Owner with electronic versions of the As-Builts on (2) 8GB thumb drives.
h. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
i. A copy of the manufacturer's warranty on the installed system.
j. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
k. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
l. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Minimum amount of training time shall be at least 4 hours.
m. One (1) 30" x 42" laminated floor plan sheets illustrating technology drops and cable designation. Contractor shall provide one complete floor plan sheet for each telecommunications room (MDF or IDF)

PART 2 - PRODUCTS

2.1 GENERAL

A. Installation: The cabling shall be installed per requirements of the manufacturer and the Project Documents utilizing materials meeting all applicable TIA/EIA standards. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.

B. Materials: Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA specifications. All approved equivalent products will be published by addendum ten days prior to proposal for Architect/Engineer to review.

C. Testing: All installed cabling shall be tested 100% good after installation by the Contractor. All final test results shall be delivered to owner at completion of project. Refer to closeout requirements listed under section 1.5.

D. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:
CM Communications Cable
CMP Plenum Rated Communications Cable
CMR Riser-Rated Communications Cable

E. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.

F. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.
1. Approved Products
a. Twisted-pair cable: Dyna-Blue
American Polywater

G. Fire Wall Sealant: Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant.
1. Approved Products
a. 3M or
b. Pre-approved equal

H. All Category 6A cables and data drops on the entire project provided shall be colored for:
1. RED INFRASTRUCTURE/UPS
2. ORANGE ACCESS POINT
3. YELLOW PRINTER
4. GREEN FACLTY/STAFF PC
5. BLUE LAB PC
6. VIOLET INTERCOM
7. WHITE SECURITY/IP CAMERAS
8. GRAY VOIP
9. BLACK AUDIO/VISUAL

2.2 DATA CLOSET (MDF/IDF) CATEGORY 6A TERMINATION HARDWARE

A. Equipment Racks/Cabinets:

Provide and install equipment racks and/or cabinets in locations indicated on the attached drawings for the following areas.

For all IDF and MDF locations:

Contractor shall provide and install new Hoffman floor mounted rack systems. Refer to floor plan and enlarged MDF/IDF room layouts for number or racks to provide at each location.

1. Approved Products
   a. Floor mounted racks – Commscope 760082479 | RK3-45A

B. Distribution Rack/Cabinet Grounding

All Racks and/or Cabinets shall be grounded using stranded #6 AWG insulated copper conductor. Connect to service entrance grounding electrode. Provide all required bonding materials and hardware and bond to building grounding electrode subsystem at building electrical service entrance.

1. Approved Products –Grounding Compression Lugs
   NSi #L6N-14
2. Approved Products – Wall Mount Bus Bar (one per MDF/IDF location) Hoffman #DGTB412

C. Fiber Optic Patch Panels

The enclosures used shall provide termination panels for SC type connectors and be of sufficient size and capacity to terminate 110% of the fiber count of the inside of outside fiber optic cables. Patch panels must be 19” rack mountable. Provide all termination accessories, fiber patch cords, enclosures, and test for a complete fiber optic distribution system.

1. Approved Products (for MDF/IDF locations):

   a. CommScope 2U Fiber Shelf 760231480 | SD-2U-FX
   b. CommScope 4U Fiber Shelf 760231464 | SD-4U
   c. CommScope 12 Fiber Inserts SC Single-Mode 760027714 | PNL-BK-012-SFA-SC02-BL
   d. CommScope Wall Mounted Single Sided Single Door Fiber Enclosure 760147496-WBE-EMT-BK-2P-PNL
   e. Provide cable grommets AMP #559496-2, or equivalent cable grommet.

D. Category 6A Patch Panels: The Category 6A data station cable shall be terminated on Category 6A RJ45 patch panels with circuit board construction, T568B terminations. Patch panels shall be 19-inch rack mountable. Workstation patch panels shall terminate all workstation communications outlets. Furnish units that adhere to the performance requirements TIA/EIA-568A standards.

1. Approved Products:
   a. CommScope Category 6A Patch Panels 24 Port 760162800 | UNP-6A-DM-1U-24
   b. Commscope Category 6A Patch Panels 48 Port 760162818 | UNP-6A-DM-2U-48
   c. (provide cable support bars at the back of all patch panels to provide additional support at rear of rack and panels)

E. Cable Management Panels
Provide cable management panels as required for vertical cable management. Provide vertical wire management on ends and in between all racks on entire project. All vertical cable managers on the entire project shall be 10” wide management. Horizontal not to be

used.

1. Approved Products

   Vertical – Hoffman, Front and Rear, # DV10DF8 with covers on front and back.

   Provide Velcro straps for cable dressing in MDF/IDF rooms.

F. Rack/Cabinet Electrical:

1. A power distribution strip shall be installed vertically at the back of each data rack and/or cabinet.
   Approved Products
   a. Chatsworth P1-1D0A5 120V 20A
   b. Provide a PDU offset bracket for each PDU installed.

Provide the following electrical UPS equipment at each location indicated.
At MDF room: (Provide quantity of two (2) each of the following at the MDF)

Smart-UPS 3000VA USB & Serial RM 2U 120V with UPS Network Management Cart with Environmental Monitoring
APC Product Number: SMX1500RM2UNC (black chassis)

3-year extended warranty
APC Product Number: WBEXTWAR3YR-SP-04

At IDF Room: (Provide quantity of one (1) each of the following at each IDF)

Smart-UPS 3000VA USB & Serial RM 2U 120V with UPS Network Management Cart with Environmental Monitoring
APC Product Number: SMX1500RM2UNC (black chassis)

3-year extended warranty
APC Product Number: WBEXTWAR3YR-SP-04

G. Network Rack Patch Cables: Cabling Contractor shall provide district with (1) – 6' Category 6A patch cable for each data drop on entire project. These cables will provide connectivity from the front of the network patch panels to the network equipment provided by district upon move-in. The patch cables are to be terminated properly with RJ-45 connections on each end with the proper pin-out assignments per project configuration.

1. Approved Products: CommScope 6' Category 6A Patch Cable

a.	RED	UC1AAA2-07F006
b.	ORANGE	UC1AAA2-06F006
c.	YELLOW	UC1AAA2-09F006
d.	GREEN	UC1AAA2-0MF006
e.	BLUE	UC1AAA2-0ZF006
f.	VIOLET	UC1AAA2-0LF006
g.	WHITE	UC1AAA2-08F006
h.	GRAY	UC1AAA2-0CF006
	BLACK	UC1AAA2-01F006

2.3 CABLE ROUTING/PATHWAY

A. Cable Tray: Metal cable tray shall be provided to affix to the top of all floor mount racks. Cable tray shall be used to brace racks to walls and to route cable from walls to racks in communication closets.

1. Approved Products:
   a. CommScope 760085647 | CR-SLR-10L12W (black)
   b. And all applicable installation accessories and those listed below:
      1. Cable Runway Elevation Kit (CPI) - #10506-706 (black) –one per rack
      2. 3” Channel Rack-to-Runway Mounting Plate CommScope 760084053 | CRR2RRMK (black) one per rack
      3. Cable Runway Radius Drop: CommScope 760083956 | CRDK-12W (black).
      4. Ladder Rack 90° Horizontal E-Bend Section: CommScope 760085530 | CR90FCB-12W (black). Provide as required.
      5. Wall Angle Support Kit: CommScope 760084160 | CR12-C24WRSK (black). Provide as required per ladder tray and wall junction.
      6. End Cap Kit: CommScope 760084012 | CRPECK (black). Provide as required per exposed end of ladder tray
      7. Junction Splice Kit: CommScope 760084046 | CRTJSK (black). Provide as required per junction.
      8. And all applicable installation accessories.

B. Cable Support System: All low voltage cabling shall be installed and supported using a modular cable support system at 48” intervals unless installed in conduit. Do not exceed manufacture recommendation for the quantity of cables supported in an individual support.

C. All cable bundles shall be grouped together using plenum rated Velcro for the entire run above and below the ceilings.

D. Innerduct shall be bright orange and shall be labeled fiber optic cables from fiber patch panel to conduit or plenum entrances. Innerduct installed in plenum rated ceilings shall be plenum rated.

1. Approved products
   a. Carlon
   b. Dura-line

2.4 FIBER OPTIC PRODUCTS

A. Fiber Optic Cable shall be UL listed type OFNP (unless noted otherwise):

1. Single-mode fibers, each with a color-coded PVC tight buffer (unless noted otherwise) shall have a maximum attenuation of 0.65 dB/km / 0.65 dB/km / 0.5 dB/km.
   a. Approved Products:
      i. 24-strand Single-mode, OSP, Armored, Gel-Free cable, shall connect the NOC with the MDF as specified on Technology Site Plans. Corning Product #024E88-33131-A3
2. Multi-mode fibers, each with a color-coded PVC tight buffer (unless noted otherwise) shall have a maximum attenuation of 2.8 dB/km / 1 dB/km.
   a. Approved Products:
      i. 12-strand Multi-mode, with plenum rated armored jacket shall connect each IDF with the MDF as specified on Technology Riser Plans. Corning Product #012T88-33190-A3

3. Provide (4) CommScope 3-meter patch cords for each backbone fiber installed on the entire project. Coordinate the required connector type, on the equipment end,

with the owner prior to procuring the products.

4. All non-armored fiber optic cable shall be installed in 1" innerduct throughout the entire run. Innerduct to be rated for the space in which it is installed in.

5. No fusion or mechanical splices will be allowed at any point in the fiber optic runs.

B. Connectors

Optical Fiber Connectors shall be SC type connectors.

1. Approved Products:

Corning LC Single-Mode #

2.5 STATION WIRING

A. Wire: The data and voice wire provided for all outlets shall be (Category 6A) Plenum-Rated unshielded twisted pair, four-pair, 24 AWG solid copper conductor, meeting the intent and quality level of the TIA/EIA-568-A Commercial Building Wiring Standard. Refer to floor plan and data outlet legend for number of active data ports to specified faceplates.

1. Approved Products: For all voice and data connections: CommScope

a.	RED	
b.	ORANGE	
c.	YELLOW	UN874050004/10 | CS44P YLW
d.	GREEN	UN874035904/10 | CS44P GRN
e.	BLUE	UN874035104/10 | CS44P BLU
f.	VIOLET	UN874041604/10 | CS44P VLT
g.	WHITE	
h.	GRAY	
i.	BLACK	

B. Testing: The Category 6A four-pair UTP cable must be UL Performance Level tested. Each 1000-foot spool must be individually tested with test results affixed to the spool. All cable must be provided on new 1000-foot spools. NO "SHORTS" WILL BE ALLOWED. IF SHORTS ARE DISCOVERED, THE CONTRACTOR WILL BE REQUIRED TO UNINSTALL ALL CABLE ON THE ENTIRE PROJECT AND INSTALL NEW CABLE AT NO ADDITIONAL COST TO THE OWNER.

C. Rating: Cable installed in conduit shall be non-plenum rated. Cable not installed in conduit shall be plenum rated if installed in plenum ceiling space, non plenum rated otherwise.

D. Provide 10 feet service loop at all headend locations properly supported above ceiling. Provide 3' service loop at each workstation outlet properly supported above ceiling. All workstation service loops shall be made in figure eight configurations, no exceptions.

E. All cable shall be bundled with Velcro from patch panel to outlet. Velcro shall be rated for plenum space.

2.6 STATION HARDWARE

A. Flush Mount Jacks: Flush mount jacks shall be high quality Category 6A RJ45 modular jacks with circuit board construction and IDC style or 110-style wire, T568B terminations. Jacks shall meet EIA/TIA TSB40 recommendations for Category 6A connecting

hardware.

1. Approved Products – Data and Voice Jacks:
   a. RED
   b. ORANGE
   c. GREEN 760241179 | UNJ10G-GR
   d. BLUE 760241176 | UNJ10G-BL
   e. VIOLET 760241180 | UNJ10G-BL
   f. WHITE 760248228 | UNJ10G-262
   g. YELLOW 760241178 | UNJ10G-YL
   h. GRAY
   i. BLACK

2. All blank inserts shall be Gray.

B. Faceplates: Faceplates shall be a 4-port, flush mounted, **stainless steel**, CommScope Uniprise solution, for RJ45 outlets at all locations.
Approved Products:
1. 4-Port Single Gang, CommScope # 760072207 | M14SP-L
2. Provide wall mounted handset faceplates where applicable for wall mounted phone. Refer to floor plan for locations. CommScope # 760100891 | M10WL4SP
3. Provide Mounting Straps (where applicable)

C. Workstation Patch Cables: Cabling Contractor shall provide district with (1) – 3 Meter Category 6A patch cable for each data drop on entire project. Each cable will be terminated properly with RJ45 connections on each end with appropriate pin-out assignments per project configuration.

D. Approved Products: CommScope Uniprise, 3 Meter Cat 6A Patch Cable
1. RED
2. ORANGE
3. YELLOW UC1AAA2-09F006
4. GREEN UC1AAA2-0MF006
5. BLUE UC1AAA2-0ZF006
6. VIOLET UC1AAA2-0LF006
7. WHITE UC1AAA2-08F006
8. GRAY
9. BLACK

PART 3 - EXECUTION

3.1 GENERAL

A. Fire Wall Penetrations: The contractor shall avoid penetration of fire-rated walls and floors wherever possible. Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.

B. Allowable Cable Bend Radius and Pull Tension: In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation. Refer to the cable manufacturers allowable bend radius and pull tension data for the maximum allowable limits.

C. Cable Lubricants: After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.

D. Pull Strings: Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract. Pull test is not to exceed 200 pounds. Data and video cables can be pulled together with pull strings.

E. Conduit Fill: Conduit fill shall not exceed 40%.

F. Damage:
1. The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over-twisted pairs at terminals and cable sheath removed too far (over 1-1/2 inches).
2. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.

G. Clean Up:
All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.

3.2 DOCUMENTATION

A. Labels

The Contractor will label all outlets using permanent/legible typed or machine engraved labels approved by the Owner (no handwritten labels permitted). Label patch panels in the wiring closet to match those on the corresponding data outlets. The font shall be at least on-eighth inch (1/8”) in height, block. All labels shall correspond to as-builts and to final test reports.

The following nomenclature should be used when labeling data/voice jacks:

All cables being served by MDF closet shall begin with ‘M’ all IDF served cables shall begin with I# (# designated IDF closet number).

Next identification letter shall refer to patch panel that is serving outlet (A, B, C…)

Next identification shall note what # data port on patch panel (1 thru 48).

Example:

Outlet from 23rd port of the third patch panel from top of rack located at IDF-2

I2-C23

Outlet from the 5th port of the second patch panel from the top of rack located at MDF

M-B5

B. Floor Plan

A floor plan clearly labeled with all outlet jack numbers shall be included in the as-built plans.

C. Contractor shall label wiring on both ends of cable at workstation and headend locations with machine labels, no exceptions.

3.3 EQUIPMENT RACK CONFIGURATION

A. Equipment Racks: Equipment racks shall be assembled and mounted in locations shown on the Drawings and as detailed. Each rack shall be securely mounted to the floor and braced to the wall with cable tray in accordance with the manufacturer's instructions and recommendations. Racks shall be mounted such that the side rails are plumb with vertical cable management panels. Racks to be located such that future expansion can occur without relocating existing racks. Racks shall be grounded in accordance with CEC requirements.

B. Wire Management Components: Horizontal cable management panels shall be installed directly above and below each patch panel, also 1 per patch panel should be left at site to accommodate the switch gear when they are installed. Vertical cable management panels shall be installed on each side of the rack. In instances where more than one rack is installed in a single location, vertical cable management shall be installed between the racks and on either side.

C. Cable Placement: Cable installation in the Wiring Closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing area horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.

D. Cable Routing: Cable shall be routed as close as possible to the ceiling, floor, or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the Wiring Closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.

E. Installation: All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels.

F. Hardware: Provide rack and jack panel hardware as required for all data station wiring.

3.4 STATION WIRING INSTALLATION

A. General:
1. Cabling between wiring closet and workstation locations shall be made as individual home runs. No intermediate punch down blocks or splices may be installed or utilized between the wiring closet and the communications outlet at the workstation location.
2. All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of the cable. There shall never be more than one and one-half inches of unsheathed enhanced Category 6A UTP cable at either the wiring closet or the workstation termination locations.

B. Exposed Cable:
1. All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed station cable will only be run where indicated on the Drawings.
2. Additional exposed cable runs will require Owner approval and will only be allowed when no other options exist.

C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.

D. Cable Routes:
   1. All cabling placed in ceiling areas must be in conduit, cable tray or J-Hooks. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Do not route cable through webbing of structural steel. Cabling must be supported in dedicated supports intended to support cabling as described in this section.
   2. Attaching cable to pipes or other mechanical items is not permitted. Use J-Hooks for up to 15 cables (Chatsworth hooks with appropriate brackets). All runs of sixteen (16) or more cables, provide cable rings on 36-inch maximum centers to hang cable. Communications cable shall be rerouted so as to provide a minimum of 18 inches spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling. Grid support wires. Cable runs shall be parallel or perpendicular to building structure. Multiple cables to be bundled together every 6 feet.

3.5 STATION HARDWARE

A. Flush Mount Jacks: Flush mount jacks shall be mounted in a faceplate with backbox.

B. Placement: Where possible, the communications outlet shall be located so that its centerline is 18 inches above floor level or 12 inches above permanent bench surfaces. Outlets shall not be mounted on temporary, movable, or removable surfaces, doors, or access hatches.

C. RJ-45 Jack Pin Assignments:
   1. Pin connections for data station cable outlets and patch panels shall match EIA/TIA 568 modular jack wiring recommendation T568B.
   2. Pin connections at data jack panels shall match pin connections at outlets (straight through wiring).

3.6 CABLE TESTING REQUIREMENTS

A. Notification: The Owner and Engineer shall be notified one week prior to any testing so that the testing may be witnessed.

B. Inspection: Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.

C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor’s use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors.

D. Errors: When errors are found, the source of each shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Re-test results must be provided on Owner approved forms and witnessed by Owner.

E. Twisted Pair Cable Testing:
   1. At a minimum, the Contractor shall test all station drop cable pairs from Data Closet termination patch panels to outlet device RJ45 jacks. Category 6A products shall be tested for compliance to ANSI/TIA/EIA 568A and ISO/IES

11801 for a Category 6A rated installation. Test equipment used shall meet TIA/EIA TSB-67, Level II accuracy. Further, the contractor shall have a copy of TSB-67 in their possession and be familiar with its contents.

2. Each wire/pair shall be tested at both ends for the following:
   a. Wire map (pin to pin connectivity)
   b. Length (in feet)
   c. Attenuation
   d. Near end cross talk (NEXT)
   e. Power Sum
3. Test equipment shall provide an electronic and printed record of these tests.
4. Test results for each Category 6A four-pair UTP cable must be submitted with identification to match labels on all patch panel ports and RJ45 jacks and must match as-builts associated with that cable.

F. Fiber Optic Cable Testing

1. Testing device for fiber optic cables shall be a high quality OTDR (Optical Time-Domain Reflectometer) equipped with a printer. The printed data shall show, in addition to any summary information, the complete test trace and all relevant scale settings. The OTDR must have the capability to take measurements from bare fiber strands as well as SC connector terminations.

2. All fiber optic cable shall be tested on the reel before installation to insure that it meets the specifications outlined herein.

3. After installation the Contractor shall test each fiber strand in accordance the EIA 455-171 Method D procedures (bi-directional testing) at both 850nm and 1300nm for multimode or 1310nm and 1550nm for singlemode. A form shall be completed for each cable showing data recorded for each strand including length, total segment (end-to-end) loss (dB) and connector losses (dB) at each end. In addition, the printed data strip for each strand shall be attached to the form. Patch cables shall also be tested.

4. Acceptable fiber optic connector loss shall not exceed .75dB per mated pair. The Contractor is responsible for obtaining minimum loss in fiber connections and polishing per manufacturer specifications.

5. Singlemode:
   a. Singlemode fibers shall have a maximum attenuation of 1.0 dB/km at 1310 nm and 1.0 dB/km at 1550 nm.

6. Multimode:
   a. 50/125um micron multimode fibers shall have a maximum attenuation of 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm. Minimum bandwidth shall be 2000 MHz/km at 850 nm and 500 MHz/km at 1300 nm.

7. **OTDR shots shall be provided for each strand of fiber optics completely installed and terminated.**

3.7 INSPECTION

A. Conformance to the installation practices covered above are to be verified when completed. In some cases, the Owner/Designer may inspect before acceptance.
   1. Written Test Report:
      a. Complete test results, including actual values associated with tests.
      b. Show all certifications for telecommunications wiring systems.

c. Include cable maps showing each cable route and keyed to cable labels. Provide owner with complete floor plans identifying outlet location and cable routing drawing in AutoCad format. Provide electronic copy of drawings to owner in AutoCad version 14 or greater.

d. Documentation of outlet, cable, and rack labeling system.

B. After performing all tests, tabulate results and bind together in format acceptable to Owner. Installer shall provide written certification in the test report that telecommunications cable is properly installed and test results certify system to all specified standards.

END OF SECTION 27 10 00

SECTION 27 21 00 – DATA COMMUNICATIONS SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Work included in this section shall be the provision of core and edge network electronics, wireless access points, IP phones, and UPS devices.

1.2 DESCRIPTION

A. The Contractor shall be responsible to furnish, install and configure an extension to an existing district wide IP based Ethernet and VOIP network which shall include, but not be limited to a new core switches, new distributed access switches and additional in MDF / IDF racks as shown on drawings, as well as a powered Ethernet system for support of a new centrally-hosted wireless access point system which shall span the new complex and interface with other existing facilities.

B. Contractor shall provide any and all SFP modules, fiber optic patch cables, stacking cables, DAC cables, other hardware, etc., to provide complete connectivity of all network devices.

C. The Owner shall configure all Contractor provided network devices.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Division 01 – General Requirements

B. 27 10 00 – CATEGORY 6A STRUCTURED CABLING SYSTEM

1.4 GENERAL SYSTEM REQUIREMENTS

A. The Technology Contractor shall provide all equipment, devices, cabling and related hardware to create an autonomous network. The Contractor shall provide a complete and functioning system, based on the designs as set forth in the Construction Documents. Any and all equipment, either implied or intentionally omitted from these documents, but generally accepted as being required for the completion of the installation, as represented in these Construction Documents, shall be provided by the Contractor at no additional cost to the Owner.

B. The Technology Contractor shall verify any and all power requirements.

1.5 CONTRACTORS REQUIREMENTS

A. The Contractor shall be certified by the manufacturer of the equipment being provided for the installation and maintenance of same.

B. The Contractor shall maintain a local shop within 75 miles of the project location which is staffed by certified personnel, specifically stationed at that location for the purpose of servicing the local clientele.

PART 2 - PRODUCTS

2.1 GENERAL

A. The equipment and devices provided by the Technology Contractor shall be as indicated on the

Drawings and in these Specifications.

B. The Technology Contractor shall provide all cabling and related hardware as recommended by the Manufacturer and/or as indicated on the Drawings and in these Specifications.

C. All devices, cabling and hardware shall be new, and UL listed as required.

D. All equipment shall compliant, as applicable, to:

1. FCC Part 15 (CFR 47) Class A
2. EN55022 and EN55024
3. CISPR 22
4. CE marking
5. AS/NZS 3548

2.2 NETWORK SWITCHES

A. Campus Core Distribution:

1. Dell N2248PX-ON at high schools.
2. Core switches shall be equipped with dual power supplies.
3. Provide 5 Year Advantage DNA Licensing.
4. Provide 5 Year Smartnet support.
5. Core switches shall be stacked with 100G-AOC1M for SVL Links and 10G-CU1M DAD Links.
6. All down links shall use single mode SFP-10G-LR modules.

B. Campus Access Switches:

1. Access switch stacks shall be created for each rack with an uplink module in the first and last switch of the stack. Uplink modules shall be Aruba 6300M.
2. The top switch of each stack should be equipped with a secondary power supply.
3. A 10G-LR shall be installed in port 1 of each module and connected in a port-channel to the core.
4. Each rack of equipment shall be physically stacked and power stacked.

C. Quantity as shown on drawings.

D. All extra devices shall be turned over to the Owner for Attic Stock.

E. Coordinate with Owner.

2.3 WIRELESS ACCESS POINTS

A. High Schools

   a. Wireless access points shall be Aruba

   b. Contractor to provide all necessary equipment to install access point.

   c. Contractor to provide protective cover in gyms.

   d. Contractor to provide Aruba weatherproof wireless access points for exterior locations.

2.4 IP Telephones

A. Every site shall receive 1 qty. Yealink SIP-T23G to be used for the site receptionist.

B. Provide 1 qty. SIP-T23G in administrative offices.

C. Provide 1 qty. SIP-T23G in each classroom.

D. Provide 1 qty. SIP-T23G in each conference room.

2.5 UPS

A. Provide a minimum of 1 UPS per IDF / MDF rack.

   1. Eaton 5P3000RT with a network card, 2-post rack mount, and CAT6 orange slim cable. for all floor mounted racks and cabinets.

   2. Eaton 5P1500R with a network card, rack shelf, and CAT6 orange slim cable for all wall racks and cabinets with 2 network devices (switches, routers, etc) or less.

   3. If a wall rack or cabinet has more than 2 network devices in it, provide 5P3000 UPS.

   4. Environmental Monitoring Probe shall be provided for each MDF/IDF/Cabinet.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Provide all configurations for all switches.

B. Coordinate configuration requirements with the Owner's Security/IT personnel.

C. The Contractor shall verify all connectivity from the Core to all end devices.

D. The Contractor shall provide all programming, interfaces, hardware and components to interface the existing District switches with the new core switch

E. Coordinate with the District’s IT Department new switch integration with existing file server.

F. Install new data network Ethernet switches and validate connectivity throughout. Verify all VLANs, QoS, IP Routing and IP Subnets. Coordinate with District’s IT Department.

