MODERNIZATION

Bessie Owens Jr. High School
Bakersfield City School District

PROJECT MANUAL
Construction Documents
March 06, 2020

Modular Building 'L' & Related Site Improvements

IBI Group - Project No. 118934

IBI GROUP
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San Luis Obispo, CA 93401 USA
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PROJECT MANUAL

BESSIE OWENS JR. HIGH SCHOOL MODNERIZATION

BESSIE OWENS JR. HIGH SCHOOL
BAKERSFIELD CITY SCHOOL DISTRICT
IBI Group Project No. 118934

Date: November 21, 2019

Owner: Bakersfield City School District
1300 Baker St.
Bakersfield, CA 93307

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP. 03-120102 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 03/27/2020

ARCHITECT:
IBI Group
4119 Broad Street, Suite 210
San Luis Obispo, CA 93401

By: _____
Richard Mello, AIA #C18079

LICENSED ARCHITECT RICHARD MELLO NO. C-18079 10/21 REN STATE OF CALIFORNIA

CIVIL ENGINEERING:
Porter & Associates, Inc
1200 21st Street
Bakersfield, CA 93309

By: _____
Fred W. Porter II, #74059

REGISTERED PROFESSIONAL ENGINEER FRED W. PORTER II RCE 74059 CIVIL STATE OF CALIFORNIA

STRUCTURAL ENGINEERING:
SSG Structural Engineers, LLP
811 El Capitan Way, Suite 240
San Luis Obispo, CA 93401

By: _____
Michael Parolini SE, #S5405

REGISTERED PROFESSIONAL ENGINEER MICHAEL E. PAROLINI No. 5405 STRUCTURAL STATE OF CALIFORNIA

LICENSED PROFESSIONAL ENGINEER DALE FERRANTI 17524 EXP. 6/30/21 ELECTRICAL STATE OF CALIFORNIA

ELECTRICAL ENGINEER:
Ferranti Consulting Engineers
1211 Maricopa Hwy, Suite #250
Ojai, CA 93023

By: _____
Dale Ferranti PE, #E17524

MECHANICAL ENGINEER:

Baskin Mechanical Engineers
175 Fulton Street
Fresno, CA 93721

By: _____
Mark Baskin ME #M-26578

REGISTERED PROFESSIONAL ENGINEER MARK JAMES BASKIN No. M26578 Exp. 9-30-20 MECHANICAL STATE OF CALIFORNIA

COMMUNICATIONS ENGINEER:
Infinity Communications & Consulti
P.O. Box 6069, Bakersfield
Bakersfield, CA 93386

By: _____
Fred Brakeman, #07765

REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER BICSI FRED BRAKEMAN REG. NO: 07765 EXPIRES: 12-31-19 RCDD

LANDSCAPE ARCHITECT:
Oasis & Associates
2427 Miguelito Court
San Luis Obispo, CA 93401

By: _____
Michael Cripe #2248

REGISTERED LANDSCAPE ARCHITECT Michael L. Cripe Lic. No.2248 11/30/21 STATE OF CALIFORNIA

TABLE OF CONTENTS TO PROJECT MANUAL

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SECTION 01 11 00

SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes:
   1. Project information.
   2. Work covered by Contract Documents.
      a. Type of contract.
   3. Access to site.
   4. Coordination with occupants.
   5. Work restrictions.
   6. Specification and Drawing formats and conventions.

B. Related Sections include:
   1. Section 01 50 00 ”Temporary Facilities and Controls” for limitations and procedures governing temporary use of Owner’s facilities.

1.3 PROJECT INFORMATION

A. Project Identification: ***Bessie Owens Jr. High School Modernization***
815 Potomac Ave.
Bakersfield, CA 93307

B. Owner: ***Bakersfield City School District***
1300 Baker St.
Bakersfield, CA 93305
(661) 631-4600

C. Architect: IBI Group
4119 Broad Street, Suite 210
San Luis Obispo, CA 93401
(805) 546-0433

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents prepared by IBI Group dated **November 