G. Coordinate network installation and integration with other systems connected to the network with the District’s and applicable DA-site’s technical and operational requirements.

H. Install and set up UPS units and establish power down procedures.

I. Connect system to DA-site WAN links and configure per CA-site requirements.

3.2 WORK COMPLETION

A. All products and system configurations will be fully tested and operational prior to final payment.

B. The Contractor shall provide a copy of all testing documentation to the Owner at the time of system commissioning and training. Final payment shall be held until such time that final commissioning and training is completed to the satisfaction of the Owner.

C. System Commissioning, including testing and certifications, shall be completed by a factory representative prior to final payment. All system operation or installation deficiencies shall be documented and submitted to the Owner at time of commissioning, and shall be resolved prior to final training and final payment.

D. Test all network connectivity end to end and document the proper operation of the network. Submit written report to Owner/Engineer.

3.3 TRAINING

A. Provide a minimum of forty (40) hours of training to the District's personnel. Plan for multiple training trips to the site. Training sessions shall cover the following topics at a minimum:

   a. System equipment connectivity

   b. Device configurations

   c. Operation, maintenance and upgrade procedures

B. Training to be arranged with District personnel. 40 hours should be spread out over the length of the warranty (example: 8 hours at project turnover/completion, 8 hours at 3 months, 8 hours at 6 months, 8 hours at 1 year, 4 hours at 2 years, 4 hours at 3 years).

C. Training to occur in maximum of 4 hour increments per personnel or groups of personnel.

D. Consider requirement Contractor to provide manufacturer training vouches for a portion of the training, which are valid during the warranty period.

E. Training shall be performed by a certified manufacturer instructor.

F. Training schedule shall be coordinated with District personnel and their needs.

G. Training plan, time line, and agenda shall be provided to District IT personnel and signed off by District and Contractor. Provide with close-out documentation.

H. Warranty certificate and agreement shall be provided in the close-out documentation and to District IT personnel at initial training session.

I. Provide two (2) digital video copies, 720p resolution minimum, of the training sessions in DVD format.

3.4 LABELING AND MARKING

A. Provide a printed, typed schedule of all data ports according to each related room jack designation for each IDF and equipment racks in accordance with the District's requirements.

3.5 TESTING

A. Contractor shall provide a complete wireless survey before placing the Wireless Access Points.

B. Verify and demonstrate proper operation of all switches, wireless access points, VLANs, routing, WAN connectivity and possible ATM Connectivity with the District and DA-site representative.

3.6 WARRANTY

A. The Local Area Network Electronics and software shall be fully warranted for three (3) years from date of substantial completion by the contractor and manufacturer. If any defects are found within this warranty period, the defective system component shall be replaced at no extra cost to the Owner for parts or labor. Provide a statement of this warranty with the O&M manuals and the I.T. director. Make available a service contract offering continuing factory authorized service of this system after the initial warranty period.

END OF SECTION 27 21 00

SECTION 27 41 16 - INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

CONDITIONS OF THE CONTRACT AND DIVISION 01, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 RELATED WORK

A. All Division 26 at it relates to this scope of work.
B. Section 27 10 00 – Category 6A Structured Cabling System.

1.2 DESCRIPTION

A. Summary of Work:
   1. Provide a complete and tested classroom video presentation system. The video presentation system shall include, but not be limited to the following:
      a. At all interactive board and LCD monitor locations; the current project construction contractor shall provide and install all audiovisual faceplates, transmission media infrastructure, and a patch cables required to connect each presentation display device to the associate input device.
      b. At all interactive locations, the project construction contractor shall provide and install all audiovisual faceplates, transmission media infrastructure, and a patch cables required to connect each presentation display device to the associate input device
      c. Proposing contractor must coordinate with project construction schedule and existing technology system contractor to provide complete turn-key solution to owner.
   2. The installation shall comply with all applicable codes and standards in effect at the job site and as indicated in the Drawings and Specifications.
   3. Reference project drawings for locations, quantities, and coordination with other trades.
   4. Contractor shall provide a mock up system integrated with two quantity video displays for video switching for demonstration to the District upon award of this contract. Coordinate with the Architect and District to schedule date, time and location for system demonstration.

1.3 QUALITY ASSURANCE

A. Contractors who do not currently possess the necessary qualifications, trained and experienced personnel, financial capacity, and meet the other requirements herein describe will be disqualified.

B. The Contractor, as a business entity, shall be an authorized distributor and designated representative of the equipment manufacturer, with full warranty privileges. The proposed contractor shall have been actively engaged in the business of selling, installing, and servicing commercial building commercial communication systems for a period of at least 5 years.

C. Recently formed companies are acceptable only if specific pre-approval is requested, and granted by the Architect/Engineer, based on experience of key personnel, current and completed projects, and all licensing requirements are met 10 working days prior to the contract proposal date.

D. The Contractor shall have an office within 150-miles of the job site, staffed with trained technicians who are qualified and licensed to supervise the installation, to be responsible that the system is installed as submitted, to conduct system start up and perform a 100 percent operational audit of all installed devices, to instruct the Owners representatives in the proper

operation of the system, and to provide service throughout the warranty period. The contractor shall be capable of dispatching technicians to repair a system within six hours of a service request.

E. The Contractor shall be fully experienced in the design and installation of the type of system herein specified, and shall furnish with the contract proposal an itemized list of the installations of the type specified herein. The list shall include the name of the project, date of completion, the amount of the contract, the name, and telephone number of a qualified person to contact for reference. This list must contain at least two (2) projects within a 150- mile radius of the school district to allow school administration officials to visit the job site for review of the system installation and service. Each reference project listed must utilize equipment by the same manufacturer as the proposed system.

F. The Contractor shall employ factory-trained technicians capable of supporting the maintenance of the system. No contract employees are allowed unless they have been to the factory service school within the last 18 months. A certificate of this training shall be provided with the contractors' submittal.

G. The Contractor shall not have any grievances or complaints of record regarding workmanship, code compliance, or service response. A Proposed Contractor that has any prior finding(s) of a code violation or has any litigation in process concerning the installation of a communication system is unacceptable.

H. Any discrepancy in quantity or part numbers between the drawings and the bid specifications shall be brought to the attention of the Consultant for clarification during the bidding period. No allowance shall be made to the Contractor by reason of failure to have brought said discrepancies to the attention of the Consultant prior to award of contract.

I. The Contractor shall provide all necessary patch cables, riser/plenum cabling and connectors interconnecting all equipment and all required A/V and network equipment to provide for fully functional systems. In addition, all cabling raceway, support systems, sleeves and any other materials required to properly install and support cabling systems.

J. The ability of the Contractor to obtain plans and provide a performance bond shall not be regarded as the sole qualification of the Contractors' competency and responsibility to meet the requirements and obligations of the contract.

K. The Builder shall be satisfied that a proposed Contractor meets all the requirements expressed herein before including the Contractor's proposal in the project.

L. The Owner may investigate, as they deem necessary to determine the ability of the proposed Contractor to perform the work. The proposed Contractor shall furnish to the Owner with any information or data requested for this purpose.

M. The Owner reserves the right to reject any contract proposal if the evidence submitted, or their investigation, fails to indicate that the Contractor is qualified to fulfill of any part of the contract or to complete the work contemplated therein.

N. The Owner reserves the right to reject the proposal of any Contractor who has previously failed to perform properly, or complete on time, contracts of a similar nature.

O. Pre-Construction Meeting:

1. The successful Contractor shall attend mandatory pre-construction meetings with individuals deemed necessary by the Owner's representative prior to the start of the work.

2. The contractor shall provide a mock-up of the complete classroom projector system to include all products listed in part 2 of this specification.
3. All proposing contractors must have ability to demonstrate a/v system being proposed and provide owner with completely installed system to evaluate performance and operation.

P. Acceptance:

1. The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

1.4 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
1. Latest Local Codes and Amendments
2. 2022 California Electrical Code

B. Other References:
1. TIA/EIA-568-A Commercial Building Telecommunications Wiring Standard
2. EIA/TIA-569 Commercial Building Standard for Telecommunication Pathways and Spaces.
3. TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
4. TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
5. EIA/TIA 455-A Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices and Other Fiber Optic Components.
6. TIA/EIA TSB 67 Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
7. TIA/EIA TSB 72 Centralized Optical Fiber Cabling Guidelines
8. ISO/IEC 1180 Generic Cabling Standard
9. EN 50173 Generic Cabling Standards for Customer Premises
10. ANSI/EIA/TIA 526-14 Optical Power Loss Measurements of Installed Multimode Fiber Cable Plan.

C. Governing Codes and Conflicts:
1. If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes and regulations.

1.5 ABBREVIATIONS

A. The following abbreviations are used in this document:

WMP	Wall Mounted Projector
PS	Presentation Station
ILCD	Interactive Flat panel screen/monitor

1.6 SUBMITTALS

A. Project Initiation:
1. Within fourteen (14) days of Notice to Proceed, the data network system installer shall furnish the following in a single consolidated submittal:

a. Permits: The Contractor shall obtain all required permits and provide copies to the Owner/Architect/Engineer.

b. Product Literature: Complete manufacturer's product literature for all cable, patch panels, cross-connect blocks, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be provided

c. Construction Schedule: A time-scaled Construction Schedule, using PERT/CPM, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.

d. Specification Compliance: A letter shall be provided stating, by section and subsection, that the Audio-Video installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. NO DEVIATIONS SHALL BE ACCEPTABLE UNTIL THEY HAVE BEEN ACCEPTED BY THE PROJECT'S TECHNOLOGY CONSULTANT.

e. Certifications: The contractor shall submit all of the following certifications and the certifications must contain dates which are valid from the date of proposal and not expirer any sooner than 12 months after substantial completion of the project.

1) Installer Certification: This certification shall show successful completion of system training and must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.

B. Shop Drawings:

1. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:

a. Proposed circuit routing and circuit grouping plan prepared by a qualified system designer. The credentials of the designer must be accepted the project's technology consultant prior to submitting a system design.

b. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:

1) Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
2) Location of sleeved wall pass-thru
3) Size of sleeve at each location installed
4) Quantity of cable passing through each sleeve
5) Location of devices, input plates, and control plates in each room
6) Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.

c. Drawing Compliance: A letter shall be provided stating that the Audio-Video installer complies with the ENTIRE project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. NO DEVIATIONS SHALL BE

ACCEPTABLE UNTIL THEY HAVE BEEN ACCEPTED BY THE OWNER.

C. Close-out Procedures:

1. Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance. The close out submittals shall include:
   a. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
   b. Provide complete test reports for all cabling and devices that comprise system as outlined in this document.
   c. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
   d. The manual shall also include Manufacturer’s data sheets and installation manuals/instructions for all equipment installed, a list of recommended spare parts.
   e. Generic or typical owner’s instruction and operation manual shall not be acceptable to fulfill this requirement.
   f. An up-to-date record (“as-built”) set of approved shop drawing prints that have been revised to show each and every change made to the structure cabling system from the original approved shop drawings. Drawings shall consist of a scaled plan of each building showing the placement of each individual item of the Audio-Video system equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
   g. As-built Drawings shall include cable pathways, and device locations with correct labeling. The as-built drawings shall be prepared using AutoCAD 2013 or later. Provide the Owner with electronic versions of the as-builts on 2 quantity 8GB thumb drive media.
   h. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
   i. A copy of the manufacturer’s warranty on the installed system.
   j. 5 sets of keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
   k. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
   l. Quick-start Guide for each system written with the assumption that the intended reader is technically inexperienced and unfamiliar with the facility. Quick-start Guide shall be provided in hard-copy format and in pdf format on an 8GB thumbdrive with the close-out documentation.
   m. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner’s operating personnel to include location, operation, and maintenance of all included systems and equipment. Minimum amount of training time shall be at least 8 hours in four 2 hour sessions.

n. Contractor shall video record training sessions and include videos in close-out documentation in DVD format.

PART 2 - PRODUCTS

2.1 GENERAL

ALL PRODUCTS LISTED IN THIS SECTION SHALL BE PROVIDED AND INSTALLED BY THE CONTRACTOR.

A. Installation: The cabling shall be installed per requirements of the manufacturer and the Project Documents utilizing materials meeting all applicable EIA/BICSI standards. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.

B. Materials: Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the EIA/BICSI specifications. All approved equivalent products will be published by addendum ten days prior to proposal for Architect/Engineer to review.

C. Testing: All installed cabling shall be tested 100% good after installation by the Contractor.

D. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:
CM Communications Cable
CMP Plenum Rated Communications Cable
CMR Riser-Rated Communications Cable

E. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.

F. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.
1. Approved Products
a. Twisted-pair cable: Dyna-Blue
American Polywater

G. Fire Wall Sealant: Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant.
1. Approved Products
i. Wiremold Flamestopper - #FS4R-RED
ii. Precut 4" conduit - #FSPCC4758

2.2 INTEGRATED FLAT PANEL MONITOR (indicated as 'ILCD' on drawings)

A. All Displays and mounts on this project shall be Owner Furnished Owner Installed (OFOI)
B. Provide and install 1 qty. Balance Box 400 height adjustable mount for each display.
C. Quantity as shown on drawings.

2.3 ADDITIONAL PARTS

A. Provide all materials listed in this specification section to furnish the media infrastructure from input component to output component, to furnish all classroom presentation system locations identified in drawings. Any change orders issued during the course of this project shall pull materials from this additional stock until the stock is depleted. In the event that that such stock is remaining upon the completion of the project, the contractor shall deliver the excess to the owner for attic stock.

2.4 CABLE ROUTING/PATHWAY

A. Cable Support System: All audio-video cabling shall be installed and supported using a Caddy Cable Cat or Arlington Loop cable support system at 4'-0" intervals unless installed in conduit. Do not exceed manufacture recommendation for the quantity of cables supported in an individual support.

B. All cable bundles shall be grouped together using plenum rated Velcro for the entire run above and below the ceilings.

2.5 CLASSROOM AUDIO / VIDEO SYSTEM

A. Provide for each classroom:

i. One (1) MLC Plus 100 Controller with all necessary equipment

ii. One (1) DXP 42 HD 4K PLUS switcher with all necessary hardware

iii. One (1) MPA 152 Amplifier.

iv. One (1) WPD 170 Wall plate.

v. One (1) FF 120T Ceiling tile speaker's product no. 42-120-13 with all necessary hardware.

vi. One Chief CMS492 ceiling mounted enclosure.

vii. Four (4) HD Pro P/35 Plenum Rated HDMI cables Product No. 26-726-35

B. Contractor shall follow installation instructions provided by the manufacturer. Installation drawings shall show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.

C. Contractor shall examine the installation drawings and verify the conditions governing the work on the job site. Contractor shall arrange accordingly, providing such fittings, horizontal cable raceways, conduits, junction boxes and accessories as may be required to meet such conditions.

D. Deviations from the installation drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the Systems, shall not be made without the written approval of the Engineer.

E. Contractor shall provide all cables, connectors, adapters, etc., required to provide for full integration and proper functionality of all devices.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor is required to properly mount Interactive display and connect each display to each HDMI in the room.

B. Contractor is required to thoroughly test and verify operation of all display inputs and video modes prior to project completion.

C. Contractor shall provide owner with written verification test process and results once all projectors have been installed, tested, and placed in final condition.

D. Damage:
1. The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over-twisted pairs at terminals and cable sheath removed too far (over 1/4 inches).

E. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.

F. Clean Up:
1. All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.

3.2 DOCUMENTATION

A. Contractor shall provide owner with detailed serial number listing and associated graphical room number designation equipment was installed. Contractor shall use actual graphical package room numbers not architectural plan numbers from construction set.

3.3 STATION WIRING INSTALLATION

A. General:
1. All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of the cable. There shall never be more than one and one-half inches of unsheathed enhanced Category 6 UTP cable at either the wiring closet or the workstation termination locations.

B. Exposed Cable:
1. All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed station cable will only be run where indicated on the Drawings.
Additional exposed cable runs will require Owner approval, and will only be allowed when no other options exist.

C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.

D. Cable Routes:
1. All cabling placed in ceiling areas must be in conduit, cable tray or Caddy Cable Cat or Arlington Loop cable support. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Do not route cable through webbing of structural steel. Cabling must be supported in dedicated supports intended to support cabling as described in this section. Contractor shall adhere to the manufacturer's suggested fill ratio for each size cable support installed.

2. Attaching cable to pipes or other mechanical items is not permitted. Communications cable shall be rerouted so as to provide a minimum of 18 inches spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling. Grid support wires. Cable runs shall be routed down the corridors; parallel or perpendicular to building structure. Multiple cables to be bundled together at and between each cable support installed.

3. Contractor shall be responsible for coordinating with other trades on the project so that the installed cable pathway does not interfere with the installation of other systems to insure that mechanical ducts, pipes, conduits, or any other above ceiling systems are not putting unnecessary stress on any portion of the install audio-video cabling.

3.4 STATION HARDWARE

A. Flush Mount Jacks: Flush mount jacks shall be mounted in a faceplate with back box.

B. Placement: As shown on drawings.

3.5 TESTING, CERTIFICATION, WARRANTY, SERVICE

A. A factory trained service technician shall supervise the final connections and testing of the system and it shall be subject to the final acceptance of the Architect, Engineer, and local authorities. Testing shall ensure the following:
   1. Before energizing the cables and wires, check for correct connections and test for short-circuits, ground faults, continuity, and insulation.
   2. Complete and functional system.
   3. Installed in accordance with manufacturer's instructions.
   4. Upon completion of the testing, the manufacturer or his representative shall issue to the Owner a letter of certification attesting to the fact that he has tested and adjusted the system, that all components are properly installed and free of defects, and that the system is in compliance with this specification.

B. The contractor shall provide a warranty for the installed system. The warranty shall be against defects in material or workmanship for a period of one (1) year from the date of substantial completion. Any equipment or wiring shown to be defective shall be replaced, repaired, or adjusted free of charge. All labor and materials shall be provided at no expense to the Owner. All equipment will carry a one year warranty or manufacturer's warranty whichever is greater.

C. The system manufacturer shall maintain engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.

3.6 DRAWINGS, MANUALS AND TRAINING

A. In addition, the contractor shall furnish complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets. Manuals shall include wiring diagrams to indicate internal wiring for each device and the interconnections between the items of equipment. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system. Provide a parts list with manufacturer and model number for commonly replaced parts. Include complete instructions for the inspection, testing, and maintenance of the system. Include copies of all programming sheets used to configure the system.

B. The Contractor shall conduct formal on-site training sessions. Provide documented general

instruction as follows:

1. Provide instruction to District personnel to include the location, inspection, maintenance, testing, and operation of all system components. Provide a minimum of four (8) hours -- four 2-hour sessions separated by a minimum of two weeks.
2. Provide instruction to designated personnel on the functions and operation of the intercom and master clock system including emergency and service request procedures. Provide a minimum of four (4) hours--two 2-hour sessions separated by a minimum of two weeks.

END OF SECTION 27 41 16

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.

1.2 SUMMARY

A. Work included:
   1. Provide assisted listening system as described herein.

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 13 00 – ACCESS CONTROL SYSTEM

CONDITIONS OF THE CONTRACT AND DIVISION 01, as applicable, apply to this Section.

PART 1- GENERAL

1.1 RELATED WORK

A. Division 26
B. 28 23 00 – IP Security Camera System

1.2 WORK INCLUDED

A. The Contractor shall furnish and install a complete microprocessor-based access control system as specified herein. The system shall include, but not be limited to, all control equipment, power supplies, power circuits, signal initiating and signaling devices, conduit, wire, fittings, and all other accessories required to provide a complete and operable system.

B. Security system devices indicated are for reference and coordination purposes only. The installing contractor shall design and provide a complete system, meeting the requirement of specification. Contractor shall provide all security system devices required for complete system perimeter coverage acceptable to all governing authorities, Architect and Owner.

C. The system shall include Security Card reader access interfaces at all locations noted.

1. The Control System shall be the product of a single manufacturer.
2. Tag all conductors or cables at each end.
3. Installation of modules and cards.
4. Interconnection of security panels.
5. Installation of new security devices.
6. Integration with existing Intrusion Detection and IP Security Camera system as required by owner.
7. Preconstruction meeting with Owner's personnel, installing technician and project superintendent.
8. Installation of all Card Readers and field devices.
9. Connection of Door Hardware to the Access Control System.

D. The contractor shall connect this location to the district monitoring station as designated by the owner.

E. Prior to rough-in or installation of any access control device, Contractor will be required to attend pre-construction meetings with the Door Hardware contractor to aid in coordination and help avoid gap / overlap during the installation phase.

F. Contractor must be in good standing with the District and have no outstanding performance or warranty items at the time of bid. Any outstanding items or issues is grounds to disqualify the Contractor's bid.

G. All structured cabling for data connections for door controllers and vestibule panel to connect to the owner's LAN shall be installed by the structured cabling contractor. Exact location of door controllers will be coordinated between Contractor and the structured cabling contractor.

H. All power circuits, conduits, penetrations and sleeves required to complete installation of the control system shall be installed by the electrical contractor. Coordination meeting(s) between Contractor and electrical contractor will be required to facilitate installation of conduits,

pathways, and power circuits. (Ref. 28-13-00 2.6.A.4 & 28-13-00 2.6.A.5)

1.3 CODES AND STANDARDS

The system shall comply with the applicable Codes and Standards as follows:

A. National Fire Protection Association Standards:
   1. NFPA 70 California Electric Code
   2. NFPA 72 California Fire Alarm Code
   3. NFPA 101 Life Safety Code

B. Local & State Building Codes

C. Requirements of Local Authorities having Jurisdiction

D. Underwriters Laboratory Requirements and Listings for use in Security Alarm Systems.

E. Requirements of American Disabilities Act (Public law 101-336).

F. State Fire Marshall.

1.4 QUALITY ASSURANCE

A. Contractor Qualifications:
   1. The installing contractor shall be the authorized representative of the Access Control Manufacturer to sell, install, and service the proposed manufacturer's equipment. The installing contractor shall have represented the security alarm manufacturer's product for at least two years.
   2. The installing contractor shall be licensed by the State of California as a security services contractor to design, sell, install, and service security alarm systems.
   3. The installing contractor shall provide 24-hour, 365 day per year emergency service with factory trained service technicians.
   4. The installing contractor shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security alarm systems for at least ten (10) years.
   5. All Contractors must submit to the owner prior to starting any work the factory training certificates for all personnel that will be working on the access control system. No person is allowed to work on the system without proper manufacturer's certification.
   6. The proposing contractor for this system and the installing contractor of this system shall be of the same organization. Absolutely no subcontracting of any portion of this system by the proposing contractor will be allowed.
   7. Contractor must be a current integrator of the specified solution in the closet major metropolitan area marketplace, have a permanent office located within 75 miles of the project, and be able to include information on current support staff to be able to service this client.

1.5 SUBMITTALS

A. The installing contractor and/or equipment supplier shall provide complete and detailed shop drawings and include:
   1. Control panel wiring and interconnection schematics.
   2. Complete point to point wiring diagrams.
   3. Riser diagrams.
   4. Complete floor plan drawings locating all system devices.

5. Factory data sheets on each piece of equipment proposed.
6. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
7. Complete system bill of material.
8. Line by line specification review stating compliance or deviation.

B. All submittal data will be in bound form with Contractor's name, supplier's name, project name, and state security license number adequately identified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND INSTALLERS

A. AMAG Technology Inc
20701 Manhattan Place
Torrance, Ca 90501
(310) 518.2380
http://www.amag.com

2.2 VESTIBULE ACCESS CONTROL PANEL

A. All hardware is to be mounted in an Altronix Trove 2 enclosure with RSB2 switch plate located in the nearest IDF to the main entry vestibule.

B. One (1) Intelligent Door Controller and door SubControllers shall be populated in the Altronix enclosure sufficient to provide access controls for all doors to be controlled from the IDF, for a minimum of eight (8) doors. The Intelligent Controller shall be IP-based. SubControllers should connect to the Intelligent Controller via network or RS-485 Data Bus.

C. An Altronix eFlow 10XNB power supply is required to be provided and installed along with a PDS8CB or PD16W Power Distribution Module and ACM8CB Access Power Controller. A (1) VR6 regulator in the enclosure to provide correct power distribution.

D. Panel must have a provided emergency power circuit to the RB2 switch panel to enable ease of power shut off for the power supply by one switch and main panel transformer on the secondary switch.

E. Two Category 6 network drops are required within the panel for local configuration of system with laptop and primary panel communication. Each drop should be properly labeled per network cabling guidelines.

F. Panel IP network configuration information shall be provided by the owner.

G. All vestibule doors are to be wired back to this main panel with approved composite access control cable and terminated in the following order:
1. Front Entry Door – Reader 1 – 24 VDC/12 VDC output 1
2. Reception Entry Door – Reader 2 – 24 VDC/12 VDC output 2
3. Vestibule Exit Door – Reader 3 – 24 VDC/12 VDC output 3
4. Reception Exit Door – Reader 4 - 24 VDC/12 VDC output 4

H. Final software configuration / programming of system integration will require owner / contractor consultation.

I. Vestibule Access Control Panel shall not be limited to provide access control power and controllers to the vestibule only, but shall be available for other controlled doors in the area of

influence of that IDF.

2.3 PERIMETER AND INTERIOR DOOR CONTROL PANELS

A. Door Control Panels are to be installed as needed in MDF/IDF rooms throughout the campus, to provide communications and power for access control devices in the area of influence of each IDF.

B. All hardware is to be mounted in an Altronix Trove 2 enclosure with RSB2 switch plate. Panel must have a provided emergency power circuit to the RB2 switch panel to enable ease of power shut off for the power supply by one switch and main panel transformer on the secondary switch.

C. One (1) Intelligent Door Controller and door SubControllers shall be populated in the Altronix enclosure sufficient to provide access controls for all doors to be controlled from the IDF, for a minimum eight (8) doors. The Intelligent Controller shall be IP-based. SubControllers should connect to the Intelligent Controller via network or RS-485 Data Bus.

D. An Altronix eFlow 10xNB power supply is required to be provided and installed along with a PDS8CB or PD16W Power Distribution Module and ACM8CB Access Power Controller. A (1) VR6 regulator in the enclosure to provide correct power distribution.

E. Two Category 6 network drops are required within the panel for local configuration of system with laptop and primary panel communication. Each drop should be properly labeled per network cabling guidelines.

F. Panel IP network configuration information shall be provided by the owner.

G. Final software configuration / programming of the system integration will require owner / contractor consultation.

2.4 VEHICLE ACCESS GATES

A. Access Controlled gates shall be connected to an IP-based 2-Door controller which may be installed near the building perimeter wall, closest to the gate, to provide additional cabling distance.

B. 2N Video Intercom (w/Wiegand and Prox reader module) to be installed on pedestal housing for access control entry through controlled vehicle gate.

C. All gates must have a Tagmaster XT-1 RFID reader installed as the secondary for utilization of district vehicle tag system.

D. Consultation is required with the owner to determine if additional Vehicle Tags will be required at the time of installation and the amounts needed.

2.5 FIELD DEVICES

A. Card Access Equipment
   1. All Card Readers locations to be installed on walls or pedestrian gates shall be PR10 card readers as manufactured Schlage.
   2. All Card Readers locations to be installed on doors shall be Harmony series readers as manufactured by Sargent.
   3. Access Control contractor shall provide ALL electronic components required for a

complete and functioning access control system, to include card reader, door contact, lock power supply, electrified locking device with integrated request to exit, power transfer hinge and wiring harnesses. The door hardware contractor shall be responsible for non-electrified, mechanical door hardware.

4. **Access Control contractor shall provide all cabling required for connection to any device incorporated and not incorporated in door hardware.**
5. Contractor shall provide 300 HID proximity cards 1386 Series for this campus. CFISD has a Corporate 1000 account set up with HID. The contractor shall purchase cards through HID using this account to ensure card numbers and facility numbers are followed.
6. Provide Ethernet Network Interface to connect school to district-wide access control system. Connect to local area network at each facility.
7. Contractor shall provide all cabling and accessories required to provide complete access control solution and proper integration with building intrusion alarm system for door contact shunting.
8. Provide all door controllers as required to connect all perimeter card reader locations shown on plan plus one additional of each type for attic stock.

2.6 WIRING

A. Access Control Contractor shall provide and install Access Control system cabling.
   1. Color code of all security intrusion detection system and access control wiring shall be purple in color.
      Approved products: Lake Composite Access Control Cable: S800081709-07
   2. Reference Specification Section 27 10 00 Technical Cabling and Section 28 16 00 Intrusion Detection for cable types.
   3. All systems shall be connected to an emergency power source as available.
   4. All 120v Power and system conduits as shown on the drawings shall be furnished by a licensed electrical contractor as part of their scope of work.
   5. Coordination with the electrical contractor is the responsibility of the Security contractor to ensure all conduit is in place for a complete installation.

PART 3- EXECUTION

3.1 INSTALLATION

A. All wiring shall be in accordance with the California 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.

B. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with CEC Article 760 if so approved by the local authority having jurisdiction.

C. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.

D. All wire shall be installed in an approved conduit/raceway system (except where permitted by CEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per CEC.

E. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.

F. 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.

G. 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.

H. Network Connection Cable: Provide a Category 6 data cable from the Master Control Panel/Node to the MDF network rack. Category 6 cable shall be purple in color.

I. All plenum wiring is to be installed parallel and perpendicular to the building structure. Install wiring tight up against structure for protection. Cable shall be bundled on a maximum of 2'-6" and secured to the structure at a maximum of 5' on center. Bundling and support shall be with plenum rated Velcro ties and J-Hooks. (Ref. 28-13-00 3.3.A)

J. Contractor is required to provide all mapping and software configuration required to operate system as per manufacturer's recommendations.

3.2 CABLE PATHWAYS

A. Cable Support:
1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including, but not limited to service loops.
   a. Approved Cable Support Product:
      PANDUIT® Corporation J-MOD™ modular support system (sized appropriately for the number of wires being installed. Reference the manufacturer's specifications for the suggested maximum cables per support size.)
2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5' of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5' of the finished ceiling and mount the J-MOD™ support hook to the threaded rod.
3. J-MOD™ cable support shall be installed at a maximum of 5' on center.
4. All cable installed shall be attached to the J-MOD™ support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each J-MOD™ cable support to keep wires neatly bundled throughout the entire run. Tiewraps will only be allowed to be used inside the control panels as required to manage the wires within each type of panel.
5. ABSOLUTELY NO CABLE, NOT INSTALLED IN CONDUIT, WILL BE ALLOWED TO BE ATTACHED DIRECTLY TO THE BUILDING'S STEEL OR SUPPORTED IN ANY OTHER METHOD THAN THAT STATED ABOVE.
6. IT IS THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR TO COORDINATE WITH ALL OTHER TRADES ON THE PROJECT TO ENSURE THAT THE PATHWAY OF THIS SYSTEM DOES NOT INTERFERE WITH THE INSTALLATION OF THE OTHER TRADES AND TO PREVENT THE INSTALLED PRODUCT OF OTHER TRADES FROM PUTTING STRAIN ON THE INSTALLED WIRING.

B. Conduit / Raceway:
1. All wire shall be installed in an approved conduit/raceway system (except where permitted by CEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per CEC.
2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per CEC.
3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
4. 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.
5. All conduit ends shall have a protective bushing to prevent cable damage. BUSHINGS

MUST BE INSTALLED PRIOR TO INSTALLING CABLE. CUTTING BUSHING TO INSTALL AROUND INSTALLED CABLES WILL NOT BE ACCEPTED.

3.3 TESTING

A. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Final test shall be witnessed by Owner, Engineer, Electrical Contractor, Door Hardware Installer, and performed by the equipment supplier. Final test report must be received and acknowledged by the Owner prior to substantial completion.

B. Provide instruction as to proper use and operation of system, for the Owner's designated personnel.

3.4 WARRANTY

A. Entire system shall be warranted against defects in materials and workmanship for a period of one (1) year from the date of substantial completion.

B. Installed main system devices must be awarded the same warranty provided to the installer by the Manufacturer of the product.

3.5 SOFTWARE

A. Provide two electronic copies of the final programming and program software to the Owner’s Security Supervisor after final approval.

END OF SECTION 28 13 00

SECTION 28 23 00 – IP SECURITY CAMERA SYSTEM

CONDITIONS OF THE CONTRACT AND DIVISION 01, as applicable, apply to this Section.

PART 1- GENERAL

1.1 RELATED WORK

A. 26 05 00 – Grounding and Bonding
B. 26 05 29 – Electrical Hangers and Supports
C. 26 05 33 – Raceway and Boxes
D. 28 13 00 – Access Control System

1.2 DESCRIPTION OF WORK

A. Provide a complete and tested IP based digital video surveillance system including cameras, cabling, digital image storage, integration and accessibility with Owner's Local/Wide Area Network (LAN/WAN), Internet accessibility through remote view application software and simultaneous user access capability. Provide fully terminated unshielded twisted pair (UTP) cable, UTP terminations, racks, raceways, conduit, and other incidental and miscellaneous premises wiring system hardware as required for a complete and useable system. The installation shall comply with applicable codes and standards in effect at the job site and as indicated in the Specifications and Drawings.

B. The system shall be Non-Proprietary in nature and be available through multiple distribution channels in the nearest metropolitan marketplace. Systems that are manufactured and installed by a factory office and are not available through multiple distribution channels will not be accepted.

C. Provide all electronic hardware and coordinate with the building's LAN/WAN. The contractor shall coordinate with other system vendors, where appropriate, to facilitate equipment installation, scheduling, protection of equipment and access to the project site in order to provide the Owner a substantially complete project in a timely manner.

F. Contractor shall provide a complete turnkey solution to the owner and be responsible for the complete installation of a fully functional security camera system.

G. The contractor must be in good standing with the district and have no outstanding performance or warranty items at the time of bid. Any outstanding items or issues is grounds to disqualify the contractors bid.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:
   1. The Video Surveillance System Installer shall be certified and shall meet all applicable regulations. The Contractor shall be a firm normally employed in the security and surveillance industry.

   2. The contractor shall be certified by the manufacturing company in all aspects of design, installation and testing of the products described herein. Each contractor shall furnish with their submittal a letter from the manufacturer indicating they are a dealer in good standing.

3. The contractor must be certified by the manufacturer of the products, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels.

4. The contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The contractor shall own and maintain tools and equipment necessary for successful installation and testing of video surveillance distribution systems and have personnel who are adequately trained in the use of such tools and equipment.

5. A resume of qualifications shall be submitted with the Contractor's proposal indicating the following:
   a. A list of five recently completed projects using the product proposed of similar type and size with contact names and telephone numbers for each.
   b. A list of test equipment proposed for use in verifying the installed integrity of metallic cable systems on this project.
   c. A technical resume of experience for the contractor's Project Manager and on-site installation supervisor who shall be assigned to this project.
   d. A list of technical product training attended by the contractor's personnel that shall install the video surveillance system shall be submitted.
   e. Any subcontractor who shall assist the video surveillance contractor in performance of this work shall have the same training and certification as the video surveillance contractor.

B. The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

1.4 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
   1. Local Building Code
   2. Local Electrical Code
   3. CEC California Electrical Code

B. Other references:
   1. TIA/EIA-568-A - Commercial Building Telecommunications Wiring Standard
   2. EIA/TIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
   3. TIA/EIA-606 - The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
   4. TIA/EIA-607 - Commercial Building Grounding and Bonding Requirements for Telecommunications
   5. TIA/EIA TSB 67 - Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
   6. ISO/IEC 11801 - Generic Cabling Standard
   7. EN 50173 - Generic Cabling Standards for Customer Premises

C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes, regulations, and manufacturer installation requirements, then the requirements of these specifications and the drawings shall govern. However, nothing in the drawings or specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

1.5 SUBMITTALS

A. The video surveillance system installer shall furnish all CCTV system submittals in a single consolidated submittal.
   1. Specification Compliance: A letter shall be provided stating, by section and subsection, that the installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. NO DEVIATIONS SHALL BE ACCEPTABLE UNTIL THEY HAVE BEEN ACCEPTED BY THE PROJECT'S TECHNOLOGY CONSULTANT.

B. Shop Drawings: Submit the following items, for Owner review and approval:
   1. Samples: Complete manufacturer's product literature and samples (if requested) for all pre-approved substitutions to the recommended products made during the course of the Project.
   2. Permits: The Contractor shall obtain all required permits and provide copies to the Owner/Architect/Engineer
   3. Product Literature: Complete manufacturer's product literature for all electronics, cable, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Architect/Engineer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included.
   4. Testing: Proposed Contractor test result forms, a list of instrumentation to be used for systems testing.
   5. A complete point-to-point floor plan diagram indicating camera locations and all required cabling to connect systems.

C. Project Completion: As a condition for project acceptance, the Contractor shall submit the following for review and approval:
   1. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
   2. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
   3. All training sessions with district staff and training media shall be complete.
   4. As-built Drawings shall include cable pathways, camera locations with correct labeling and MDF/IDF locations. The as-built drawings shall be prepared using AutoCad 2017 or later. Provide the Owner with electronic versions of the as-builts on CDs.

PART 2 – PRODUCTS

2.1 SUBMITTALS

A. The data cabling to each camera location on this project shall be provided and installed by the security camera data cabling contractor. The security camera installing contractor

shall be responsible for the installation of all power wiring for exterior PTZ domes and power supplies.

B. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.

D. Materials shall be as listed no alternate products will be allowed without prior consent of the project's security consultant. Any items approved as equivalent products shall be published by addendum ten days prior to proposal for Architect/Engineer review.

D. All equipment and materials used shall be standard components, regularly manufactured, regularly utilized in the manufacturer's system.

E. All systems and components shall have been thoroughly tested and proven in actual use.

F. All systems and components shall be provided with the availability of a toll free 24-hour technical support phone number from the manufacturer. The phone number shall allow for immediate technical assistance for either the dealer/installer or the end user at no charge.

G. All systems and components shall be provided with an explicit manufacturer warranty.

2.2 DATA CLOSET (MDF/IDF) TERMINATION HARDWARE

A. Provide and Install new Tripplite, #B030-008-17-IP, NetDirector 8-Port 1U Rack-Mount Console HDMI KVM Switch with 17 in. LCD and IP Remote Access, Dual Rail.

B. Security contractor is responsible to coordinate with district technology department on acquiring network connections as well as any network configuration information such as IP numbers that will be required to connect NVR servers to district network.

C. Security contractor is responsible to provide network cabling connection, either fiber or category 6A, to owner provided network equipment. This connection allows NVR to be connected to owner's local area network.

D. Security contractor shall provide (1) Minuteman E2000RTXL2U UPS per NVR unit at each rack location to support NVR equipment. Provide 120v. electrical connection at location where NVR is installed.

2.3 CABLE AND INSTALLATION

A. The Contractor shall provide and install all low voltage plenum rated power cable to exterior PTZ dome camera locations from a central power supply(s). Each power cable shall be individually fused at the power supply so a short in one power cable will blow that fuse and not affect the other cameras. The power supply will be UL listed in an approved enclosure. It is the responsibly of the Contractor to size the power supply to handle the full load of the cameras.

B. The data cabling to each camera location on this project will be provided and installed by cabling contractor certified by Systimax and authorized to install the cable plant and connectivity products. All category 6 cable shall be Systimax Purple 2071 CAT6.

C. Camera contractor is responsible to request and oversee all penetrations and all conduit runs as necessary for installation of CCTV installation.

D. All exterior penetrations require necessary weatherproofing to avoid moisture penetration.

E. All Cameras will require 10ft purple Cat6 patch cord at camera location and 7ft purple CAT6 patch cord at panel location provided by certified Systimax Data contractor.

F. All outdoor cable runs underground shall be in fiber rated for underground use according to Technology specs.

G. All power circuits required for the NVR servers are to originate as emergency power from its provided UPS.

H. Contractor shall not run any power cabling for any security equipment on rack tray system due to EMI considerations. Contractor shall provide individual cabling support for all low voltage power cabling.

I. All cabling for entire project shall be installed at 5'-0" intervals in dedicated support system using a j-hooks support system. Cable supports will be securely attached directly to building structure. Do not attach cabling or supports to ductwork, piping, grid hangers, conduit, or equipment.

J. Refer to CFISD structured cabling specifications for Category 6 materials and methods.

K. All Category 6 cabling shall be routed to existing MDF and IDF locations and be terminated on existing racks. Provide additional patch panels as required and label ports using existing labeling scheme.

L. For all cameras that will exceed the maximum Category 6 cable limitation the contractor shall provide and install Veracity Outreach Max universal Ethernet and Poe Extender and clearly identify on as-builts. If installed a spare unit will be provided to the owner.

2.4 PROPOSALS

A. All proposals shall be in the format as shown in the General Conditions Section of the Specification.

2.5 DIGITAL VIDEO RECORDING, MANAGEMENT AND TRANSMISSION SYSTEM

A. The contractor shall provide and install Network Video Recorders for this project.

B. Final connection for all new IP cameras shall be provided by the camera contractor. Coordinate all recording settings and functions with owner prior to programming.

C. Network Video Recorders shall be preprogrammed to include a floor plan graphic of each school and the exact camera locations and name of cameras. Field verification of camera names is required to complete this task.

2.6 EQUIPMENT REQUIRED

A. Provide a 5 year warranty for all NVR equipment.

B. Digital Video Recorders

1. Provide One Seneca Assurance, ASC-CFISD server per 50 cameras to be installed unless stated otherwise.
2. The contractor shall coordinate correct Exacq software version prior to

submitting or procuring equipment.

3. NVR must have SSA agreement in place for two years at time of install
4. In response to proposal, contractor shall provide owner with amounts of annual service maintenance agreement than can be purchased after warranty ends.

2.7 CAMERAS

A. Camera Types:

1. All ceiling mounted cameras shall be surface mounted on the ceiling using ceiling mounting kit.
2. All cameras shown on the drawings to be corner mounted shall receive corner mount kit no exception.
3. Where cameras have been discontinued, provide manufacturer's recommended replacement. Confirm with security consultant prior to purchase.
4. Interior Fixed cameras shall be AXIS M4206-LV or P3265-LV if primary is not available.
5. Exterior Fixed cameras shall be Axis P3245-LVE.
6. Interior Fisheye cameras shall be Axis M3057-PLVE.
7. Multi-sensor Interior/Exterior cameras shall be Axis P3719-PLE.
8. Duo cameras shall be Axis 3715-PVLE Platform with IR or Wisenet PNM-700VD Platform with (2) 2.8mm Fixed Lens SLA-2M2800D if Axis is unavailable.
9. Axis F44 and Axis F1004 sensors shall be provided to view around a column or skylight where a center mounted single camera cannot be employed. All F1004 lens must be installed with Axis F8214 Dome accessory kit. Audio function shall not be used.
10. Parking Lot pole cameras shall be Axis Q6100-E with Axis Q6075-E PTZ and Axis T94A01 attachment kit if specifically called for by owner.

B. Field of View Determination by the contractor as necessary for fixed camera locations shall be performed at no additional cost to provide the view desired by the owner. Contractor shall coordinate all final camera views and locations with owner for final approval.

C. IP camera address scheme will be provided to contractor by the owner. All Camera addresses shall follow the provided scheme and be sequential.

D. Refer to Drawings for additional camera part numbers and Quantities.

E. Confirmation of camera type per location requires customer verification.

2.8 ADDITIONAL HARDWARE OR EQUIPMENT REQUIRED

A. Licensing to be provided for all equipment that require licenses.

B. Camera mounts and brackets shall be per camera manufacturer.

C. One ViewSonic VX3211-2K-MHD 32” LED Monitor is required per NVR. (ADD. #4)

D. One of each type of camera used on the project is required upon final inspection for spare replacement equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fire Wall Penetrations: The Contractor shall avoid penetration of fire rated walls and floors wherever possible. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.

B. Provide three-sided pre-finished metal hood and seal to wall where conduit penetrates exterior wall.

C. Install new conduit on portable pipe supports- (low profile type), as manufactured by Portable Pipe Hangers or Advanced Support Products. Provide roof protection pads under each support. Coordinate location and routing with design engineer prior to rough-in or installation of system.

D. Do not install wall mounted cameras into metal fascia. Ensure they are mounted into brick, and sealed top and sides (not bottom)

E. Wall Penetrations:
1. Exterior Penetrations – shall be performed by a certified electrical contractor and be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant.
2. Interior Penetrations – shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant.

F. Cable Pathway:
1. In suspended ceiling and raised floor areas where duct, cable trays or conduit are not available, the Contractor shall bundle, in bundles of 25 cables or less, with cable ties snug, but not deforming the cable geometry. Cable bundles shall be supported via “J” hooks attached to the existing building structure and framework at a maximum of five (5) foot intervals. Plenum rated cable ties shall be used in all appropriate areas. The Contractor shall adhere to the manufacturer’s requirements for bending radius and pulling tension of all cables.
2. Cables shall not be attached to lift out ceiling grid supports or laid directly on the ceiling grid.
3. Cables shall not be attached to or supported by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling air space.

3.2 EQUIPMENT RACK CONFIGURATION

A. Cable Placement: Cable installation in the wiring closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.

B. All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels.

C. Cable shall be routed as closely as possible to the ceiling, floor or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the wiring closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.

3.3 WIRING INSTALLATION

A. General:
   1. Cabling between wiring closet and camera locations shall be made as individual home runs. No intermediate splices may be installed or utilized between the wiring closet and the camera location.
   2. All cable must be handled with care during installation so as not to change performance specifications.

B. Exposed Cable: All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed cable shall only be run where indicated on the Drawings. Additional exposed cable runs shall require Owner approval, and shall only be allowed when no other options exist. Cabling shall be installed concealed at all times, except in unfinished mechanical rooms or wiring closets where cable shall be installed exposed and located to avoid conflicts with pass-through cabling, etc. Tie wraps shall be used to provide a neat appearance. Provide “D” rings or the appropriate cable guides to dress the cable.

C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner’s efficient use of their full capacity.

D. Cable Routes: All cabling placed in ceiling areas must be in conduit, cable tray, or J-Hooks. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Attaching cable to pipes or other mechanical items is not permitted. Use J-Hooks for up to 15 cables (Caddy CAT 21 or CAT 32 hooks with appropriate brackets). All runs of sixteen (16) or more cables, provide cable rings on 36” maximum centers to hang cable. Cable shall be routed so as to provide a minimum of 18” spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling grid support wires. Cable runs shall be parallel or perpendicular to building structure. Multiple cables to be banded together every 6 feet.

3.4 DOCUMENTATION

A. Labels: The Contractor shall label all outlets using permanent machine engraved labels approved by the Owner. Label patch panels in the wiring closet to match those on corresponding camera locations. The font shall be at least one-eighth inch (1/8”) in height, block. All labels shall correspond to as-builts and to final test reports.

B. Contractor shall ensure complete typed labeling of all cameras with numbers that correspond to locations on video server. Labeling system shall correspond to the Owner’s labeling system. Verify with Owner. Provide tags (black letters on white labels, plastic coated) on all cables and outlets.

C. All cables shall be labeled at both ends with a machine label and all terminations shall be stenciled with a typed label for quick circuit identification. Labeling shall conform to TIA/EIA standard 606 and include interconnect cable identification numbers.

G. A floor plan, clearly labeled with all numbered camera locations, shall be included in the as-built plans.

3.5 CABLE TESTING - BY MANUFACTURER’S REQUIREMENTS

A. Notification: The Owner/Architect/Engineer shall be notified one week prior to any testing so that the testing may be witnessed.

B. Final Acceptance: Before requesting a final acceptance, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and time table for all copper and fiber optic cabling.

C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation shall be evaluated in the context of each of these factors.

H. Errors: When errors are found, the source of each error shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Retest results must be entered on the test results form. All corrections shall be made prior to final acceptance test.

3.6 INSPECTION

A. Conformance to the installation practices covered above are to be verified when completed. In some cases, the Owner/Architect/Engineer may observe before acceptance.

3.7 WARRANTY

A. Labor and all other costs as necessary to maintain the equipment in operating condition as intended by the product manufacturer after a period of 1 year shall be negotiated with the owner upon project completion.

B. Guarantee and warrant all equipment provided for a period of 3 years following date of substantial completion, or a period equal to the stated guaranty/warranty offered by the product manufacturer, whichever is the longest in duration. All such warranties shall include all parts (NVR's, and Cameras).

END OF SECTION 28 23 00

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. Provide a complete, fully addressable, power limited, fire detection and voice evacuation system for this project. The system shall be connected, tested, verified by AHJ to be acceptable and left in first class operating condition. All equipment herein specified shall be engineer-approved and California State Fire Marshal (CSFM) listed. The entire installation shall conform to the National Fire Protection Association (NFPA) Standard 72, 2016 90A & CEC Article 760 and authorities having jurisdiction as applicable. The system specified and depicted on the plan is a complete and approved system. The entire fire alarm system has been submitted and approved by the Division of the State Architect as a complete submittal. 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.
2. 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.
3. 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 15 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.
4. 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.
5. Testing: The completed system shall be tested in accordance with NFPA Standard 72 7.6.6 and 7.8.2.
6. All Fire Alarm wiring shown in drawings shall be installed in conduit.
7. 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.
8. 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 or two (2) 6-hour sessions.

9. Coordination with Section 26 05 33: Raceway and Boxes for Electrical Systems.
10. Furnishing of special back boxes where required for installation of fire alarm devices.
11. All conductors to be installed in conduit pursuant to Specification Section 26 05 33: Raceway and Boxes for Electrical Systems.
12. 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.
13. All initiating devices shall be separately addressed for individual identification at control panel.
14. 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.
15. 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.
16. The FACP shall integrate with the to prevent bells from activating during a fire alarm.
17. The FACP shall meet the requirements of UL ANSI 864 Ninth Edition. Systems listed to UL ANSI 864 Eighth Edition or earlier revisions are not acceptable.
18. Per DSA IRA-1 chapter of approval for temporary school use of DSA approved relocatable buildings, Approval of fire alarm and/or fire sprinkler systems for temporary use buildings shall be in accordance with the Chapter 9, CCR, Title 24, Part 2.

    a. Fire Alarm: Section 3.4.4.4 For buildings sited less than three years and used for educational purposes (instruction), provide an approved manual fire alarm system consisting of manual pull-stations, visual notification appliances and audible device(s) (with a minimum rating of 95 dBA at 10 feet).
    Buildings more than 25 feet apart are to be provided with additional audible devices to ensure the fire alarm signal can be heard within adjacent buildings.

    b. Communications: Section 3.4.4.5 Buildings more than 25 feet from other buildings,

including other temporary buildings, with a stand-alone fire alarm system must be provided with approved “two-way communication” with the main administration offices consisting of an intercom system, permanently mounted telephone or “walkie-talkie” devices or other similar systems. Buildings that are less than 25 feet from existing permanent buildings on the site shall be interconnected with the campus fire alarm system.

B. Substitutions
1. Substitution of system components or manufacturer will require the contractor to separately obtain approval with DSA 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. General:
1. Two (2) copies of all submittals shall be submitted to the Architect/Engineer for review and approval.
2. All references to manufacturers model numbers and other pertinent information herein is intended to establish minimum standards of performance, function, and quality.
3. For equipment other than that specified, the contractor shall provide proof that the proposed substitute equipment equals or exceeds the form, feature, function, performance, and quality of the specified equipment.

C. 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.

D. 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, annunciators, 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 15 mins alarm.
6. System operational matrix.

E. 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.

F. Other documentation

1. In addition to the shop drawings, the following information shall also be included with the submittal.

a. Manufacturer's technical data sheets for each piece of equipment that will be installed.

b. Standby battery calculations for the FACP and any remote power supply or other panels that include their own standby batteries.

c. Voltage drop calculations showing the worst-case end of line voltage for all notification appliance circuits

d. Detailed description of the overall operation of the system or a sequence of operation matrix.

e. Proof of factory training and certification of the supervising technician assigned to the project.

f. Proof of factory training and certification of a service technician employed by the installation company that can be onsite to troubleshoot and repair any service-related problems with the system, within 4 hours of being notified of the problem.

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.

H. The secondary power source of the fire alarm control panel shall be capable of providing at least 24 hours of backup power with the ability to power the system for an additional 15 minutes in an alarm condition, at the end of the 24-hour backup period.

I. Basic System Operation

1. When an off normal condition occurs (Alarm, Supervisory, or Trouble) the respective LED on the FACP shall illuminate.

2. A piezo sounder shall activate at the FACP during any off normal condition until the SILENCE button is pressed by an authorized user.

3. A Red LED shall illuminate when an alarm or pre-alarm condition exists.

4. An Amber (yellow) LED shall illuminate when a Supervisory or Trouble condition exists.

5. A backlit 4-line 40-character LCD screen shall display all messages that refer to an off-normal condition.

6. An Alarm condition shall have priority over all other signals.

7. The FACP shall include an event buffer that maintains the last 4,000 system events including a date and time stamp for each.

8. In response to a fire alarm condition, the systems notification appliances and relay-controlled output circuits that are associated through programming with the device initiating the alarm, shall automatically activate. Additionally, the system shall notify an approved central station via dial-up, IP, or cellular means as deemed acceptable by the local Authority Having Jurisdiction (AHJ).

1.5 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 shall fully comply with the latest issue of the current code and standards.

   2. All requirements of the Authority Having Jurisdiction (AHJ).

The FACP and associated field devices system shall comply with the following Underwriters Laboratories Inc. (UL) USA listing standards as applicable.

1. No. 38 Manually Actuated Signaling Boxes
2. No. 50 Cabinets and Boxes
3. No. 864 Control Units for Fire Protective Signaling Systems
4. No. 268 Smoke Detectors for Fire Protective Signaling Systems
5. No. 268A Smoke Detectors for Duct Applications
6. No. 346 Waterflow Indicators for Fire Protective Signaling Systems
7. No. 464 Audible Signaling Appliances
8. No. 521 Heat Detectors for Fire Protective Signaling Systems
9. No. 1638 Private Mode Emergency and General Utility Signaling
10. No. 1971 Visual Notification Appliances

1.6 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.

1.7 ACCEPTABLE MANUFACTURER

A. All fire alarm system devices and equipment shall be manufactured with the one indicated on the drawing 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 UL. listed for their intended use.

C. All equipment provided shall be available for purchase from at least two authorized distributors within the service area.

1.8 MAINTENANCE:

Maintenance and testing shall be on a semi-annual basis or as required by the AHJ. A preventative maintenance schedule shall be provided by the contractor describing the protocol for preventative maintenance. The schedule shall include:

Systematic testing and complete inspection of the entire fire alarm system including control panels, field devices, and wiring terminations including smoke sensors, heat sensors, manual pull stations, sprinkler system switches, remote panels, power supplies, and terminal boxes, and all other fire alarm accessories, in accordance with NFPA 72. Cleaning and adjusting of these devices shall be conducted at this time.

An inspection and test of system power supplies, batteries, circuit breakers, and fuses as well as a load test of the batteries shall be conducted in accordance with NFPA 72.

Placing the system into an alarm condition and checking each notification device for proper operation.

Removing devices from the FACP SLC circuit to ensure a trouble condition occurs.

Input and output mapping shall be tested to ensure proper sequence of operation.

Signal transmission shall be tested to the Monitoring Station.

A report showing the calibrated sensitivity of each of the systems smoke detectors shall be generated from the fire alarm control panel and verified to ensure all smoke detectors are within UL tolerance.

Following each periodic maintenance and test, the owner shall be provided with a detailed report of the test results including any deficiencies found.

PART 2 PRODUCT

2.1 MANUFACTURERS

A. Fire Alarm Control Panel (FACP): Notifier

B. Fire Alarm Amplifier: Evax by potter

C. Area Smoke Detectors and Heat Detectors: Notifier

D. Strobes, Combination Speaker/strobe and Weatherproof Speaker: System Sensor

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

EXISTING FIRE ALARM CONTROL PANEL (FACP)

A. FACP shall be as indicated model on the drawing or approved equivalent.

2.1 System description

A. The fire alarm system as outlined on the drawings, shall be a fire life safety system as manufactured by the panel indicated on the drawing. It shall be complete with all necessary hardware, software and memory specifically tailored for this project.

B. All equipment needed for a complete operable system, (whether specifically indicated or not) shall be included in this section. It shall be the installing contractor’s responsibility for a complete and operable system upon completion of this project.

2.2 Automatic alarm operations

A. The fire alarm system operation subsequent to the alarm initiation via pull station, smoke detector, heat detector, sprinkler flow switch, etc., shall be as follows:

1. All audible alarm indicating devices shall sound the temporal signal code in synchronization with each other, until silenced at the control panel or at the remote annunciator.

2. All visual alarm indicating devices shall flash per NFPA requirements in synchronization with each other, until reset at the control panel or at the remote annunciator.

3. Alarm audible devices and alarm visual devices shall operate on the same circuit

4. The alarm signals shall be inhibited from being silenced for a period of at least 1 minute after commencing operation. this rate is to be field programmable for actual AHJ requirements.

5. Display type and location of alarm per point on the main control panel lcd display.

6. Display type and location of alarm per point on remote lcd annunciator.

7. List on printer the time, date, type, and user defined message for each event printed.

8. Graphically display on the fireworks station, school diagram showing whole school, with graphic scrolling thru system prompts, down to point of alarm activation.

9. Subsequent alarms are to report to the main control panel and fireworks, shall indicate to the operator that a subsequent alarm is present, and also indicate the number of subsequent alarms.

10. Shut down all associated air handlers in alarm zone.

2.3 Automatic supervisory operation

A. All data, initiating, indicating and supervisory lines shall be constantly monitored for integrity. indicate opens, shorts, grounds, at main control panel and remote annunciator.

2.4 operation

A. During the normal state, the normal led (green) shall flash. the first line of the lcd shall display the time in (hh: mm: ss) as well as the number of active points (ap) and the number of disabled points (dp) in the system.

B. When the control panel goes into alarm condition, the normal led (green) extinguishes and the alarm led (red) shall light, the buzzer pulsates, and the lcd indicates the time, the number of messages waiting, the type of alarm, the point id number of devices, and the time that the alarm occurred. the second line is dedicated to the user specified message.

C. To silence the panel buzzer, the operator shall press the local silence button and the buzzer will silence.

D. To silence the audible devices, the operator shall press the alarm silence button. a new alarm shall cause the audibles to resound.

E. During the trouble condition, the amber trouble led shall light, the normal led shall go out, and the buzzer shall pulsate. the display shall indicate the point id number of the device, the

time the event occurred and up to a 40-character custom user description.

F. During the monitor or supervisory condition, the appropriate led shall light, the normal led shall go out, and the buzzer shall pulsate. the display shall indicate the point id number of the device, the time the event occurred and up to a 40-character custom user description.

B. Fire Alarm Amplifier:
1. The intelligent fire alarm amplifier shall be as indicated model on the drawing or approved equivalent. The intelligent 50 or 70-watt amplifier 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 amplifier can produce 50 or 70 -watts of audio power. Up to four amplifiers can be used on the voice evacuation system. The amplifier has its own power supply with battery backup and four speaker circuits which can be expanded to eight speaker circuits. The amplifier is fully supervised by the main panel for trouble conditions.

C. Fire Alarm Power Module:
1. The intelligent fire alarm power module shall be as indicated model on the drawing or approved equivalent. It delivers 6 amps of notification appliance circuit power and built-in synchronization. Its switch mode power supply design is up to 50% more efficient than competitive linear mode power supplies.
2. The power supply is a 6-amp notification power expander that provides its own AC power connection, battery charging circuit, and backup battery for use with the same manufacturer series fire alarm control panels (FACPs). The power supply is the cost-effective solution for powering notification appliances required by the Americans with Disabilities Act (ADA). It has built-in ANSI cadence pattern. The output circuits can be programmed as notification appliance circuits, or as auxiliary power (configurable for constant, resettable, or door holder power).

D. Intelligent Photoelectric Smoke Detector
1. The intelligent photoelectric smoke detector shall be as indicated model on the drawing or approved equivalent and shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

E. Intelligent Thermal Detectors
1. The intelligent thermal detectors be as indicated model on the drawing or approved equivalent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.

F. Control Relay Module:
1. The Control Relay is intended for use in intelligent, two-wire systems where the individual address of each module is selected using the built-in rotary switches. It allows a compatible control panel to switch discrete contacts by code command. The relay contains two isolated sets of Form-C contacts, which operate as a DPDT switch and are rated in accordance with the table in the manual. Circuit connections to the relay contacts are not supervised by the module. The module also has a panel-controlled LED indicator.

G. Intelligent Monitor Module:
1. The monitor module indicated on the drawing is an addressable monitor module for

use with Honeywell Silent Knight Series fire alarm control panels (FACPs). The monitor module is intended for use in intelligent, two-wire systems, where individual address of each module is selected using the built-in rotary switches.

2. It supports Class A supervised or Class B supervised wiring to the load device. Conventional 4-wire smoke detectors can be monitored for alarm and trouble conditions.

H. Ceiling Mounted Strobe

1. The notification appliances shall be as indicated model or approved equivalent model as 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 ½” 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 ceiling models shall have a low-profile measuring.
9. When synchronization is required, the appliance shall be compatible with Sync Modules, PS Power Supplies, or other manufacturer’s panels with built-in manufacturer 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.

I. Combination Speaker Strobes

1. The 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 manufacturer 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.

J. Weatherproof Speaker
1. 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 indicated manufacturer 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.

K. 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 CEC, 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.

C. 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. All fire alarm wiring shall be new.

B. 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.

C. All wiring shall be in accordance with NFPA 72, the California 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.

D. 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 CEC Article 760 if so, approved by the local authority having jurisdiction.

E. No A.C. wiring or any other wiring shall be run in the same conduit as fire alarm wiring.

F. 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.

G. 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.

H. Contractor shall provide a service loop located above each device installed on the entire project. The service loop shall be a minimum of 5’.

I. 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.

J. 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:

A. 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 CEC.

B. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per CEC, 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 CEC 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 and correct annunciation 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.

B. Intelligibility shall be tested according to NFPA 72 annex D.2 (speech intelligibility).

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 10 00 - SITE CLEARING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Remove surface debris.

B. Remove paving, curbs, foundations and surface improvements.

C. Clear site of plant life and grass.

D. Remove trees and shrubs.

E. Remove root system of trees and shrubs.

1.02 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable codes for disposal of debris. Burning debris on site not permitted.

B. Coordinate clearing work with utility companies.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earthwork."
   1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

B. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that existing plant life and features designated to remain are tagged or identified.

3.02 PROTECTION

A. Protect utilities that are designated to remain from damage.

B. Protect trees, plant growth and features designated to remain as final landscaping.

C. Protect bench marks and designated existing structures from damage or displacement.

D. Erect barricades in accordance with Title 8, Subchapter 4, Construction Safety Orders, California Code of Regulations.

E. Protect existing items not indicated to be altered.

3.03 CLEARING

A. Clear areas required for access to site and execution of Work.

B. Remove paving, curbs, foundations and surface improvements. Patch and repair surfaces not indicated to be removed.

C. Remove trees and shrubs indicated. Remove stumps, main root ball, root system to full depth.

D. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.

E. Clear undergrowth, grass and deadwood. Protect plant material not scheduled for removal.

F. Keep site free of dust by sprinkling with water. Maintain adequate water trucks, hoses and water supply.

G. The limits of clearing and grubbing shall be the area of new construction

H. Remove all trash, rubbish and all other material not suitable for construction operations.

I. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.

J. Use only hand methods for grubbing within tree protection zone.

K. Chip removed tree branches and dispose of off-site.

L. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground or compact to 90 percent of maximum dry density per ASTM D1557. Bring grade to match surrounding surfaces.

3.04 REMOVAL

A. Remove debris, rock and extracted plant life from site as work progresses. Dispose legally.

B. Burial of removed materials not permitted.

C. Use of Owner's disposal system not permitted. Do not use disposal system belonging to any other property Owner.

D. Loose fill material, buried trash, abandoned underground structures or deleterious materials of any kind encountered shall be identified and removed to expose natural earth.

END OF SECTION 31 10 00

SECTION 31 23 15 - SITE EARTHWORK AND BUILDING EXCAVATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Site earthwork preparation.

B. Excavation for building foundations within building area.
   1. Building Area: Areas indicated on Drawings, plus 5 feet minimum beyond footing lines, including covered walks.

C. Excavation for site structures.

1.02 REFERENCES

A. ASTM D 1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort.

B. AQMD – South Coast Air Quality Management District, Local Regulations, Rule 403 for Fugitive Dust.

1.03 GENERAL REQUIREMENTS

A. Existing Conditions: Contractor shall examine site of Work and verify existing conditions under which work will be performed, including known subsurface conditions.

B. Drainage and Pumping: Maintain excavations and site free from water throughout work. Run surface water or seepage to sumps with float-switch controlled pumps. Pump to drainage system as approved by Architect.

C. Protection: Provide and maintain protection to retain earthbanks, and protect adjoining existing monuments, grades and structures from caving, sliding, erosions or other damage and provide suitable forms of protection against bodily injury or property damage.

D. Provide barricades and berms at top of slopes to prevent water from flowing over top

E. Borrow. Fill, backfill, aggregate base, and other soil materials obtained from off-site sources shall be sampled and tested in compliance with CA EPA Department of Toxic Substances Control recommendations to prevent the importation of contaminated materials to the Site.
   1. Testing Frequency
      a. For borrow up to 1,000-cu.yrd, conduct 1 test for each 250-cu.yrds.
      b. For borrow between 1,001- and 5,000-cu.yrd; conduct 4 tests for first 1,000- cu.yrd, if material tests acceptable, conduct 1 test for each additional 500-cu.yrds.
      c. For borrow over 5,000-cu.yrds, conduct 12 tests during import of first 5,000-cu.yrd, if material tests acceptable, conduct 1 test for each additional 1,000-cu.yrds.
   2. Owner's Testing Laboratory shall take samples at source, conduct testing and evaluate test results prior to delivery.
   3. Conduct tests for lead and other heavy metals, asbestos, PCB's, pesticides, herbicides, VOCs, and semi-VOCs.
   4. When detectable quantities of hazardous materials are found, determine the risk to human health, the environment, or both using the DTSC Preliminary Endangerment Assessment Guidance Manual.
   5. Do not import soils that exhibit a known risk to human health, the environment, or both.

1.04 SUBMITTALS

A. Compaction Report indicating requirements per ASTM D1556.

B. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.05 FIELD CONDITIONS

A. Geotechnical Investigation Report has been prepared under direction of Owner. Geotechnical Investigation Report is hereby referenced as information for Work of this Section. Architect assumes no responsibility for conclusions Contractor may draw, from information provided. Contract Documents take precedence over recommendations that may be contained in Geotechnical Investigation Report and Contractor must obtain approval for deviations from Contract Documents. Copy of the Geotechnical Investigation Report is available at Architect's office.

B. Verify that survey benchmark and intended elevations for Work are as indicated.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine entire site including subsurface conditions.

B. Identify required lines, levels, contours and datum.

C. Identify known underground, above ground and aerial utilities. Stake and flag locations. Replace as necessary throughout construction operations.

D. Notify utility company to remove and relocate utilities where required for construction operations.

E. Protect above and below grade utilities that are to remain.

F. Protect plant life, lawns and other features remaining as portion of final landscaping.

G. Protect bench marks, existing structures, fences, sidewalks, paving and curbs from excavation equipment and vehicular traffic.

H. Repair or replace property damaged by Work of this Section.

I. Commencement of Work means acceptance of existing conditions.

3.02 SITE EARTHWORK

A. Conform to Section 31 10 00 for clearing requirements.

B. Sub-excavate and remove loose existing soils to depths recommended by Geotechnical Engineer.

C. Loose fill and natural on-site soils acceptable to Geotechnical Engineer may be stockpiled for subsequent use as fill material.

D. After clearing and removal of loose fill, Geotechnical Engineer will inspect exposed surfaces, before commencing further earthwork operations.

E. After sub-excavating existing soils, Geotechnical Engineer will inspect exposed surfaces. Before commencing further earthwork operations, verify elevations and line. Elevations shall be within 0.2 foot of required.

F. Correct unauthorized over excavation at no cost to Owner.

G. Notify Geotechnical Engineer of unexpected subsurface conditions and discontinue affected work until notified to resume work.

H. Unless otherwise recommended in Geotechnical Report scarify exposed surface to depth of 6 inches. Bring to optimum moisture content and recompact to minimum 90 percent of maximum dry density per ASTM D1557.

I. Place approved fill in 8 inch or less lifts, each lift with optimum moisture content and compacted to minimum 90 percent of maximum dry density per ASTM D 1557.

J. Bring fill to elevations indicated on structural drawings or to those indicated on grading plans. Elevations shall be within 0.1 foot of required.

K. Backfill holes, voids or depressions caused by earthwork operations with identical fill and compaction standards.

L. Completed earthwork to determine suitability of exposed soils, will be inspected by Geotechnical Engineer, including cuts, fills and earth bank slopes (cut or fill).

3.03 BUILDING AREA PREPARATION

A. Within building area and to distance of 5 feet beyond exterior footings or covered walks, remove existing fill or loose natural soils (sub excavate) to a depth recommended by Geotechnical Engineer.

B. Geotechnical Engineer will inspect exposed surfaces. Additional unsuitable soil, as approved by Geotechnical Engineer shall be removed.

C. Scarify exposed surface to depth of 6 inches. Bring to optimum moisture content and recompact to 90 percent of maximum dry density per ASTM D 1557.

D. Add approved fill to required subgrade elevation in 8 inch maximum lifts. Bring to optimum moisture content and compact to 90 percent of maximum dry density per ASTM D1557.

E. Fill: As specified in Section 31 23 23 and as approved by Geotechnical Engineer.

3.04 EXCAVATION FOR FOUNDATIONS

A. Underpin adjacent structures that may be damaged by excavation work, including utilities, pipes and electrical undergrounding. Protect existing monuments, grades and improvements of any kind. Remove all obstructions to Work.

B. Excavate subsoil to elevations required to accommodate building foundations, slabs-on-grade, construction operations, forms, forms removal and inspection. Subexcavate existing soils to depths recommended by Geotechnical Engineer.
   1. Side forms in foundation excavations may be omitted where earth remains firm with no cave-in providing one inch is added to footing width for each form removed.
   2. Finish subgrade to a tolerance of 0.05 foot within required elevations for subgrade.

C. Machine slope banks. Earth banks shall be sloped to 1-1/2 (horizontal) to 1 (vertical). Tops of earth banks shall be level to distance of 5 feet minimum from existing structures and 5 feet minimum behind construction barricades adjacent to driveways.

D. Excavation cut not to interfere with normal 45 degree bearing splay of foundation.

E. Grade top perimeter of excavation to prevent surface water from draining into excavation.

F. Hand trim excavation. Remove loose matter. Machine tamp bottom of excavation.

G. Remove lumped subsoil, boulders and rock up to any size encountered. Totally remove abandoned pipes and utilities found in excavations. Cap or plug both ends of pipes and conduits to provide complete seal with concrete plugs, threaded caps or other approved methods.

H. Notify Geotechnical Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume Work.

I. Correct over-excavation as recommended by Geotechnical Engineer.

J. Correct areas over-excavated by error by filling with specified concrete.

K. Stockpile approved excavated material in area designated on site and remove excess material not being reused from site.

L. Bulkheads and shoring shall conform to Title 8, California Code of Regulations, Construction Safety Orders.

M. Maintain excavations free of water throughout operations. Run surface water or seepage to sumps or drainage system.

3.05 FIELD QUALITY CONTROL

A. Testing and Inspection: Owner will engage a qualified independent Geotechnical Engineer to perform field quality-control testing and inspections. Do not proceed with concrete placement without approval of John R Byerly Inc.

B. Testing agency will test compaction of soils in place according to ASTM D1556, and ASTM D2937 as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of building slab, but in no case fewer than 3 tests.
   2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.

C. Frequency of Tests: Geotechnical Engineer may make as many tests as are necessary to ensure specified results.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.06 SEASONAL LIMITS

A. No fill material shall be placed, spread or rolled while it is frozen or thawing or during unfavorable weather conditions. When Work is interrupted by heavy rain, fill operations shall not be resumed until field tests by Geotechnical Engineer indicate that moisture content and density of fill are as previously specified.

3.07 PROTECTION

A. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing or excessive water inundation.

END OF SECTION 31 23 15

SECTION 31 23 17 - **TRENCHING**

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Excavate trenches for utilities.

B. Compacted bedding.

C. Backfilling and compaction to required elevations.

D. Slurry concrete.

E. Thrust blocks.

1.02 REFERENCES

A. ASTM C150 - Portland Cement.

B. ASTM C494 - Chemical Admixtures for Concrete.

C. ASTM D1557 - Laboratory compaction characteristics of soil using modified effort.

D. SSPWC - Standard Specifications for Public Works Construction, Latest Edition.

E. California Code of Regulations, Title 8, Industrial Relations, Construction Safety Orders, Division 01, Chapter 4, Sub-Chapter 4, Article 6 Excavations.

F. California Public Contract Code, Section 7104 - Public Works Contracts for Digging Trenches or Excavations; Notice on Discovery of Hazardous Waste or Other Unusual Conditions; Investigations; Change Orders; Effect on Contract.

G. California Labor Code, Section 6705 - Public Works Contracts requiring detailed plans for shoring, bracing, sloping, indicating protection from caving ground for trenching work in excess of 5’ deep and contract amounts stipulated therein.

1.03 SUBMITTALS

A. The Contractor shall submit in advance of excavation, for acceptance by the Owner’s civil or structural engineer, detailed plan(s) 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 trenches more than 5 feet in depth. If such plan(s) varies from the shoring system standards, the plan shall be prepared by a registered civil or structural engineer.

1.04 QUALITY ASSURANCE

A. Verify survey benchmark and intended elevations for Work.

B. Borrow. Fill, backfill, aggregate base, and other soil materials obtained from off-site sources shall be sampled and tested in compliance with CA EPA Department of Toxic Substances Control recommendations to prevent the importation of contaminated materials to the Site.
   1. Testing Frequency
      a. For borrow up to 1,000-cu.yd, conduct 1 test for each 250-cu.yrds.

b. For borrow between 1,001- and 5,000-cu.yrd; conduct 4 tests for first 1,000- cu.yrd, if material tests acceptable, conduct 1 test for each additional 500-cu.yrds.
c. For borrow over 5,000-cu.yrds, conduct 12 tests during import of first 5,000-cu.yrd, if material tests acceptable, conduct 1 test for each additional 1,000-cu.yrds.

2. Owner's Testing Laboratory shall take samples at source, conduct testing and evaluate test results prior to delivery.
3. Conduct tests for lead and other heavy metals, asbestos, PCB's, pesticides, herbicides, VOCs, and semi-VOCs.
4. When detectable quantities of hazardous materials are found, determine the risk to human health, the environment, or both using the DTSC Preliminary Endangerment Assessment Guidance Manual.
5. Do not import soils, that exhibit a known risk to human health, the environment, or both.

1.05 SOILS INFORMATION

A. Geotechnical Investigation has been prepared under direction of Owner. Investigation is hereby referenced as information for Work of this Section. Architect assumes no responsibility for conclusions Contractor may draw from information provided. The Contract Documents take precedence over recommendations that may be contained in the Investigation and the contractor must obtain approval for any and all deviations from the Contract Documents. Copy of investigation is available at Architect's office.

PART 2 - PRODUCTS

2.01 FILL AND BEDDING MATERIALS

A. Sand: Sand shall consist of natural or manufactured granular material, or a combination thereof, free of deleterious amounts of organic material, mica, loam, clay and other substances not suitable for the purpose intended. Conform to Subsection 200-1.5.5, SSPWC, for gradation as required for Portland Cement Concrete, sand must achieve compaction of a minimum 90 percent.

B. Imported Fill: Granular, free of debris, no gravel larger than 3 inches in any dimension, non-expansive, approved by the Architect prior to placement on the site.

C. Slurry Concrete:
1. Slump: Between 4 inches and 6 inches.
2. Aggregate: 40 percent sand by weight, 60 percent pea gravel, minimum 1/4 inch, maximum 5/8 inch.
3. Portland Cement: ASTM C150, 2-sack mix (2 sacks of cement per cubic yard).
4. Admixture: Calcium Chloride free, in proportions not to exceed the manufacturer's recommendations.
5. Artificial Coloring: ASTM C494. Mix in Mapico Red pigment, proportions as recommended by the manufacturer, L.M. Scofield or equal.
6. Sufficient water shall be added to produce a fluid, workable mix that will flow and can be pumped without segregation of aggregate. Material shall be mechanically mixed until the cement and water are thoroughly dispersed.

D. Stockpiled Fill: Onsite soils, stored separately on the site, approved for re-use by the Architect.

2.02 ACCESSORIES

A. Underground Warning Tape: Metallic Detection Tape, aluminum core, 6 inches wide AASHTO specification colors, by Safety Sign Company, Cleveland, OH, or equal.

B. Color Coding and Lettering: as required for type of underground utility.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify fill material to be reused is acceptable to the Geotechnical Engineer.

3.02 PREPARATION

A. Identify required lines, levels, contours and datum.

B. Backfill with approved fill and compact to density equal to or greater than requirements for subsequent backfill material.

C. Prior to commencement of trenching operations, notify Underground Service Alert of Southern California (800) 422-4133, Monday through Friday, 7:00 A.M. to 5:00 P.M.

3.03 EXCAVATION

A. Conform to Construction Safety Orders, Title 8, CCR, For Sloping, Benching, Shoring, Bracing, Protective Systems, and Shafts.

B. Conform to Section 7104, Public Contract Code. Promptly notify Owner of any contact with hazardous materials or differing conditions.

C. Conform to Section 6705, Labor Code. Provide detailed plan 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 trenches.

D. Excavate subsoil required for utilities. Trenches shall be level or parallel to finish grade unless designated on drawings to be installed to specific gradient.

E. Cut trenches sufficiently wide to enable installation of utilities and allow inspection.

F. Water, storm drainage piping located in the same trench shall be separated by 12 inches horizontally and vertically, and water line shall be placed on a solid shelf excavated on one side of the common trench. Cross-over water lines shall also be separated 12 inches vertically from storm drainage pipe.

G. Water and sewer piping shall not be located in the same trench and they shall be separated by 12 inches horizontally and 12 inches vertically.

H. Excavation shall not interfere with normal 45 degree bearing splay of foundations. Parallel trenches, no closer than 18 inches from building foundations.

I. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

J. Remove lumped subsoil, boulders and rock.

K. Correct unauthorized excavation.

L. Stockpile approved excavated material in area designated on site and remove excess material not being used from site.

3.04 BEDDING

A. Support pipe and conduit during placement and compaction of bedding fill. Provide uniform bearing along entire length. Conform to Section 306, SSPWC.

B. Bedding: Place and compact materials in continuous layers not exceeding 6 inches compacted depth, ASTM D1557.

3.05 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen materials.

B. Fill areas will be inspected, tested and approved by Geotechnical Engineer.

C. Soil Fill over Bedding: Place and compact material in continuous layers as scheduled, compacted to ASTM D1557.

D. Employ placement method that does not disturb or damage conduit, ducts or piping in trench.

E. Maintain optimum moisture content of backfill materials to attain required compaction density. When operations are interrupted by rain, do not resume Work until field tests indicate that moisture content and density of fill are as previously specified.

F. Remove surplus backfill materials from site and dispose legally.

G. Leave fill material stockpile areas completely free of excess fill materials.

H. Minimum Cover over Piping, Conduits or Duct Banks: 24 inches.

I. Lay out and install or otherwise confirm invert elevations of all gravity flow systems to avoid conflict with other sub-surface structures or utilities of any kind. Adjust elevations or layout of pipes, conduits or duct banks to permit the required gravity flow.

J. Jetting for utility trenching compaction may be used outside building perimeter and only when recommended by Geotechnical Engineer, in accordance with Section 306 SSPWC.

K. Pressurized piping shall be installed level or shall be installed parallel to finish grades unless designated on the Drawings to be installed to specific gradients.

3.06 THRUST BLOCKS

A. Install at turns of water lines and as indicated in drawings.

3.07 TOLERANCES

A. Top Surface of Backfilling Under Paved Areas: 0.2 ft from required elevations.

B. Top Surface of General Backfilling: Plus or minus 0.2 ft from required elevations.

3.08 FIELD QUALITY CONTROL

A. Backfill materials and operations will be inspected and approved by Geotechnical Engineer including earth bank slopes (cut or fill).

B. Tests, analysis and compaction of fill material will be performed in accordance with ASTM D1557.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

D. Frequency of Tests: Geotechnical Engineer may make as many tests as are necessary to ensure specified results.

3.09 PROTECTION OF FINISHED WORK

A. Protect finished Work.

B. Recompact fills subjected to vehicular traffic.

3.010 TEMPORARY PROTECTION OF UNFINISHED WORK

A. Trenching for placement of underground utilities shall be covered and protected with steel trench plates during non-work hours. Adequate warnings and protection indication of open trenches during work hours must be provided for project safety.

3.011 SCHEDULE

A. Storm and Sanitary Piping:
1. Bedding Fill: Sand, minimum thickness below piping 0.4 times outside diameter of pipe but no less than 4 inches. Minimum thickness above top of piping, 12 inches, compacted to 90 percent.
2. Cover with stockpiled fill in 8-inch lifts to specified subgrade elevations, compact to 90 percent or to 95 percent under vehicle traffic-supporting paved areas.
3. Fill: Slurry concrete, 6” cover at top, bottom and sides of pipes at exterior paved areas (at vehicle traffic) where minimum fill cover is less than 12” below finished elevation of paving.
4. Bury warning tape marked “Caution Sewer Line” 12 inches above all concrete-encased piping. Align tape parallel to and within 3 inches of the centerline of the piping.

B. Power Ducts: Concrete Encased
1. Fill: Slurry concrete, 3 inches cover at top, bottom, between conduits and sides of duct bank.
2. Fill: Slurry concrete, 6 inches cover at top, bottom and sides of duct bank conduit at exterior paved areas where minimum fill cover is less than 24” below finished elevation of paving, and less than 12” below finished elevations of interior floor slabs and at building footings where conduit is in the footing structural splay.
3. Install two No. 4 bars in slurry concrete at top of bank under paved areas, minimum 3 inch concrete cover.
4. Cover with stockpiled fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent, or to 95 percent under traffic-supporting paved areas.
5. Bury warning tape marked “Caution Buried High Voltage Line” 12 inches above all concrete-encased duct banks. Align tape parallel to and within 3 inches of the centerline of the duct bank.

C. Water Piping and Gas Piping:
1. Bedding Fill: Sand, minimum thickness below piping 0.4 times outside diameter of pipe but not less than 4”. Minimum thickness above top of piping, 6 inches, compacted to 90 percent.
2. Fill: Slurry concrete, 6 inches cover at top, bottom and sides of pipes at exterior paved areas where minimum fill cover is less than 24” below finished elevation of paving, and less than 12” below finished elevations of interior floor slabs and at building footings where piping is in the footing structural splay.

3. Cover with stockpiled fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent, or 95 percent under traffic-supporting paved areas.
4. Observe joints at pressure tests.
5. Bury warning tape marked “Caution Buried Gas (or “Pipeline”) Line” 12 inches above all trenching. Align tape parallel to and within 3 inches of the centerline of trench.

D. Fire Lines:
1. Bedding Fill: Manufactured Sand, minimum 6” thickness under piping, minimum thickness above top of piping and sides, 6”, compact to 90 percent.
2. Fill: Slurry concrete, 6” cover at top pipes at exterior paved areas where minimum fill cover is less than 24” below finished elevation of paving.
3. Cover with stockpiled fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent, or 95 percent under traffic-supporting paved areas.
4. Bury warning tape marked “Caution Buried Pipeline” 12 inches above all trenching. Align tape parallel to and within 3 inches of the centerline of trench.

E. Low Voltage Conduits and Communications: Direct Burial Minimum trench depth 36 inches.
1. Bedding Fill: Sand, 6 inches at bottom, sides and 12 inches on top, compacted to 95 percent.
2. Cover with stockpiled fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent, or 95 percent under traffic-supporting paved areas.
3. Bury warning tape marked “Caution Buried Communication Line Below” 12 inches above conduits. Align tape parallel to and within 3 inches of the centerline of conduits.

END OF SECTION 31 23 17

SECTION 31 23 23 - BACKFILLING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Authorized types of fill.

B. Building area backfilling to subgrade elevations.

1.02 **REFERENCE**S

A. ASTM D1557 - Laboratory compaction characteristics of soil using modified effort.

B. SSPWC - Standard Specifications for Public Works Construction, Latest Edition.

C. Chapters 18A and 33, California Building Code, 2022.

D. CSS - Caltrans Standard Specifications, Latest Edition.

1.03 SUBMITTALS

A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
   1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
   2. Laboratory compaction curve according to ASTM D 1557 for each on-site and borrow soil material proposed for fill and backfill.

B. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.04 QUALITY ASSURANCE

A. Borrow. Fill, backfill, aggregate base, and other soil materials obtained from off-site sources shall be sampled and tested in compliance with CA EPA Department of Toxic Substances Control recommendations to prevent the importation of contaminated materials to the Site.
   1. Testing Frequency
      a. For borrow up to 1,000-cu.yrd, conduct 1 test for each 250-cu.yrds.
      b. For borrow between 1,001- and 5,000-cu.yrd; conduct 4 tests for first 1,000- cu.yrd, if material tests acceptable, conduct 1 test for each additional 500-cu.yrds.
      c. For borrow over 5,000-cu.yrds, conduct 12 tests during import of first 5,000-cu.yrd, if material tests acceptable, conduct 1 test for each additional 1,000-cu.yrds.
   2. Owner's Testing Laboratory shall take samples at source, conduct testing and evaluate test results prior to delivery.
   3. Conduct tests for lead and other heavy metals, asbestos, PCB's, pesticides, herbicides, VOCs, and semi-VOCs.
   4. When detectable quantities of hazardous materials are found, determine the risk to human health, the environment, or both using the DTSC Preliminary Endangerment Assessment Guidance Manual.
   5. Do not import soils, that exhibit a known risk to human health, the environment, or both.

PART 2 - PRODUCTS

2.01 FILL MATERIALS

A. This Section establishes standards of quality for backfill materials to be used as approved by Geotechnical Engineer in accordance with Chapter 18A CBC, Section 1803A.2 and Appendix J Section J107, California Building Code, and as scheduled in other Sections of this specification.

B. Crushed Rock and Rock Dust: Crushed rock and rock dust shall be product of crushing rock or gravel. Portion of material that is retained on a 3/8 inch sieve shall contain at least 50 percent of particles having three or more fractured faces. Not over 5 percent shall be pieces that show no such faces resulting from crushing. Of that portion which passes 3/8 inch sieve but is retained on No. 4 sieve, not more than 10 percent shall be gravel particles. Crushed rock shall conform to 3/4 inch sieve size in accordance with Subsection 200-1.2, SSPWC, Crushed Rock Gradation Table.

C. Pea Gravel: Natural stone; washed, free of clay, shale, organic matter; graded to the following:
   1. Minimum Size: 1/4 inch.
   2. Maximum Size: 5/8 inch.

D. Sand: Sand shall consist of manufactured granular material, or combination thereof, free of deleterious amounts of organic material, mica, loam, clay and other substances not suitable for purpose intended. Conform to Section 200-1.5.5, SSPWC, for gradation as required for Portland Cement Concrete, sand must achieve compaction of a minimum 90 percent.

E. Crushed Aggregate Base: Crushed rock and rock dust conforming to requirements of Section 200-1.2, SSPWC, with 3/8 inch sieve requirement waived, or Class 2 aggregate base as defined in Section 26, CSS.

F. Imported Fill: Clean granular, free of debris, no rock larger than 3 inches in any dimension, non-expansive, approved by Geotechnical Engineer prior to placement on site.

G. Concrete: As specified in Section 32 13 13.

H. Concrete Slurry: as specified in Section 31 23 17.

I. Stockpiled Fill: On-site soils, stored separately on site, approved for re-use by Geotechnical Engineer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify fill materials to be reused or imported are acceptable to Architect.

B. Verify foundation perimeter drainage installation has been inspected and approved.

3.02 BACKFILLING

A. Backfill and compact areas to contours and elevations with unfrozen materials. Remove debris from areas to receive backfills.
   1. Compaction: ASTM D1557, Compact to 90 percent of maximum dry density.
   2. Floor slabs shall be in place a minimum of 7 days before backfill is placed against walls.

B. Fill areas and types of fill shall be inspected, tested and approved by Geotechnical Engineer.

C. Employ placement method that does not disturb or damage foundation perimeter drainage, foundation waterproofing and protective cover or utilities in trenches. Do not commence backfill until such work is in place, inspected and approved.

D. Maintain optimum moisture content of backfill materials to attain required compaction density. When operations are interrupted by rain, do not resume work until field tests indicate that moisture content and density of the fill are as previously specified.

E. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise.

F. Make grade changes gradual. Blend slope into level areas.

G. Remove surplus backfill materials from site.

H. Leave fill material stockpile areas completely free of excess fill materials.

I. Compaction Equipment: Wherever feasible, perform compaction with approved power-driven equipment such as rollers and sheeps-foot compactors. Compact areas inaccessible to rollers with pneumatic tampers or other approved compactors.

J. Flooding and jetting is not permitted.

3.03 TOLERANCES

A. Top Surface of Backfilling Subgrade: Within 0.05 feet from required elevations.

3.04 FIELD QUALITY CONTROL

A. No fill shall be placed on any prepared surface until that surface has been inspected and approved by Geotechnical Engineer.

B. If tests indicate work does not meet specified requirements, remove work, replace and retest. Cost of retests shall be paid by Owner and deducted from contract sum by Change Order.

C. Frequency of Tests: Architect may require as many tests as are necessary to ensure specified results.

3.05 PROTECTION OF FINISHED WORK

A. Protect finished Work.

B. Recompact fills subjected to and damaged by vehicular traffic.

END OF SECTION 31 23 23

SECTION 32 12 16 ASPHALT PAVING

PART 1 - GENERAL

1.1 REQUIREMENT

A. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the work as indicated in the Contract Documents and specified herein.

B. The following types of pavement shall be covered in this Section:
   1. Paving for utility trenching, parking lots, playgrounds, areas between buildings, adjacent to planting and turf areas, and as indicated on Construction Documents.

C. Related Sections:
   1. Section 31 20 00: Earthwork.
   2. Section 32 12 36: Seal Coat.
   3. Section 32 17 13: Pavement Markings.

1.2 QUALITY ASSURANCE

A. The work provided herein shall conform to and be in accordance with the Contract Plans, General Conditions/Specifications and Special Provisions, as well as the Standard Specifications for Public Works Construction (“GREENBOOK”), 2021 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the “Standard Specifications”.

B. The Owner's inspector shall test the temperature of each batch of asphaltic concrete prior to placement. At the time of delivery to the work site, the temperature of mixture shall not be lower than 260 degrees F or higher than 320 degrees F, the lower limit to be approached in warm weather and the higher in cold weather. If asphaltic concrete temperature is not within these tolerances the affected batch shall be rejected. Any and all costs due to the rejected asphaltic concrete shall be the responsibility of the paving contractor.

1.3 ESTABLISHMENT OF GRADES

A. The Contractor’s Surveyor will set grade stakes. The Surveyor shall be a California registered land surveyor or licensed Civil Engineer. The Surveyor shall be hired and paid by the Contractor, and shall be subject to the approval of the Owner. Contractor shall notify the Owner at least 48 hours before staking is to be started. The Owner will determine if work is ready for staking.

B. All work shall conform to the lines, elevations, and grades shown on the Construction Plans. Three consecutive points set on the same slope shall be used together so that any variation from a straight grade can be detected. Any such variation shall be reported to the Engineer. In the absence of such report, the Contractor shall be responsible for any error in the grade of the finished work.

C. Protect and maintain stakes in place until their removal is approved by the Owner. Grade or location stakes lost or disturbed by Contractor, shall be reset by the Surveyor at the expense of Contractor.

D. Areas having drainage gradients of 2 percent or more shall have elevation stakes, set with instrument, at grid intervals of 25 feet. Intermediate stakes may be set by using a tightly-drawn string line over the tops of adjacent stakes. Grade stakes must be set at all grade breaks, grade changes, etc.

E. Areas having drainage gradients of less than 2 percent shall have elevation stakes, set with instrument, at 10 foot intervals. Grade stakes must be set at all grade breaks, grade changes, etc.

1.4 SUBMITTALS

A. Mix Designs: The CONTRACTOR shall formulate a job-mix formula using the Hveem method in accordance with Standard Specifications Section 203-6.2 and submit it to the ENGINEER for approval. The resultant mixture shall have Hveem properties conforming to Standard Specifications Section 203-6.4.3.

B. Samples:

1. Prior to the delivery of specified aggregate to the site, the CONTRACTOR shall submit samples of the material for the INSPECTOR's acceptance in accordance with Standard Specifications Section 4-1.4. Samples shall be typical of materials to be furnished from the proposed source and in conformance with the specified requirements.

2. Aggregate base gradation and quality certifications shall be dated within 30 days of the submittal.

C. Certificates

1. Twenty days prior to the delivery of aggregates, asphalt materials, and paving mixes to the project site, the Contractor shall submit to the Engineer certificates and test results of compliance of such materials with these specifications.
2. Submit certificates of compliance from the supplier for bituminous materials for paint binder, asphaltic concrete, and seal coat.
3. Submit weigh master's certificates or certified delivery tickets for each truck load of asphaltic material delivered to the project site.
4. Upon completion of the weed control treatment, and as a condition for final acceptance, furnish a written certificate stating the brand name of the sterilant and the manufacturer, and that the sterilant used had at least the minimum required concentration, and that the rate and method of application complied in every respect with the conditions and standards contained herein.

1.5 QUALITY CONTROL

A. Asphaltic Concrete Producers Qualifications: Use only materials furnished by a bulk asphaltic concrete producer regularly engaged in production of hot mix, hot laid bituminous concrete.

B. Applicator Qualifications: Paving machine and roller operators shall be fully trained and experienced in the installation of asphaltic concrete paving on projects of similar size and complexity.

C. Regulatory Requirements: The quantity of volatile organic compounds (V.O.C.) used in weed killer, seal coat, primer and other materials shall not exceed the limits permitted under the current regulations of the local authorities having jurisdiction.

1.6 ENVIRONMENTAL LIMITATIONS

A. Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Tack Coats: Minimum surface temperature of 60 deg F.

2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

1.7 PAVEMENT-MARKING PAINT

A. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Base Course Material: Crushed aggregate base material shall consist of materials that meet the provisions of Specifications Section 31 20 00 Earthwork, Part 2.01F.

B. Asphalt Surfacing Materials: Furnish asphalt surfacing meeting the following requirement, furnished from a commercial asphalt central mixing plant.

1. Paint Binder/Tack Coat: Asphalt emulsion shall be CSS-1 or CSS-1h and shall conform to the requirements of Standard Specifications Section 203-3 Emulsified Asphalt.
2. Asphalt Concrete Composition & Grading:
   a. Asphalt concrete shall conform to Standard Specification Section 203-6.4, Type III-C3-PG-64-10 unless noted on the plans.
   b. The bottom 2-inches of asphalt located in Type II Duty areas, as noted on the civil drawings, shall conform to Standard Specification Section 203-6.4, Type III-B3-PG-64-10.
   c. Rubberized asphalt paving is not allowed.

C. Weed Control:

1. The soils sterilant shall be in accordance with current EPA acceptable standard and the California Department of Pesticide Regulations for soils sterilant. Sterilant shall be selected as appropriate for the environment in which is it to be placed. Contractor shall be licensed with the State of California to apply sterilant. Sterilant shall be commercial grade for commercial application. Payment for soil sterilization will include full compensation for application and all materials and incidental work required.
2. Apply Dow Elanco Spike 80DF, or approved equal, to the subgrade soil under all new asphalt, prior to asphalt paving. Spike 80DF weed control should be applied at the rate of seven pounds per acre. If another manufacturer is used follow their recommendations.

D. Headers and Stakes:

1. Headers: Redwood, Construction Heart Grade, size 2 x 6, unless otherwise indicated on construction drawings
2. Stakes: 2 x 4 redwood or 2 x 3 Douglas fir, Construction Grade.
3. Nails: Common, galvanized, 12d minimum.

PART 3 - EXECUTION

3.1 HEADERS

A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.

B. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of adjacent undisturbed earth.

C. Fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid grade a minimum of 12 inches. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header. Provide a minimum of 2-12d galvanized common nails through each stake.

D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.

E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.

F. Provide additional stakes and anchorage as required to fasten headers in place

3.2 SUBGRADE PREPARATION

A. Subgrade Preparation:
1. Refer to Table 1 on sheet C3.00 for requirements.

B. The subgrade preparation recommendations on C3.00 are based on the assumption that soils encountered during field exploration are representative of soils throughout the site. However, there can be unforeseen and unanticipated variations in soils between points of subsurface exploration. For this reason, the actual subgrade preparation will have to be determined on the basis of in-grading observations and testing performed by representatives of the project geotechnical consultant.

C. A California Licensed Surveyor (LS) must provide grade stakes and elevations for the Geotechnical Engineer to verify that the over-excavation depths, shown on the construction drawings for asphalt concrete pavement structural sections, have been achieved prior to re-compaction.

D. Subgrade tolerances: Subgrade for pavement shall not vary more than 0.02’ from the specified grade and cross section established by the Engineer. Subgrade for subbase or base material shall not vary more than 0.04’ from the specified grade and cross section. Variations within the above specified tolerances shall be compensating so that the average grade and cross section specified are met.

E. Correct irregularities by dressing down or filling as may be required, to bring areas to true subgrade elevations.

F. Where filling is required, scarify the subgrade to bond the new material to the in place material; use additional material as required, subject to the approval of the Architect, and provided by the Contractor.

G. Remove excess material from the site to a legal disposal area.

3.3 APPLICATION GENERAL

A. Finish elevations, extent of asphalt paving and locations of type of asphalt and class of base shall be as indicated and specified herein and on the Construction Documents. Bring subgrade elevations sufficiently below the finish elevations of the paving so as to accommodate the thickness of paving and base.

3.4 STERILANT APPLICATION

A. Place herbicide below all aggregate base course under new asphalt pavement. Meet the applicable environmental control requirements. Apply as directed by the manufacturer's printed instructions just before application of the base course. Sterilant shall not be applied within two feet of planting areas.

3.5 APPLICATION OF BASE COURSE

A. Install base course material, encompassing spreading and compacting, in accordance with the S.S.P.W.C. Section 301-2, Untreated Base.

B. After preparing the subgrade all traffic on the subgrade shall be avoided. Should it be necessary to haul over the prepared subgrade, the CONTRACTOR shall drag and roll the traveled way as frequently as may be necessary to remove ruts, cuts, and breaks in the surface. All cuts, ruts, and breaks in the surface of the subgrade that are not removed by the above operations shall be raked and hand tamped. All equipment used for transporting materials over the prepared subgrade shall be equipped with pneumatic tires.

C. Continued use of sections of prepared subgrade for hauling, so as to cut up or deform it from the true cross-section, will not be permitted. The CONTRACTOR shall protect the prepared subgrade from all traffic.

D. Maintain the surface in its finished condition until the succeeding layer is placed.

3.6 PLACING ASPHALT CONCRETE SURFACING:

A. Asphalt binder (tack coat) shall be applied to all existing pavement surfaces to be overlaid and/or joined per section 302-5.4 of the Standard Specifications. Asphalt binder (tack coat) shall be applied to existing surfaces to be surfaced and between layers of asphalt concrete, except when eliminated by the Engineer. A layer of asphalt binder (tack coat) shall be applied to all vertical-cut faces and between subsequent AC lifts.

B. Asphalt Concrete Pavement:

1. All work shall be in accordance with Section 302-5 of the Standard Specifications, except as noted herein. Asphalt concrete work shall include full-depth patching and variable thick asphalt concrete transition areas. The Contractor shall, on a daily basis, provide the Inspector with copies of certificates of weight for all materials delivered to the job site and/or incorporated in the work. At no time shall the coarse aggregate that has segregated from the mix be scattered across the paved mat.
2. Asphalt concrete shall not be placed on any surface, which contains ponded water or excessive moisture in the opinion of the Engineer. If paving operations are in progress and rain or fog forces a shut down, loaded trucks in transit shall return to the plant, and no compensation will be allowed therefore. The Contractor shall furnish and use canvas tarpaulins to cover all loads of asphalt from the time that the mixture is loaded until it is discharged from the delivery vehicle, unless otherwise directed in writing by the Engineer
3. The Inspector will examine the base before the paving has begun. The Contractor will correct any deficiencies before the paving is started.

4. Asphalt concrete of the class indicated in Section 2.B.2 shall be laid in courses conforming to S.S.P.W.C. Table 302-5.5(A) unless otherwise stated herein.
5. Successive courses may be laid upon previously laid courses as soon as the previous course has cooled sufficiently to show no perceivable displacement under equipment or loaded material delivery trucks and a tack coat has been applied.
6. Wherever AC pavement does not terminate against a curb, gutter, or another pavement, the Contractor shall provide and install a redwood or pressure treated Douglas fir header at the line of termination.
7. Smoothness of asphalt shall conform to section 302-5.6.2 of the Standard Specifications
8. Density shall conform to the below requirements:
    a. In-place density of the Asphalt Concrete will be based on test results from a nuclear gauge and core samples taken in accordance with CTM 375, “Determining the in Place Density and Relative Compaction of Asphalt Concrete Pavement” except as modified below. The Inspector will determine when core sample testing shall be completed.
    b. Asphalt Concrete shall be compacted to not less than 95.0 percent for a single test and not less than an average in place density of 96.0 percent relative compaction of the Laboratory Test Maximum Density as determined by, Caltrans Testing Method (CTM) 375 except as modified by these specifications.
    c. The materials testing laboratory, paid for by the contractor, will obtain random samples of the hot mix asphalt material from behind the paving machine in accordance with Caltrans Testing Method (CTM) 125, “Methods for Sampling Highway Materials and Products in Roadway Structural Sections”, to determine the Laboratory Test Maximum Density of the asphalt mixture in accordance with CTM 308.
    d. Asphalt Concrete compaction shall be accepted based upon passing tests taken from the nuclear gauge. In the event that the nuclear gauge testing presents failing results, then core samples will be the determination for the in place density and acceptance or rejection of the compaction.
    e. When core testing is to be performed to determine the relative compaction after nuclear gauge testing has not produced passing tests, the materials testing laboratory will obtain four 4” diameter core specimens (or four 6” diameter core specimens) for determination of relative density of the completed pavement. The four cores shall represent the sample frequency requirements specified in CTM 375.
9. Pavement at all longitudinal joints shall have a Field Density of 95%, as described in 302-5.6.2 of the Standard Specifications. When the test results of the field cores are less than 95% Relative Compaction, the Contractor shall remove a 1 foot wide section on each side of the longitudinal joint. The Contractor shall replace the removed pavement with an asphalt mix that meets the job specification at no additional cost to the Owner.

3.7 FLOOD TESTING

A. Flood Test: Before acceptance, all pavements shall be water tested to ensure proper drainage as directed by the Inspector. The Contractor shall provide water for this purpose. The flooding shall be done by water tank truck. Depressions where the water ponds to a depth of more than 0.01 foot shall be filled with Type E/School Mix pavement or the slope corrected to provide proper drainage. The edges of the fill shall be feathered and smoothed so that the joint between the fill and the original surface is invisible. Practical field measurement: 0.01 foot = two quarters stacked.

B. No standing water shall remain after 60 minutes on a 70 degree F (or warmer) day.

3.8 SEAL COAT

A. Allow new asphalt pavement to cure 30 days before application of seal coat. See Project Specification Section 32 12 36: Seal Coat.

3.9 FIELD QUALITY CONTROL

A. Thickness: Tolerances for asphalt pavement thickness shall be ¼ inch, plus or minus.

B. All paving shall drain properly before being accepted. Upon completion, the pavement shall be true to grade and cross section. The asphalt substrate, shall not vary from the planned cross slope by more than +- 0.1. When a 10 foot straightedge is laid on the finished surface of the asphalt, the surface shall not vary from the edge of the straightedge more than 1/8 inch, except at grade breaks. Where paving does not meet these tolerances, the paving material shall be repaired by a method determined by the Owner. Repairs shall not be made to pavement surface by feather-edging at the join lines. All expenses for pavement repair up shall be borne by the Contractor at NO cost to the Owner.

C. Corrective Measures: It is the Contractor's responsibility to determine if the planarity, cross slopes, and general specifications have been met. If all of the conditions have been met the Contractor must notify the Owner in writing of the acceptance of the asphalt paving.

3.10 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.11 CLEAN UP

A. Clean all debris and unused materials from the paving operation. Clean all surfaces that have been spattered or defaced as a result of the paving operation. Asphalt or asphalt stains which are noticeable upon surfaces of concrete, or materials which will be exposed to view, shall be promptly and completely removed. Cleaning shall be done in a manner that will not result in any discharge of contaminated materials into any catch basin. All expenses for clean up shall be borne by the Contractor at NO cost to the Owner.

END OF SECTION 32 12 16

SECTION 32 12 36 SEAL COATS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Surface sealer over new asphalt paved surfaces.

1.02 REFERENCES

A. Conform to Section 203 and 302 of the Standard Specifications for Public Works Construction.

B. Comply with International Slurry Surfacing Association (ISSA) performance guidelines.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's product information and application procedures for bituminous surfacing.

1.04 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications Section 203-9, “SEALCOAT – ASPHALT BASED”.

B. Obtain materials from same source throughout.

C. Schedule a pre-construction conference at jobsite in advance of beginning of Work. In existing areas to be seal coated and restriped, document existing striping to be duplicated before commencing seal coating work.

D. Review and resolve conflicts involving requirements of specifications. Record discussions and furnish copies to all attendees.

E. Beginning of Work means Contractor accepts all conditions.

F. Agitate bulk materials during transport.

1.05 REGULATORY REQUIREMENTS

A. Comply with local air quality management district regulations for emissions maximums.

B. Maintain control of vehicular and pedestrian traffic during seal coating operations as required for other construction activities and in accordance with local traffic authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Seal Coat: The materials for sealcoat shall conform to Section 203-9 – “Sealcoat – Asphalt Based” of the Standard Specifications. Before incorporation in the Work, the Contractor shall submit a 2 Liter (2-quart) sample of undiluted seal coat at no cost to the Owner.

1. Seal Coat: Provide one of the following surface seals:

Product Name	Manufacturer
GuardTop	Vulcan Materials Company
Over Kote	Diversified Asphalt Product
Park Top	Western Colloid Products
Sure Seal	Asphalt Coating Engineering
MasterSeal	SealMaster Pavement Products & Equipment

B. Crack Sealing: Crack sealant shall be CalSeal Modified Asphalt joint sealant as manufacturered by Henry Inc, Crafco Polyflex Type 3 or equal.

PART 3 - EXECUTION

3.01 REPAIRING AND SEALCOATING OF SURFACES

A. Preparation of Surfaces:

1. Before placing the sealcoat, the pavement surface shall be cleaned by sweeping, flushing or other means necessary to removal all loose particles of paving, all dirt, and all other extraneous material. This shall include vegetation in pavement cracks and between pavement and curb/gutter. Prior to removal an approved herbicide, which leaves behind a visible blue marker dye, shall be sprayed where vegetation exists. Surface contaminates, grease or oil spots shall be cleaned to allow for proper adhesion.

2. Prior to applying sealcoat material, cracks wider then 1/8 inch shall be cleaned, treated with weed killer, and filled with an asphalt-based crack filler (large cracks may require several applications). For best quality, it is recommended that all broken asphalt be removed and patched with new asphalt. It is also suggested that extreme low spots be filled with new asphalt. New asphalt must cure 30 days before application of sealcoat.

3. Immediately before commencing the sealcoat operations, all surface metal utility covers (including survey monuments) shall be protected by thoroughly covering the surface with an appropriate adhesive and oiled or plastic paper. No adhesive material shall be permitted to cover, seal or fill the joint between the frame and cover of the structure. A vertical tab shall be placed on each cover for locating after the seal application is complete. The tab shall extend at least 3” above the existing pavement surface. Covers are to be uncovered and cleaned of asphalt emulsion material by the end of the same work day. Inspector shall inspect surfaces before the installation of seal coat.

4. For best results, the asphalt, just prior to being sealed, should be sprayed with a mist of water in an amount that will leave the surface damp but with no puddles or

visible water. This procedure is critical when ambient temperature is hot with bright sunlight or when the pavement is excessively aged or porous.

5. A prime or tack coat may be necessary on surfaces that have weathered excessively or are dusted. The primer should be diluted with three parts clean, potable water and one part SS-1h emulsion and shall be applied at the rate of 0.05 gallon per square yard.

6. Install barricades as required to divert traffic from operations. Install temporary “no parking” signs and similar notices.

B. Application:

1. Sealcoat may be mixed with water to obtain desired consistency for job requirements to a maximum of 20% of the total volume. Care should be taken not to over dilute. Material after dilution shall be mixed with a mechanical agitator to maintain consistency and ease of application. Note that as the pavement increases in roughness, the amount of dilution should be decreased.

2. Sealcoat shall only be applied when the atmospheric temperature is greater than 55 degrees F and if rain is not forecast for the period of 24 hours after application.

3. The sealcoat material shall be applied in two applications. Unless otherwise specified, the total quantity applied (before dilution) shall be 50 gallons per 1,000 square feet.

4. Sealcoat material shall be applied using a truck-mounted tank or wheeled container in continuous parallel lines and spread by means of brooms or rubber-faced squeegees either by hand or machine and in such a manner as to eliminate all ridges, lap marks, and air pockets.

5. Hand tools shall be available in order to remove spillage. Ridges or bumps in the finished surface will not be permitted. Sealcoat material shall be homogeneous prior to spreading, with no visible separation of solids and liquids.

6. When the first coat has completely dried to the touch, apply the second coat. While misting is not normally required before second coat, surface should be clean with no foreign materials on it.

C. Drying Time:

1. Sealcoat should be allowed to dry 24 – 48 hours before permitting traffic. When asphalt is cold or in shade, or air temperature is below 75 degrees F, based on general weather, humidity and temperature conditions, drying time may need to be extended.

3.02 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

B. Striping for parking or traffic flow should be done only after the sealcoat has thoroughly dried. It is recommended that a high quality water based Traffic Line Paint be used for best results.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION 32 12 36

SECTION 32 13 13 - SITEWORK CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
1. Cast-In-Place concrete pedestrian paving and sidewalks.
2. Curbs and gutters.
3. Concrete stairs, ramps and landings.
4. Light standard bases, railing footings and similar site structures.
5. Utility concrete pads.
6. Perimeter concrete curbing, mow strips, concrete drainage structures, swales.
7. Stamped concrete.
8. Slurry Concrete.
9. Detectable Warnings

B. Related Sections:
1. Section 31 23 15 - Earthwork and Building Excavation.

1.02 REFERENCES

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and

B. Materials.

C. ACI 224.3R-95 - Joints in Concrete Construction

D. ACI 318 - Building Code Requirements for Structural Concrete and Commentary, 2008 Edition.

E. ACI 301 - Structural Concrete for Buildings.

F. ASTM - American Society for Testing and Materials
1. ASTM A185 - Steel Welded Wire Reinforcement, Plain, for Concrete
2. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
3. ASTM C33 - Concrete Aggregates
4. ASTM C94 - Ready-Mixed Concrete
5. ASTM C150 - Portland Cement
6. ASTM C171 - Sheet Materials for Curing Concrete
7. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete
8. ASTM C920 - Elastomeric Joint Sealants
9. ASTM C979 - Pigments for Integrally Colored Concrete
10. ASTM C1107 - Packaged Dry, Hydraulic - Cement Grout (Non-Shrink)
11. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete, Paving and Structural Construction

G. CBC - 2013 California Building Code and Supplements
1. CBC-11 – CBC Chapter 11B, Accessibility to Public Buildings, Public Accommodations, Commercial Facilities and Publicly Funded Housing
2. CBC-17 – CBC Chapter 17A, Structural Tests and Special Inspections
3. CBC-19 – CBC Chapter 19[A], Concrete [DSA]

1.03 SUBMITTALS

A. Placement Schedule for approval: Provide details or sketches showing location of each placement of concrete Work. Do not deviate from location of expansion joints or scorelines.

B. Design mix for each concrete mix.

C. Steel reinforcement shop drawings, including materials, grade, bar schedules, spacing, bent bar diagrams, arrangement and supports.

D. Submit contraction (crack control) joint, expansion, isolation and construction joint layout to Architect for approval.

E. Product data on joint filler, sealants, curing compounds and reinforcing.

F. Project Record Documents
   1. Accurately record actual locations of embedded sleeves, utilities and components that are concealed from view.

G. Submit Certification of experience for Color finisher.

1.04 REGULATORY REQUIREMENTS

A. Pedestrian walks, plazas and paving shall comply with CBC Chapter 11B. Portland Cement concrete paving shall be stable, firm, and slip resistant and shall comply with CBC Sections 11B-302 and 11B-403.

1.05 QUALITY ASSURANCE

A. Maintain one copy of all records on site.

B. Acquire cement and aggregate from same source for all Work.

C. Conform to ACI 318-11 Chapter 5.13, California Building Code, when placing concrete during hot weather.

D. Conform to ACI 318-11 Chapter 5.12, California Building Code, when placing concrete during cold weather. No placement of concrete permitted below 50 degrees Fahrenheit.

E. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

F. Mock-up
   1. Install minimum 5 feet by 5 feet mock-up of concrete sidewalk for each surface treatment specified.
   2. Install mock-up one month prior to installation.
   3. Locate as approved by the Architect.
   4. Use identical forming system, sub-grade type, reinforcing, expansion joints, score joints, finishing and edge trim as specified for installation.
   5. Architect approval required.
   6. Mock-up may not be used in final installation.
   7. Remove mock-up materials from site and dispose legally.

1.06 EXTENDED WARRANTY

A. Manufacturer shall warrant prefabricated detectable warning texture products against failure in materials or workmanship for at least the specified warranty periods. Upon written notice from Owner manufacturer shall promptly, without cost, and with least practicable inconvenience to Owner correct such defects.
   1. Failures include, but are not limited to, significant degradation in color fastness, conformation, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly.
      a. Significant degradation means that product loses 10 percent or more of its approved design characteristics, as determined by the authority having jurisdiction.
   2. Minimum Warranty Period: 5 years from date of Certified Completion.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement: ASTM C150 - Type I - Normal or Type II - Moderate, Portland Cement type, from one manufacturing plant only.

B. Aggregates: ASTM C33, single source for all materials. Maximum size aggregate: 1 inch.

C. Non-Shrink Grout: ASTM C1107, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 4,000 psi in 24 hours and 7,500 psi in 7 days unless otherwise indicated on Drawings; of consistency suitable for application and a 30 minute working time.

D. Threshold and landing mortar: Wheelchair lift ramp mortar: Ardex K301, Mapei Quickcem Top 101 or equal. Finish with manufacturer’s cement dressing products for smooth surface.

E. Crushed Aggregate Base: Crushed rock and rock dust conforming to requirements of Section 200-1.2, SSPWC, with 3/8 inch sieve requirement waived, or Class 2 aggregate base as defined in Section 26, CSS.

2.02 ACCESSORIES

A. Expansion Joints:
   1. Expansion Joint Filler - ASTM D1751: Closed cell, 1/2 inch thick; DECK-O-FOAM by W. R. Meadows, Dayton Superior or equal.
   2. Joint Devices: Integral extruded polystyrene plastic; 1/2-inch max. thick, with removable top strip exposing sealant trough; Snap Cap Expansion Joint Cap by W. R. Meadows or equal.
   3. Sealant: Polyurethane two-component type, self-leveling, for level surface application, UREXPAN NR-200 or DYNATRED for sloped surfaces, manufactured by Pecora Corp., Harleysville PA, or equal. Color shall be selected by Architect from manufacturer's standard list of colors.
   4. Primer: As recommended by sealant manufacturer.
   5. Joint Backing: ASTM C1330, Cylindrical, Type C, closed cell, polyethylene backer rod; oversized 30 to 50 percent larger than joint width. Green Rod by Nomaco Inc. or equal.

B. Slip Resistant Finish: Dry shake type aluminum oxide abrasive grains, hardness No. 9 on Mohr's scale; Emery Non-slip, manufactured by Dayton Superior, Kansas City, KS, Emery Aggregate manufactured by Oregon Emery Co., Halsey OR, or equal as approved in accordance with Division 01, General Requirements for Substitutions.

C. Detectable Warning Texture: Division of the State Architect (DSA/Access Compliance) approved products shall be used, compliance with CBC Sections 11B-705, IRs 11B-3 and 11B-4 and the California Accessibility Reference Manual.
   1. Truncated Domes: provide raised Detectable Warnings with diameter of 0.90" min. to 0.92" max. at base tapering to 0.45" min. to 0.47" max. at top, height of 0.18" - 0.22" and base-to-to base spacing of 0.65" min. measured between the most adjacent domes on a square grid (in-line pattern).
      a. Truncated Dome: shall contrast visually with adjoining surfaces, light-on-dark or dark-on-light per section 11B-705.1.1.3. Material used to provide contrast shall be integral part of walking surface. Warning surface shall differ from adjoining surface in resiliency or sound to cane contact.
   2. Detectable Warning Texture (Truncated Domes): Paver Tiles: 12 by 12 inches unless noted otherwise on drawings, with pre-formed fastener locations.

D. Safety Stair Nosings: Style B-41A, 4 inches wide manufactured by Barrycraft Pattern and Foundry, Inc., Birmingham, AL, or equal as approved in accordance with Division 01, General Requirements for Substitutions. Provide nosings (strips) at all treads.
   1. Install 2" wide nosings (Strips) (2" min. – 4" max.) in contrasting color (70% contrasting), 1" maximum from edge of nosing of each exterior stairs, CBC Section 1133B.4.4. Colors to be selected by Architect.
   2. Install in fresh concrete, cast in place.

E. Anti-Slip Floor Tape: Coarse grit tape, OSHA 1910.265, 2 inches wide x the length of the stair nosing, Setonwalk Anti-slip Tape by Seton Name Plate Co. Branford, CT, Tred-Sure by Garon Products, Inc., New Brunswick, NJ or equal. Color: in contrasting color to be selected by Architect.

2.03 CONCRETE MIX

A. Mix and deliver concrete in accordance with Section 1905A, California Building Code. Deliver concrete in transit mixers only. Mix concrete for 10 minutes minimum at a peripheral drum speed of approximately 200 feet per minute. Mix at jobsite minimum 3 minutes. Discharge loads in less than 1-1/2 hours or under 300 revolutions of the drum, whichever comes first, after water is first added.
   1. Design Mix:
      a. Conform to ACI 318-11 Chapter 5.8 for Proportioning on the basis if field experience or trial mixtures method.
      b. Conform to ACI 318-11 Chapter 5.8 for Selection of concrete proportions method. Selection of concrete proportions and ingredients for design mix by a DSA-approved Testing Laboratory and certified by a registered civil engineer licensed in California.
   2. Do not exceed 0.50 water-cement ratio by weight for slabs and for other concrete.
   3. Quantities of Materials: Weighmaster's records not required for sitework concrete.
   4. Required Strength: Minimum 3,000 psi for sitework concrete.

B. Slurry Concrete:
   1. Slump: Between 4 inches and 6 inches.
   2. Aggregate: 40 percent sand by weight, 60 percent pea gravel, minimum 1/4 inch, maximum 5/8 inch.
   3. Portland Cement: ASTM C150, 2-sack mix (2 sacks of cement per cubic yard).
   4. Sufficient water shall be added to produce a fluid, workable mix that will flow and can be pumped without segregation of aggregate. Material shall be mechanically mixed until the cement and water are thoroughly dispersed.

2.04 REINFORCEMENT

A. Reinforcing Steel: ASTM A615; deformed billet steel bars, in grades as follows, and conforming to CBC-19, Section 1903A.
   1. For No. 4 and larger bars, use 60 ksi yield grade.
   2. For ties and stirrups, and No. 3 and smaller bars, use 40 ksi yield grade.
   3. For welded bars, use ASTM A706 60 ksi yield grade.

B. Welded Wire Reinforcement: Plain type, ASTM A185; in flat sheets; uncoated finish, 6 x 6 - W4.0 x W4.0 unless otherwise note on drawings.

C. Tie Wire: Annealed steel, minimum 16 gage size.

D. Dowels: ASTM A615; 60 ksi yield grade, plain steel, uncoated finish.

2.05 FORMS

A. Conform to ACI 318-11 Chapter 6.

B. Plywood Forms: APA - Medium density overlay, Group 1, Exterior, PS-1, for exposed surfaces. APA Plyform B-B, Class 1, Exterior, PS-1 for unexposed surfaces.
   1. Use flexible or curved forms for curves with a radius 100 feet or less.

C. Lumber: Douglas Fir species, construction grade, Surfaced Lumber, with grade stamp clearly visible for smooth and straight exposed surface.

D. Form Release Agent; commercially formulated form-release agent that will not bond with, stain or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.06 CURING MATERIALS

A. Polyethylene Film ASTM C171; 10 mil thick, clear, manufactured from virgin resin with no scrap or additives, manufactured by Burke-Edoco, Long Beach, CA, or equal as approved in accordance with Division 01, General Requirements for Substitutions.

B. Water: Potable and not detrimental to concrete.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify site conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely and will not cause hardship in placing concrete.

3.02 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

B. In locations where new concrete is doweled to existing Work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. Ensure sub-base or base materials have been compacted or otherwise treated.
   1. Sub-base and base preparation per Section 31 23 15 - Earthwork and Building Excavation and Section 31 23 23 - Backfilling.

3.03 PLACING CONCRETE (GENERAL)

A. Convey and deposit concrete in accordance with ACI 318-11 Chapter 5.9 and 5.10. Remove loose dirt from excavations.

B. Notify Job Inspector minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed joint fillers, joint devices and accessories are not disturbed during concrete placement.

D. Install joint fillers, primer and sealant in accordance with manufacturer's instructions.

E. Place concrete continuously between predetermined expansion joints.
   1. Install expansion joints at vertical concrete walls at 24 feet on center unless noted otherwise on drawings.

F. Do not interrupt successive placement; do not permit cold joints to occur. Avoid segregation of materials. Perform tamping and vibrating so as to produce a dense, smooth application free of rock pockets and voids. Do not use vibrators to move concrete horizontally.

G. Do not allow concrete to fall free from any height which will cause materials to segregate. Maximum height of free fall permitted in any case: 5 feet.

H. Defective Installation: Repair and clean at Contractor's expense all concrete damaged or discolored during construction. Where concrete requires repair before acceptance, the repair shall be made by removing and replacing entire section between joints and not by refinishing the damaged portion.

I. Proper curing of concrete surfaces is the responsibility of the Contractor. Concrete failing to meet specified strength shall be removed and replaced.

3.04 ON-SITE CONCRETE SIDEWALKS, PEDESTRIAN PAVED AREAS AND RAMPS

A. Forms, Wood: Free from warp, with smooth and straight upper edges, surfaced one side, minimum thickness 1-1/2 inches adequate to resist springing or deflection from placing concrete.

B. Forms, Metal: Gauge thickness sufficient to provide rigidity and strength equivalent to wood.

C. Reinforcing Steel: #4 bars, place bars at 12 inches on center each way for sidewalks and paved areas and #4 bars for edges unless otherwise indicated on Drawings.

D. Concrete Placement: Dampen subgrade to retain moisture in concrete mix. Tamp and spade to consolidate concrete for entire length of pour. Strike off upper surface to specified grades.

E. Isolation Joints: Locate at slabs abutting vertical concrete surfaces and as patterned on drawings. Install vertically, full depth of concrete with preformed joint filler recessed for plastic cap at 1/2 inch depth at top for sealant application.

1. Doweled Isolation Joints at Heavy Vehicle Driveways and Parking: At abutting building foundations; provide 1/2-inch diameter smooth steel dowels 14 inches long, one end of dowel lubricated and set in capped sleeve to allow for longitudinal movement, spaced at 24 inches on center maximum, 6 inches from edges.
2. Monolithic Curb and Gutter: No expansion joints required between gutter and curb face.

F. Expansion Joints: Locate maximum 24 feet centers and as patterned on drawings. Install vertically full depth of concrete, install preformed joint filler recessed for plastic cap at 1/2 inch depth at top for sealant application.
1. Monolithic Curb and Gutter: No expansion joints required between gutter and curb face.

G. Contraction/Crack Control Joints: At 8 feet each way at concrete paved areas, and 5 feet at sidewalks, tool joint with 1/2 inch radius, depth 1/4 the thickness of slab but not less than 1 inch deep. Refer to drawings for required design patterns.

H. Curb Ramps: Form grooves, flush to finished surfaces, 12" wide border. Grooves at 1/4" deep, 1/4" wide and at 3/4" on centers at 3 sides on level surface of the sidewalk. Provide patterns as indicated in drawings. Detectable Warnings at Curb Ramps per IR 11B-2 and 11B-3, 11B-4 CBC 1127B.5.7.
1. Detectable warning (Truncated Domes) required at curb ramps less than 1:15 (6.7% slope), DSA IR 11B-3
2. Detectable Warnings (Truncated Domes) required at all Curb Ramps, American with Disabilities Act Standards for Accessibility Design Section 4.7.7.
   a. Plastics/Composites: Cast in place plastic tiles per manufacturer's instructions and in accordance with CBC.

I. Finish:
1. Portland cement paving shall be stable, firm, and slip resistant and shall comply with CBC Sections 11B-302 and 11B-403.
2. Screed concrete to required grade, float to a smooth, flat, uniform surface. Edge all headers to 1/2 inch radius. Edge expansion joints to 1/4 inch radius. Steel trowel to hard surface.
3. Medium Broom Finish: After final troweling, apply a medium broom finish transverse to centerline or direction of traffic.
4. Heavy Broom Finish At Ramps: After final troweling, apply a heavy broom finish transverse to centerline or direction of traffic.
5. Surface Cross slopes: surface cross slopes shall not exceed one unit vertical in 50 units horizontal (2-percent).

J. Curing: Cure surfaces utilizing one of the following methods:
1. Spraying: Spray water over slab areas and maintain wet for 7 days, use burlap mats.
2. Spread polyethylene film over slab areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for 7 days.
3. Apply liquid curing compound at rate of 200 sf per gallon, using power sprayer equipped with agitator. Do not apply liquid curing compound to surfaces scheduled to receive paving units of any kind.

K. Remove expansion joint plastic caps. Prime both sides of joint and apply self-leveling sealant per Section 07 92 00. Provide smooth concave surface.

3.05 LIGHT STANDARD BASES, FENCE POST BASES, RAILING FOOTINGS, MISCELLANUOUS SURFACES, UTILITY PADS, AND SIMILAR SITE STRUCTURES

A. Forms: Suitable material and type, size, shape, quality and strength to insure construction as designed, true to line and sufficiently rigid to resist deflection during placing of concrete. Clean forms of all dirt, mortar and foreign matter before use.

B. Reinforcement: Place accurately and hold in position, using metal chairs, spacers, metal hangers, supporting wires and other devices of sufficient strength to resist crushing under full load. Clean reinforcing steel of mortar, oil, dirt, loose mill scale loose or thick rust and coatings.

C. Coordinate installation of conduits, cast in place items and other inserts.

D. Finish: Grind or sack as required as determined by the Architect to produce a smooth, straight, plumb and acceptable finish without burrs or form marks. For horizontal surfaces: provide float finish.

E. Curing: Cure surfaces utilizing one of the following methods:
   1. Spraying: Spray water over slab areas and maintain wet for 7 days.
   2. Spread polyethylene film over slab areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for 7 days.
   3. Apply liquid curing compound at rate of 200 square feet per gallon, using power sprayer equipped with agitator. Do not apply liquid curing compound to surfaces scheduled to receive paving units or finish of any kind.

3.06 FORMED CONCRETE STAIRS AND LANDINGS

A. Subgrade Preparation: As approved by the Geotechnical Engineer.

B. Forms: Suitable material and type, size, shape, quality and strength to ensure construction as designed, true to line and sufficiently rigid to resist deflection during placing of concrete. Clean forms of all dirt, mortar and foreign matter before use.

C. Reinforcement: Place accurately and hold in position, using metal chairs, spacers, metal hangers, supporting wires and other devices of sufficient strength to resist crushing under full load. Clean reinforcing steel of mortar, oil, dirt, loose mill scale, loose or thick rust and coatings.

D. Form grooved nosing flush to finished surface, 3” wide. Grooves at 1/4” deep, 1/4” wide and at 3/4” on centers full length of stair at all treads. Apply contrasting color paint at all treads per Section 09 90 00.

E. Finish: Hard steel trowel at monolithic risers. Steel trowel surfaces treated with Slip Resistant Finish sufficiently to allow particles to extend slightly above finish surface.
   1. Slip Resistant Finish: Apply in accordance with manufacturer's instructions on surfaces at a minimum rate of 50 lbs. per 100 square feet.
   2. Owner's Option in lieu of Slip Resistant Finish:
      a. Apply Medium Broom Finish.

F. Curing: Cure surfaces utilizing one of the following methods:
   1. Spraying: Spray water over slab areas and maintain wet for 7 days.
   2. Contractor's Option
      a. Spread polyethylene film over slab areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for 7 days.

b. Apply liquid curing compound at rate of 200 square feet per gallon, using power sprayer equipped with agitator.

3.07 CURB AND GUTTER, MOW STRIPS, CONCRETE DRAINAGE STRUCTURES, SWALES

A. Subgrade Preparation: Subgrade material, base material and compaction requirements as approved by the Geotechnical Engineer.

B. Forms: Single face type required, cut to conform exactly with face batter and radius, sufficiently rigid to resist springing or deflection from concrete placement. Clean forms of all loose dirt, mortar or similar materials and apply a light coating of oil or other suitable material prior to concrete placement.
1. Slip Forms: Contractor's option upon approval of the Architect.

C. Reinforcement: Refer to drawings for size and spacing. Interrupt reinforcement at expansion joints.

D. Concrete Placement: Dampen subgrade to retain moisture in concrete mix. Tamp and spade to consolidate concrete to entire length of pour. Strike off upper surface to specified grades. Cut drain pipes to conform to curb batter.

E. Expansion Joints: Locate joint filler at maximum 20 foot centers. Trim off excess filler material flush to finish surface. No sealant application required.

F. Control Joints: at 8 feet on center, tooled joints, 1/2 inch radius.

G. Finish: Apply thin layer of mortar of 1 part Portland cement to 1-1/2 parts sand to exposed faces. Trowel to a smooth and even finish with a fine hair broom applied parallel with the line of the work. Round all edges to 1/2 inch radius. No Contractor identification permitted.

H. Curing: Cure surfaces utilizing one of the following methods:
1. Spraying: Spray water over curb and gutter and maintain wet for 7 days.
2. Spread polyethylene film over areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for 7 days.
3. Apply liquid-curing compound at rate of 200 sf per gallon, using power sprayer equipped with agitator.

3.08 TOLERANCES

A. Construction tolerances shall not violate dimensions, grades, slopes required by CBC for accessibility requirements. Adjust work accordingly to comply with requirements.

B. Comply with tolerances of ACI 117 and as follows (tolerances may not exceed CBC maximum or minimum):
1. Maximum deviation of 1/8 inch in 10 feet.
2. Elevation: 1/4 inch (6 mm).
3. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
4. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/8 inch (3 mm).
5. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch (25 mm).
6. Vertical Alignment of Tie Bars and Dowels: 1/4 inch (6 mm).
7. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch (13 mm).

8. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches (6 mm per 300 mm).
9. Joint Spacing: 3 inches (75 mm).
10. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
11. Joint Width: Plus 1/8 inch (3 mm), no minus.

END OF SECTION 32 13 13

SECTION 32 17 13 PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 REFERENCE:

A. Related Sections:

1. Section 32 12 16: Asphalt Paving.

1.02 DESCRIPTION:

A. Principal Work Items Are:

1. Painted lines, lettering, and symbols at parking areas.

2. Painted stripes at exterior stairs.

3. Fire Lane “No Parking.”

4. Curb marking and red curbs.

1.03 JOB CONDITIONS:

A. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

B. Sequencing, Scheduling: Coordinate with paving work. Verify that paint type is compatible with asphalt paving surfaces seal coats.

B. Protection: Do not apply pavement markings for seven days after application of asphalt surface seal coat. After application, protect from traffic until thoroughly dry.

1.04 QUALITY ASSURANCE:

A. Regulatory Requirements:

1. 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
    a. Accessible Parking
        i. Accessible parking spaces serving a particular building or facility shall be located on the shortest accessible route to an entrance complying with CBC Section 11B-208.3.1.
        ii. Accessible parking spaces serving more than one accessible entrance shall be dispersed and located on the shortest accessible route to the accessible entrances.
        iii. Accessible parking spaces in a parking facility not serving a particular building or facility shall be located on the shortest accessible route to an accessible pedestrian entrance of the parking facility. CBC Section 11B-208.3.1
        iv. Minimum number of required accessible parking spaces shall be provided in accordance with CBC Table 11B-208.2 for each parking facility provided on a site.
        v. For every six or fraction of six accessible parking spaces, at least one shall be an accessible van parking space. CBC Section 11B-208.2.4
        vi. Accessible parking spaces and access aisles shall comply with CBC Section 11B-502 and shall be dimensioned to the centerline of the marked lines as follows:

a) Parking spaces and access aisles shall be marked according to CBC Figures 11B-502.2, 11B-502.3, and 11B-502.3.3. Their surfaces shall comply with CBC Section 11B-302 and shall be at the same level, with slopes not steeper than 1:48 in any direction. CBC Section 11B-502.4
b) Parking spaces shall be 9'x18' minimum and van parking spaces shall be 12'x18' minimum with an adjacent access aisle of 5'x18' minimum. Access aisles shall be placed on either side od the standard parking spaces, but only on the passenger side of the van parking spaces. Van parking spaces shall be permitted to be 9'x18' minimum where the access aisle is 8'x18' minimum.
c) Access aisles shall be marked by a blue painted borderline around their perimeter. The area within the blue borderline around their perimeter. The area within the blue borderlines shall be marked with hatched lines a maximum of 36" on center in a color contrasting with that of the aisle surface, preferably blue or white. Access aisle markings may extend beyond the minimum required length. CBC Section 11B-502.3.3
d) Access aisles (accessible parking spaces as well – similar application) shall not overlap the vehicular way. CBC Section 11B-502.3.4
e) A vertical clearance of 8'-2" minimum shall be provided for accessible parking spaces, access aisles, and vehicular routes serving them. CBC Section 11B-502.5.

b. Passenger Drop-Off and Loading Zones
   i. At least one passenger loading zone shall be provided in every continuous 100 linear feet of loading zone space, or fraction thereof, complying with CBC Section 11B-209 and 11B-503 as follows:
      a) Vehicular pull-up spaces shall be 8' x 20' minimum.
      b) Access aisles shall be 5' wide minimum x full length of vehicular pull-up spaces they serve and shall be adjacent and parallel to the vehicular pull up spaces. They shall be at the same level with each other and with slopes not steeper than 1:48 in any direction. Access aisle shall adjoin an accessible route and shall not overlap the vehicular way.
      c) Access aisles for passenger drop-off and loading zone shall be marked with a painted borderline around their perimeter. The area within the boderlines shall be marked with hatched lines a maximum of 36" on center in a color contrasting with that of the aisle surface. (Blue perimeter lines with blue interior hatch lines are preferred for concrete surfaces and blue perimeter lines with white interior hatch lines are preferred for asphalt surfaces.) CBC Section 11B-503.3.3
      d) A vertical clearance of 9'-6" minimum shall be provided for vehicular pull-up spaces, access aisles, and a vehicular route serving them connecting a vehicular entrance and a vehicular exit. CBC Section 11B-503.5

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Traffic Paint:

1. Type: Water base, roadway traffic lane marking type; colors as selected.

2. Acceptable Manufacturers:

a. Dunn-Edwards, Vin-L-Stripe No. W-801, vinyl-epoxy as a standard of quality.

b. J. E. Bauer latex base Formula No. 1030A9 White, No. 1056A9 Yellow, No. 1865A9 Blue, No. 1118A9 Green, and No. 1854A9 Red.

c. Sinclair No. 160 Vinyl Traffic Line Paint, water base.

d. Ennis Traffic Safety Solutions.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Layout: Accurately measure and layout work. Use stencils for all work; snap lines for straight work.

f) Prior to application of paint, allow the pavement to properly cure. Clean and prepare in accordance with paint manufacturer's written recommendations.

g) Provide mechanical equipment to install paint in a uniform, straight or curved pattern, without holidays and other defects.

h) Do not permit traffic until paint has completely cured.

i) Provide two installations/applications of pavement marking; once for initial use and once after final seal coat.

j) Install 2 coats in thickness recommended by manufacturer.

3.02 APPLICATION:

A. Painted Lines, Lettering, and Symbols At Parking Areas:

1. Parking Stall Lines: 4 inches wide, color white.

2. Access aisles for accessible parking spaces shall be marked by a blue painted borderline around their perimeter. The area within the blue borderlines shall be marked with hatched lines a maximum of 36” on center in a color contrasting with that of the aisle surface, preferably blue or white. Access aisle markings may extend beyond the minimum required length. CBC Section 11B-502.3.3.

3. Access aisles for passenger drop-off and loading zone shall be marked with a painted borderline around the perimeter. The area within the borderlines shall be marked with hatched lines a maximum of 36” on center in a color contrasting with that of the aisle surface. CBC section 11B-503.5.

4. Color: White, for all work except blue at wheelchair accessible parking stalls borders and red at Fire Lanes.

5. Specific areas designated as fire lanes must be marked with red curbs using OSHA safety red paint. “FIRE LANE – NO PARKING” shall be painted on the top of curb in 3” white lettering at a spacing of 30’ on center or portion thereof.

6. Painted lines and markings on pavement at wheelchair accessible parking stalls shall be 4 inches wide (blue in color) equal of Color No. 15090 per Federal Standard 595C.

7. Detectable warnings surfaces shall comply with CBC Section 11B-705.1.

8. Detectable warning surfaces shall be yellow conforming to FS 33538 of Federal Standard 595C, except for locations at curb ramps, islands, or cut-through medians where color used shall contract visually with that of adjacent walking surfaces, either light-on-dark, or dark-on-light. CBC Sections 11B-705.1.1.3 and 11B-705.1.1.5.

9. Provide a minimum 5 year warranty on detectable warning surfaces per DSA Bulletin 10/31/02, revised 04/09/08.

B. Stripes At Exterior Stairs:

1. Stripes: 2" wide, located 2" from, and parallel to, nosing.

2. Required Locations: All treads, all top landings, all intermediate landings.

END OF SECTION 32 17 13

SECTION 32 17 26 TACTILE WARNING SURFACING

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. Cast-In-Place Pressed Concrete Tiles and Cast-In Place replaceable plastic tactile and detectable warning tiles for pedestrian walking surfaces meeting State of California ADA 11B requirements.

B. Reference Standards:
1. 49 CFR 37 - Transportation Services for Individuals with Disabilities (ADA); current edition.
2. AASHTO LRFD - Bridge Design Specifications, Customary U.S. Units (Current Edition).
3. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
4. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
5. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
6. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
7. ASTM C501 - Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.
8. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
9. ASTM D570 - Standard Test Method for Water Absorption of Plastics.
10. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
11. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.
12. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
13. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
14. ASTM G155 - Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials.
15. ATBCB PROWAG - Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way.
16. FED-STD-595C - Colors Used in Government Procurement (Fan Deck).
17. Accessibility Requirements:
    a. Americans with Disabilities Act of 1990, as amended:
        1) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design.
    b. CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
        2) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data, standard details, details specific to this

project; written installation and maintenance instructions.

B. Samples: Submit two (2) samples of tactile warning surfacing, 12 x 12 inches minimum, in pattern and color specified.

C. Shop Drawings.

D. Installer Qualifications: Submit evidence that installer meets specified requirements and is certified by manufacturer.

E. Warranty: Submit manufacturer warranty; complete forms in District's name and register with manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years documented experience.

B. Accessibility Requirements:
1. Detectable warning surfaces shall comply with CBC Section 11B-705.1.
2. Detectable warning surfaces at transit boarding platform edges, bus stops, hazardous vehicular areas, reflecting pools, and track crossings shall be yellow and approximate FS 33538 of Federal Standard 595C. Detectable warning surfaces at other locations shall contrast with that of adjacent walking surfaces. The material used to provide visual contrast shall be an integral part of the surface. See CBC Section 11B-705.1.1.3.
3. Detectable warning surfaces shall differ from adjoining surfaces in resiliency or sound-on-cane contact. Such constraint shall not be required for detectable warning surfaces at curb ramps, islands, or cut-through medians. See CBC Section 11B-705.1.1.4.

1.5 WARRANTY

A. Plastic Tiles - Provide manufacturer's standard five (5) year warranty against manufacturing defects, breakage or deformation. Warranty shall also indicate compliance with architectural standards as published in the current edition of the California Building Standards Code, and also include durability criteria which indicate that the shape, color fastness, confirmation, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly for specified years after initial installation:
1. As used in this bulletin, "not degrade significantly" means that the product maintains at least 90 percent of its approved design characteristics, as determined by the enforcing agency.

B. Installer’s Warranty: 1 year.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Tactile Warning Surfacing shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy plastic wrappings to protect tile from concrete residue during installation and tile type shall be identified by part number.

B. Tactile Warning Surfacing shall be delivered to location at building site for storage prior to installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Plastic Tactile and Detectable Warning Surface Tiles:
1. Armorcast Products Company.
2. Access Tile
3. ADA Solutions, Inc.
4. Armor-Tile.
5. Or approved equal.

2.2 TACTILE AND DETECTABLE WARNING DEVICES

A. Plastic Tactile and Detectable Warning Tiles - ADA Standards compliant, glass fiber and carbon fiber reinforced, exterior grade, matte finish polyester sheet with truncated dome pattern, solid color throughout, internal reinforcing of sheet and of truncated domes; with factory applied removable protective sheeting:
1. Basis of Design: Cast-in-Place Tile, by Armor-Tile
2. Material Properties:
   a. Water Absorption: 0.07 percent, maximum, when tested in accordance with ASTM D570.
   b. Slip Resistance: 0.50 minimum dry static coefficient of friction, when tested in accordance with ASTM D2047 or 1.18 dry, 1.05 wet when tested in accordance with ASTM D2047.
   c. Compressive Strength: 25,000 pounds per square inch, minimum, when tested in accordance with ASTM D695.
   d. Tensile Strength: 10,000 pounds per square inch, minimum, when tested in accordance with ASTM D638.
   e. Flexural Strength: 25,000 pounds per square inch minimum, when tested in accordance with ASTM D790.
   f. Chemical Stain Resistance: No reaction to 1 percent hydrochloric acid, motor oil, calcium chloride, gum, soap solution, bleach, or antifreeze, when tested in accordance with ASTM D543.
   g. Abrasion Resistance: 300, minimum, when tested in accordance with ASTM C501.
   h. Flame Spread Index: 25, maximum, when tested in accordance with ASTM E84.
   i. Accelerated Weathering: Delta-E of less than 5.0 at 2,000 hours exposure, when tested in accordance with ASTM G155.
   j. Loading: No damage when tested according to AASHTO LRFD test method HS20.
   k. Salt and Spray Performance: No deterioration or other defect after 200 hours of exposure, when tested in accordance with ASTM B117.
3. Installation Method: Cast in place replaceable.
4. Shape: Rectangular.
5. Color: FED-STD-595C, Table IV, Federal Yellow No. 33538.
6. Truncated Dome Dimensions:
   a. Height: 0.2 inch (5.1mm).
   b. Base Diameter: 0.9-inch (22.9mm) minimum to .92-inch (23.4mm) maximum.
   c. Top Diameter: 0.45-inch (11.4mm) minimum to .47-inch (11.9mm) maximum.
   d. Pattern: Wide Inline (Square) Pattern, 2.35 inches on center each way.
7. Tile Dimensions: As specified on Drawings.

B. Pressed Concrete Detectable Warning Surface Tiles – ADA Standards compliant, Pressed Concrete Truncated Dome Tiles, 2 inch to 2 ¾ inch thickness, 24 inch square and 12 inch square sizes, refer to drawings for details and locations.
1. Materials: Pressed Concrete.
2. Setting Beds: 2 inch sand min. over compacted fill (Depending on location and vehicle impact, refer to manufacturers installation requirements)
3. Truncated Dome Dimensions:
   a. Height: 0.2 inch (5.1mm).

b. Base Diameter: 0.9-inch (22.9mm) minimum to .92-inch (23.4mm) maximum.
c. Top Diameter: 0.45-inch (11.4mm) minimum to .47-inch (11.9mm) maximum.
d. Pattern: Wide Inline (Square) Pattern, 2.35 inches on center each way.

4. Color: Contrasting color to adjacent concrete finish meeting CBC 11B-705.1.1.2 and CBC 11B-705.1.1.3. Select color from standard manufacturers listing.

2.3 ACCESSORIES

A. Fasteners - ASTM A666, Type 304 stainless steel:
1. Type: Countersunk, color matched composite sleeve anchors.
2. Size: 1/4-inch diameter and 1-1/2 inches long.

B. Adhesive: Type recommended and approved by surfacing tile manufacturer.

C. Sealant: Elastomeric sealant of color to match adjacent surfaces; approved by surfacing tile manufacturer.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Maintain minimum temperature of 40 degrees F in spaces to receive Tactile Warning Surfacing for at least 24 hours prior to installation, during installation, and for not less than 24 hours after installation.

3.2 EXAMINATION

A. When installation location is near site boundary or property line, verify required location using property survey.

B. Verify that work area is ready to receive work:

C. If existing conditions are not as required to properly complete the work of this section, notify Architect.

D. Do not proceed with installation until deficiencies in existing conditions have been corrected.

E. Verify that dimensions, tolerances, and attachment methods for work in this section are properly coordinated with other work on site.

3.3 INSTALLATION, GENERAL

A. Install in accordance with manufacturer's written instructions:
1. Do not install damaged, warped, bowed, dented, abraded, or otherwise defective units.

B. The physical characteristics of the concrete shall be consistent with the contract specifications while maintaining a slump range of four (4) to seven (7) inches to permit solid placement of the Tactile Warning Surfacing.

C. The concrete shall be poured and finished true and smooth to the required dimensions and slope prior to the tile placement. The tile shall be placed true and square to the curb edge in accordance with the drawings. Tiles shall be tamped into fresh concrete to ensure the field level of the tile is flush to adjacent concrete surface.

D. The elevation and slope of the tile shall be set consistent with the contract drawings to

permit water drainage and eliminate ponding.

E. Field Adjustment:
1. Locate relative to curb line in compliance with CBC Chapter 11B, Section 705.
2. Orient so dome pattern is aligned with the direction of travel.
3. Align truncated dome pattern between adjacent units.

F. Install units fully seated to substrate, square to straight edges and flat to required slope.

3.4 INSTALLATION, CAST IN PLACE PLASTIC TILES

A. When installing multiple adjacent units, leave a 3/16-inch gap between units to allow for expansion.

B. Tamp and vibrate units as recommended by manufacturer.

C. Place and position weights on units while concrete cures as recommended by manufacturer. Ensure no voids or air pockets exist between top surface of concrete and underside of units.

3.5 CLEANING PLASTIC UNITS

A. Remove protective plastic sheeting within 24 hours of installation.

B. Remove excess sealant or adhesive from joints and edges.

C. Clean four days prior to date of scheduled inspection.

3.6 PROTECTION

A. Protect installed units from traffic, subsequent construction operations or other imposed loads until concrete is fully cured.

B. Touch-up, repair or replace damaged products prior to Date of Substantial Completion.

END OF SECTION

SECTION 33 11 00 - WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to provide water distribution system components and other work, as required in these specifications, on the drawings and as otherwise deemed necessary to complete the work. The limits of the work, including the responsible party for testing purposes, shall be clearly defined on the Drawings. Included are the following topics:

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Related work specified elsewhere:
1. Section 33 31 00 – Sanitary Sewage Systems
2. Section 33 41 00 – Storm Drain Systems
3. Section 31 23 17 – Trenching

1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):
1. B88 Standard Specifications for Seamless Copper Water Tube
2. F477 Standard Specifications for Elastomeric Gaskets for Joining Plastic Pipe
3. D3139 Standard Specifications for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
4. D3350 Standard Specifications for Polyethylene Plastic Pipe and Fittings Materials

B. American Water Works Association (AWWA):
1. C502 Dry Barrel Fire Hydrants
2. C504 Rubber-Seated Butterfly Valves
3. C509 Resilient-Seated Gate Valves for Water Supply Service
4. C515 Reduced Wall, Resilient Seated Gate Valves for Water Supply Service
5. C550 Protective Epoxy Interior Coatings for Valves and Hydrants
6. C800 Underground Service Line Valves and Fittings
7. C900 Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings for Water Distribution (4”-12”)
8. C905 Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings for Water Distribution (14”-48”)
9. C906 Polyethylene Pressure Pipe, and Fabricated Fittings for Water Distribution (4”-63”)
10. C104/ANSI A21.4 Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
11. C105/ANSI A21.5 Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
12. C111/ANSI A21.11 Standard for Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
13. C151/ANSI A21.51 Standard for Ductile Iron Pipe, Centrifugally Cast
14. C153/ANSI A21.53 Standard for Ductile Iron Compact Fittings

1.04 SUBMITTALS

A. Provide manufacturers product information (cut sheets) and O&M information for watermain materials including:
   1. Pipe
   2. Fittings
   3. Valves
   4. Hydrants
   5. Joint Restraint Materials

B. Provide copies of all pressure and electric continuity testing procedures and results for the project to the Project Representative and the AE within 48 hours of completing the individual tests.

C. Provide reports that document safe sample collection procedures and results.

1.05 CONTINUITY OF EXISTING WATER DISTRIBUTION SYSTEM

A. Provide a construction schedule to Project Representative, municipal water utility (if applicable) and local fire department (if applicable) for review and approval prior to starting construction. Schedule shall indicate the date and time of all required water supply interruptions.

B. Do not interrupt existing water supply without approval from Project Representative, municipal water utility, and local fire department.

C. Once approved, notify all distribution system users impacted by outages a minimum of 48 hours in advance of outage. Notification shall be provided in writing and describe the nature and duration of outages and provide the name and number of Contractor's foreman or other contact.

1.06 PROVISIONS FOR FUTURE WORK

A. Construct watermain system in a manner that will facilitate future extension or connection.

B. Unless otherwise shown on the drawings, provide valves on "dead end" mains that will allow dry connection to the watermain system. Terminate "dead end" mains with full length of pipe be-yond the valve, and a bell end with restrained plug.

1.07 AS-BUILT DRAWINGS

A. Show the actual locations of watermain and services, valves and hydrants on drawings and show changes to proposed watermain size, alignment, or grades. Show the actual locations, siz-es and types of underground utilities and other features encountered during construction.

PART 2 - MATERIALS

2.01 PVC WATERMAIN

A. Polyvinyl chloride pipe shall have a dimension ratio (DR) of 18 or less and conform to the requirements of AWWA C900 (4"-12") or AWWA C905 (14"-48"). Pipe shall meet applicable NSF standards for use in a potable water distribution system.

B. PVC watermain joints shall be rubber gasket push-on joint conforming to ASTM D 3139, using a gasket that conforms to ASTM F477.

2.02 COPPER WATER SERVICE

A. BELOW GROUND 2-1/2" AND SMALLER:
   1. Type K copper water tube, O (annealed) temper, ASTM B88; with cast copper pressure fittings, ANSI B16.18; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; or cast copper flared pressure fittings, ANSI B16.26.

2.03 DUCTILE IRON WATERMAIN FITTINGS

A. Fittings shall be ductile iron cement mortar lined mechanical joint compact style fittings meeting the requirements of ANSI/AWWA C153/A21.53.

B. Fittings shall be manufactured in the United States.

2.04 POLYETHYLENE FITTINGS

A. HDPE fittings manufactured in accordance with ASTM D2683 (socket fused) or ASTM D3261 (butt fused). Fittings shall be supplied by the HDPE piping manufacturer. Butt fusion outlets shall be made to the same dimensional characteristics and tolerances as the mating pipe. All fittings and custom fabrications shall be fully rated for the same internal pressure as the mating pipe. Pressure de-rated fabricated fittings are prohibited.

2.05 VALVES

A. Resilient Wedge Gate Valve
   1. Resilient seated wedge gate valve meeting the requirements of AWWA C509 and C515. Body, bonnet and gate shall be constructed of ductile iron. Bolts shall be stainless steel.
   2. Interior and exterior surfaces of valve shall be provided with epoxy coating meeting the requirements of AWWA C550. Symmetrical wedge shall be completely encapsulated with resilient material.
   3. Valve stem shall be non-rising, low-zinc (zinc content not to exceed 6%) bronze. Valve stem shall have an integral thrust collar. Thrust collar bearings shall be designed to withstand maxi-mum torque without distortion.
   4. Stem seal shall be so designed that the O – ring above the stem collar can be replaced while the valve is under pressure and in the fully open position.
   5. Valve shall be left opening and be provided with standard 2” square operating nut.
   6. Valve shall be provided with mechanical joint connections. Mechanical joint ends shall conform to AWWA C509 and shall be furnished complete with all mechanical joint accessories including approved M.J. bolts and nuts. Glands shall be full body gray iron or ductile iron. Mechanical joint bells, glands and rubber gaskets shall be in accordance with AWWA C111.
   7. Mueller, Kennedy, US Pipe, American Flow Control, Clow, or approved equal.

B. Butterfly Valve
   1. Rubber-seated butterfly valve meeting the requirements of AWWA C504, for Class 150B. Body and disc shall be constructed of ductile iron. Bolts shall be stainless steel. Disc shall be lens shaped.
   2. Interior and exterior surfaces of valve shall be provided with epoxy coating meeting the requirements of AWWA C550. Disc shall be provided with a stainless steel disc edge.
   3. Valve stem shall be stainless steel. Packing shall be permanent duty “chevron V-type” or “O-ring” type. Bearings shall be permanent, non-metallic, and self-lubricating.
   4. Valve seat shall be a single piece of elastomeric material that is not penetrated by the valve shaft.
   5. Provide manual operator that is suitable for underground service and includes a standard 2” square operating nut.

6. Valve shall be provided with mechanical joint connections. Mechanical joint ends shall conform to AWWA C509 and shall be furnished complete with all mechanical joint accessories including approved M.J. bolts and nuts. Glands shall be full body gray iron or ductile iron. Mechanical joint bells, glands and rubber gaskets shall be in accordance with AWWA C111.
7. Mueller/Henry Pratt, Kennedy or approved equal.

C. Tapping Valve
1. Resilient seated wedge gate tapping valve having 100% port, and meeting the requirements of AWWA C509 and C515. Body, bonnet and gate shall be constructed of ductile iron. Bolts shall be stainless steel.
2. Interior and exterior surfaces of valve shall be provided with epoxy coating meeting the requirements of AWWA C550. Symmetrical wedge shall be completely encapsulated with resilient material.
3. Valve stem shall be non-rising bronze. Stem collar shall be provided with thrust bearings that are protected by upper and lower O-ring seals both above and below.
4. Valve shall be left opening and be provided with standard 2” square operating nut.
5. Valve shall be provided with flange connection on inlet side of valve and mechanical joint connections on outlet side of valve. Mechanical joint end shall conform to AWWA C509 and shall be furnished complete with all mechanical joint accessories including approved M.J. bolts and nuts. Glands shall be full body gray iron or ductile iron. Mechanical joint bells, glands and rubber gaskets shall be in accordance with AWWA C111.
6. Provide suitable companion tapping sleeve.
7. Mueller, US Pipe, American Flow Control, Clow, or approved equal.

2.06 BRASS WATER SERVICE FITTINGS

A. Service Saddles
1. Double strap, bronze service saddles meeting the requirements of AWWA C800. Service saddles shall be provided with nitrile O-ring gasket and AWWA Taper outlet.
2. Service saddles shall be properly sized to accommodate both the main and service lines.
3. Mueller BR 2B Series, Ferguson, Romac, or approved equal.

B. Corporation Stops
1. Corporation stops shall be brass, ball style. Inlets shall be AWWA Taper; outlet connection shall be compression having a positive indicator to avoid over-tightening.
2. Corporation stops shall be Mueller B-25008, A.Y. McDonald Mfg. Co., or approved equal.

C. Curb Stops
1. Curb stops shall be brass, with compression connections having a positive indicator to avoid over-tightening Curb stops shall be provided with a quarter turn check.
2. Curb stops shall be Mueller B-25209, A.Y. McDonald Mfg. Co., or approved equal.

D. Unions
1. Unions shall be 3-piece brass, with compression connections having a positive indicator to avoid over-tightening.
2. Unions shall be Mueller H-15403, A.Y. McDonald Mfg. Co., or approved equal.

E. U-Branch, Wyes, Etc.
1. U-branch, wye and other fittings shall be brass, with compression connections having a positive indicator to avoid over-tightening. Fittings shall be produced specifically for water supply applications.
2. Mueller, A.Y. McDonald Mfg. Co., or approved equal.

2.07 VALVE BOXES

A. Gate/Butterfly Valve Boxes
   1. Valve boxes shall be screw type and shall consist of a base, middle section, top section with cover and intermediate extension sections. The top section shall be designed to thread onto the middle section so that the unit can be adjusted to a variable length. The top section shall be de-signed to receive a circular drop cover.
   2. The valve box and component parts shall be cast iron in accordance with ASTM-A48 class 20, 30, 35, or approved equal.
   3. Boxes shall be 5-1/4" with stay-put "WATER" cover.
   4. The cast iron valve box and components shall be free from blowholes, cold shots, shrinkage defects, cracks or other injurious defects and shall have a normal smooth casting finish.
   5. All cast iron valve boxes and components shall be thoroughly coated with asphaltic pitch varnish or approved equal.
   6. Provide valve box extensions as necessary to accommodate depth of cover shown on drawings, or 6.5-foot minimum.
   7. Valve boxes shall be Bingham & Taylor, East Jordan Iron Works, Tyler, or approved equal.

B. Curb Stop Boxes
   1. Curb stop boxes shall be 1 1/4" minimum diameter, cast iron, arch style, valve boxes. Boxes shall be telescopic, extendable to accommodate 7' bury. Lid shall be two piece threaded, with a plug having a pentagonal bolt for removal.
   2. Provide valve box extensions as necessary to accommodate depth of cover shown on drawings, or 6.5-foot minimum.
   3. Ford, Mueller, or approved equal.

2.08 HYDRANTS

A. Fire hydrants shall be dry-bury type meeting the requirements of AWWA C110, C111, and C502.

B. Hydrants shall be ductile iron, 250 psi rated working pressure.

C. Hydrants shall be traffic rated as specified in AWWA C502 except which is modified to permit a complete 360 degree rotation, or any increment thereof.

D. Hydrants shall be provided with the following features:
   1. 7' bury (6.5' cover over lead)
   2. 6" mechanical joint inlet
   3. 5 ¼" main valve opening
   4. One 4 ½" pumper nozzle with National Standard Threads
   5. Two 2 ½" hose nozzles with National Standard Threads
   6. Nozzle caps with chains
   7. Pentagon operating nut, open counter-clockwise, conforming to AWWA C502. Material of the operating nut shall be either hardened bronze or ductile iron.
   8. Painted red. Painting shall be in accordance with AWWA C502.

E. All extensions shall be made for insertion below the breakable flange. Extensions shall be made from the same material as that of the barrel. The hydrant must be designed to allow the use of barrel extension kits, which allow the raising of the hydrant to a new grade while retaining the "Safety Coupling and Breakable Flange" traffic collision feature at the new grade. Extension kits are to be in 6" increments, with the shortest being 6" long.

F. All nozzles shall be at the same elevation. Nozzle shall be capable of being threaded into the upper barrel and shall be mechanically locked in place. The distance from the base of the operating nut to the center of the pumper nozzle shall not be less than 7-1/8". The distance between the ground and the center of the pumper nozzle shall not be less than 15 inches nominal dimension.

G. Hydrant shall be Waterous, Mueller, U.S. Pipe, or approved equal.

2.09 JOINT RESTRAINTS

A. Retainer Glands for Ductile Iron Pipe
1. Ductile iron wedge action retainer glands designed for use with ductile iron pipe.
2. Glands shall be constructed of. Restraint shall be provided by a minimum of three wedges that are tightened onto the exterior of the pipe using a threaded, torque limiting mechanism.
3. Glands shall be tested to provide restraint at 250 psi operating pressure.
4. EBAA Iron, Mueller AquaGrip, Romac Romagrip, or approved equal.

B. Retainer Glands for PVC Pipe
1. Wedge action retainer glands designed for use with PVC pipe.
2. Glands shall be constructed of ductile iron. Restraint shall be provided by a minimum of four wedges that are tightened onto the exterior of the pipe using a threaded, torque limiting mechanism.
3. Glands shall be tested to provide restraint at 200 psi operating pressure.
4. Retainer glands shall be MEGA-LUG by EBAA Iron, or approved equal.
5. EBAA Iron, Mueller AquaGrip, Romac Romagrip, or approved equal.

2.10 POLYETHYLENE ENCASEMENT BAG

A. 8-mil polyethylene encasement bag meeting the requirements of ANSI/AWWA C105/A21.5, Class “C” black.

2.11 BOARD INSULATION

A. Insulation shall be rigid, closed-cell extruded polystyrene insulation suitable for buried installation. Individual boards shall have minimum dimensions of 8’x4’x2”.

B. Owens Corning, Dow Styrofoam, or approved equal.

2.12 TRACER WIRE

A. Tracer wire shall be #10 solid copper wire with insulated jacket. Tracer wire insulation color for non-metallic, potable water pipe shall be blue. Tracer wire insulation color for non-metallic, non-potable water pipe shall be purple.

2.13 LOCATOR TAPE

A. Tape shall be detectable metallic locator tape, specifically manufactured for marking utilities with a minimum width of 6 inches and detectable at a depth of 18”.

B. Tape for potable water shall be marked “WATER” and blue colored. Tape for non-potable water shall be marked “NON-POTABLE WATER” and purple colored.

2.14 CHLORINE

A. Chlorine disinfectant shall be calcium hypochlorite tablets or granules. Calcium hypochlorite product shall meet requirements for AWWA C651 – Standard for Disinfecting Water Mains - latest revision, Arch “HTH”, or approved equal.

2.15 PIPE JOINT LUBRICANT

A. Petroleum free pipe lubricant formulated for use with potable water systems. Product shall meet the requirements of ANSI/AWWA C111/A21.11 - latest revision.

PART 3 - EXECUTION

3.01 GENERAL

A. Complete exploratory excavations at utility crossings as shown on the drawings and as necessary to complete the work.

B. Maintain clearances between watermains and existing or proposed sewer lines as follows:
1. 8’ horizontal separation (measured center to center) between watermains and existing or proposed sanitary or storm sewers.
2. 12” vertical separation (measured from outsides of pipes) where watermains cross over sanitary or storm sewers.
3. 18” vertical separation (measured from outsides of pipes) where watermains cross under sanitary or storm sewers.

C. Notify the Project Representative of utility conflicts as soon as they are encountered.

D. Store and handle pipe in accordance with manufacturers’ recommendations. Keep pipes clean of soil, debris and animals.

E. Watermain construction shall be completed in a manner that minimizes interruptions to existing services.

3.02 CONNECTIONS TO EXISTING WATERMAINS/TAPPING

A. Provide tapping sleeves, valves, cutting-in sleeves and other materials specifically manufactured for use with the type of pipe to which the connection is being made.

B. Notify the Project Representative if the proposed point of connection is located within 4’ of an existing joint.

C. Connections shall be made at existing pipe stubs, valves or other fittings.

D. At connections to existing mains, locate the new valve as close to the existing main as possible. Swab the interior surfaces of all pipe, fittings, valves that will be exposed to the existing system. Swab solution shall consist of a 5% (by weight) solution of calcium hypochlorite.

3.03 BEDDING /UTILITY COVER

A. Provide bedding and utility cover in accordance with the applicable requirements of Section 31 23 17 – Trenching.

B. Watermain and water service piping shall be provided with 6” of bedding material and 12” of utility cover material (both measured at the bell of the pipe).

C. Bedding and cover material for various types of pipe shall consist of the following:
1. PVC Watermain: Crushed stone bedding.
2. Copper Water Services: Bedding sand or crushed stone screenings.

3.04 LAYING WATERMAIN

A. Install pipe in accordance with the SSSWC and ASTM specifications that pertain to the specified type of pipe material and the installation situation.

B. Provide a minimum of 6.5' of cover over watermain, unless otherwise shown on the drawings or directed by the Project representative. For watermains with less than 6.5' of cover, provide insulation as shown on the drawings, or as directed by the Project Representative.

C. Lay watermain at uniform grades between deflection points shown on the drawings; do not install watermains with intermediate high points.

D. Unless otherwise shown or approved by the Project Representative, lay pipe with bell end facing the direction of pipe laying.

E. For ductile iron watermain, place polyethylene encasement bag on watermain prior to lowering into trench. Once pipe is joined, pull bag over entire length of pipe, overlap joint at adjacent pipe and secure using "Duct" tape or other approved method.

F. Prepare pipe bell and gasket in accordance with manufacturers requirements. Lubricate bell and/or pipe with AWWA/NSF approved lubricant.

G. Push pipe home in accordance with manufacturer's recommendations regarding tools and methods.

H. Pipe joint deflection shall not exceed manufacturer's requirements.

I. For ductile iron pipe, connect bonding straps or lugs to provide electrical continuity along entire watermain. Provide exothermic weld to attach new bonding straps, when existing straps are missing or damaged. Follow manufacturer's requirements for exothermic welding procedures.

J. Locate the geographic location of all dead end watermains and services and note actual location on As-Built Drawings.

K. Disinfect pipe by placing calcium hypochlorite in each section of pipe as pipe laying progresses. Provide dosage as indicated on Table 33 11 00-1.

Watermain Nominal Diameter	Dose Calcium Hy-pochlorite*
(inches)	(oz./length pipe)
4-6	1
8	3
10	5
12	7

* Granular/tablet calcium hypochlorite with 68% (weight) available chlorine

Table 33 11 00-1

L. When required, provide board insulation in the thickness and width shown on the drawings. Unless otherwise shown, insulation shall be provided at a minimum thickness of 2 inches.

M. Install insulation on compacted initial cover material 6 inches above the top of pipe. Stagger joints when placing multiple layers of insulation.

N. Provide insulation with a minimum of 1 foot of utility cover material. Place backfill material in manner that does not damage insulation; replace damaged insulation.

3.05 TRACER WIRE

A. Provide tracer wire for buried non-metallic water piping. Tracer wire shall be installed directly above the top of pipe and within six inches of the pipe.

B. Splices in tracer wire shall be made with split-bolt or compression-type connectors.

C. Access points are required every 400 feet. At access points the tracer wire shall be brought to grade in valve boxes, utility structures or other covered access devices.

3.06 LOCATOR TAPE

A. Install locator tape directly above new non-metallic sanitary sewer pipe approximately 15 inches below finished grade. Bring tape to surface and terminate in valve box or other structure.

3.07 FITTINGS, VALVES AND HYDRANTS

A. Install fittings, valves and hydrants at locations shown on the drawings.

B. Unless otherwise shown, provide restrained mechanical joint connections. Install materials in accordance with manufacturer's recommendations.

C. Maintain electrical continuity through all fittings, valves and hydrants. Provide and install suitable jumper cables for epoxy coated valves.

D. Place hydrants and valves on 4"x8"x16" solid concrete masonry units set on compacted soil.

E. Install joint restraints in accordance with the requirements of this section.

F. Install valve box so that bonnet rests on compacted initial backfill material at the same elevation as the top of the valve stuffing box. Center the valve box over the valve nut.

G. Install valve box plumb and level, backfilling evenly. Extend valve box to proposed final grade; provide valve box extensions as necessary. Valve boxes that shift during backfilling or restoration shall be excavated and re-set.

H. Mark all valve boxes with a steel "U" fence post to protect them from damage.

I. Install hydrants at elevation shown on drawings or as required to provide a minimum of 6.5' cover over the hydrant lead.

J. Place approximately ½ cy of clear stone bedding material from the base of the hydrant to 6" above the drain holes on the hydrant elbow. Cover clear stone material with a "skirt" of polyethylene encasement bag material to prevent backfill material from migrating into the clear stone.

K. Install hydrant plumb and level, backfilling all sides evenly.

L. Cover all new hydrants with a plastic garbage bag or similar cover until the main has been filled and placed in service.

3.08 JOINT RESTRAINT

A. Unless otherwise noted, all fittings, valves and hydrants shall be installed with restrained joints. Joint restraints shall be used on the adjacent full length (or more lengths as shown on the drawings) of pipe on all sides of fittings. Additionally, branch runs of pipe shall be installed with re-strained joints beginning at the fitting at the main to the first valve.

B. Hydrant leads shall be provided with restrained joints beginning at the fitting at the main to the hydrant.

C. Joint restraint shall be provided using retainer glands.

D. Install all joint restraint products in accordance with manufacturer's recommendations and drawings.

3.09 COPPER WATER SERVICES AND BRASS FITTINGS

A. Connect copper water service piping to watermain, wellhouse, or other supply as shown on the drawings.

B. Watermain taps shall be made under pressure using a tapping machine specifically designed to tap and install corporation stops. Dry watermain taps are not allowed.

C. Service saddles shall be installed on services where the corporation stop is 1 ½" nominal diameter or greater.

D. Provide a horizontal offset adjacent to the main for all copper services. Comply with pipe manufacturer's requirements with respect to minimum radius on bends.

E. Install curb stops as shown on the drawings. If specific curb stop location is not shown on the drawings, consult with Project Representative to determine acceptable location prior to installing.

F. Place curb stop box on a 4"x8"x8" solid concrete masonry unit set on compacted ground. Orient box so that no portion of the box bears on the water service or curb stop.

G. Install curb stop box plumb and level and backfill all side simultaneously. Extend curb stop box to proposed final grade; provide extensions as necessary. Curb stop boxes that shift during backfilling or restoration shall be excavated and re-set.

H. Install copper water service as shown on the drawings. Prepare copper pipe joints in accordance with pipe and fitting manufacturer recommendations. Cut pipe squarely, remove burs and round ends as necessary.

I. Install fittings in accordance with manufacturer's recommendations. Torque compression connections to recommended tightness; do not over-tighten compression joints.

J. Provide dead-end copper water services with compression connectors fitted with plugs. Do not tap or crimp the ends of copper water services shut.

K. Locate the geographic location of all dead end services and curb stop boxes and note actual location on As-Built Drawings.

3.010 FILLING WATERMAIN

A. Fill watermain after main has been installed and completely backfilled.

B. Fill main slowly to limit entrapped air and evenly distribute calcium hypochlorite. Open all hydrants completely to allow air to escape and monitor filling.

C. Once main is full, allow a minimum of 48 hours of time for disinfection to occur before flushing.

3.011 PRESSURE TESTING

A. Pressure test all watermain and copper water services.

B. Provide all valves, fittings, joint restraints, hoses, compressors, water and power supply as necessary to complete pressure testing. Utilize testing apparatus that is fabricated specifically for testing watermains. Calibrate pressure gauges as necessary.

C. Flush main as necessary to remove air prior to testing. Comply with the requirements of this section with respect to flushing.

D. For longer installations or installations consisting of watermain and copper water service, the Contractor may elect to pressure test the system in short segments.

E. All pressure testing shall be conducted in the presence of the Project Representative. Provide minimum of 48 hours advanced notice of testing.

F. Conduct a combined pressure/leakage test for 1 hour at a pressure equal to 150% of system normal operating pressure (as measured at the lowest point in the system), or a minimum pressure of 150 psig.

G. When conducting test, pressure test equipment shall be set-up as close to the highest point in the line as possible.

H. Make-up water for the test shall be clean potable water supplemented with ½ oz of dry calcium hypochlorite per 35 gallons of water.

I. Leakage for test shall not exceed gallons per hour as allowed by the attached formula:

$$G=(ND\sqrt{P})/7400$$

Where: G= Allowable leakage (gallons per hour of test)
N=Number of joints under test
D=Nominal diameter of main (inches)
P=Average pressure during test (psig)

J. Allowable leakage for high density polyethylene pipe shall be zero.

K. Record and document pressure test by recording the following information:
1. Date of test
2. Section tested
3. Diameter and length of main under test
4. Number of fittings, valves hydrants, etc.
5. Results of test including test length, pressure, actual water loss
6. Calculation of allowable leakage
7. If a failed test, describe actions taken to eliminate leaks and results of re-testing

L. Submit reports documenting pressure testing.

3.012 ELECTRIC CONTINUITY TESTING

A. Conduct electric continuity test on all ductile iron watermain and copper water services.

B. The electric continuity test shall be performed using a multi-meter to verify electrical continuity of the watermain system.

C. The Contractor shall furnish all labor and equipment necessary to conduct the electric continuity test.

D. Document electric continuity testing by recording the following information:
1. Date of test
2. Test methods and equipment
3. Section tested
4. Diameter and length of main under test
5. Number of fittings, valves hydrants, etc.
6. Results of test including resistance
7. If a failed test, describe actions taken to eliminate leaks and results of re-testing

E. Submit reports documenting electric continuity testing.

3.013 DISINFECTION/FLUSHING

A. After filling the main, allow a minimum of 48 hours of time for disinfection to occur before flushing.

B. Flush all sections of watermain and water service. When possible, utilize hydrants or other large diameter orifices to complete flushing and achieve 2.5 fps water velocity. If needed, utilize services or temporary connections to complete flushing.

C. All watermain and services shall be flushed for a minimum of 10 minutes, or as necessary to obtain a sediment-free and bacteriologically safe sample.

D. Utilize diffusers, hoses, settling basins and other devices as necessary to limit erosion and other damage to the site and downstream areas.

E. Contractor shall be responsible for providing all necessary fitting, valves, joint restraints, hydrants and other materials necessary to conduct flushing.

F. Submit reports documenting disinfection and flushing.

3.014 BACTERIOLOGICAL SAMPLE

A. Following all pressure testing and flushing, the contractor shall collect a sample from the newly installed watermain or water service(s). Samples shall be submitted to the State Laboratory of Hygiene, or other licensed testing laboratory for bacteriological (coliform bacteria) analysis.

B. The Contractor shall be responsible for all costs associated with sample collection(s) and analysis.

C. Document bacteriological sample collection and analysis by recording the following information:
1. Date of sample collection
2. Sample collection methods and equipment
3. Person collecting the sample
4. Location(s) sample was collected
5. Results of sample analysis

D. If sample results indicate water is “Unsafe – Coliform Bacteria Present”, Contractor shall re-disinfect watermain and water services by introducing additional chlorine into the line and re-flushing the main. This process shall be repeated as necessary until a clean sample is obtained. The Contractor shall be responsible for all costs associated with all efforts necessary to obtain a “Safe – Coliform Bacteria Not Present” sample.

E. Submit reports documenting bacteriological sample collection and analysis.

END OF SECTION 31 11 00

SECTION 33 31 00 - SANITARY SEWAGE SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sanitary drainage piping, fittings and accessories.

B. Connection of building sanitary drainage system to site sewer systems.

C. Cleanout access.

D. Connection of site sewer system to campus sewer system unless indicated otherwise on Drawings.

E. Grease Interceptor

1.02 REFERENCES

A. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

B. SSPWC - Standard Specifications for Public Works Construction, Latest Edition.

C. APWA - American Public Works Association.

D. ANSI / ASTM D3034 – Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

1.03 REGULATORY REQUIREMENTS

A. Conform to Section 306, Standard Specifications for Public Works Construction, for materials and installation of Work of this Section.

1.04 SUBMITTALS

A. Shop drawings indicating dimensions, locations and elevations of manholes, cleanouts and sub-surface structures.

B. Product data for pipe and pipe accessories.

C. Project Record Documents
   1. Accurately record location of pipe runs, connections, manholes, cleanouts and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 - PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Plastic Pipe: ASTM D2751, acrylonitrile-butadiene-styrene (ABS) material; sizes; bell and spigot style solvent sealed end joints.

B. PVC pipe is for outside conditions.

C. Hub and Spigot, Cast-Iron Soil Pipe and Fittings: ASTM A74, Service class, gray cast iron for gasketed joints. Include ASTM C564, rubber compression-type gaskets.

2.02 PIPE ACCESSORIES

A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene-ribbed gasket for positive seal.

B. Fittings: Same material as pipe, molded or formed to suit pipe size and end design, in required "T", bends, elbows, cleanouts, reducers, traps and other configurations required.

C. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D3034, SDR 35, for solvent-cemented or gasketed joints.
1. Gaskets: ASTM F477, Elastomeric seals.

2.03 CLEANOUTS

A. Lid and Frame: Cast iron construction, removable lid, closed checkerboard grill lid design; nominal lid and frame diameter as required for pipe sizes. (APWA 304-0)

B. Manholes: American Public Works Association, APWA 321-1 Los Angeles County Department of Public Works Standard Drawing 2003-1.

2.04 FILL MATERIAL

A. Bedding and Fill: As specified in Section 31 23 17 - Trenching.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that trench cut or excavation base is ready to receive work, excavations, dimensions and elevations are as indicated on Drawings.

B. Beginning of installation means acceptance of existing conditions.

C. Verify that existing invert elevations on site will allow proper tie in to new work with proper positive slope. Ascertain accuracy prior to trenching and installation of sanitary sewer system.

3.02 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with approved fill material.

B. Remove large stones or other hard matter that could damage sewer pipe or impede consistent backfilling or compaction.

3.03 INSTALLATION - PIPE

A. Prior to commencing Work, Contractor shall pothole existing utilities at points of connection. Notify Architect in event of discrepancies.

B. Install pipe, fittings and accessories in accordance with Section 306, SSPWC and manufacturer's instructions. Seal joints watertight.

C. Place pipe on bedding as specified in Section 31 23 17 - Trenching.

D. Lay pipe to slope gradient noted on Drawings with maximum variation from true slope of 1/8 inch in 10 feet.

E. Do not displace or damage pipe when compacting.

F. Connect to site sewer outlet system through installed sleeves.

G. Do not cover joints until lines have been tested and approved.

3.04 INSTALLATION - CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Establish elevations and pipe inverts.

C. Mount lid and frame level in grout secured to top cone section to elevation indicated.

3.05 PROTECTION

A. Protect pipe cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 31 00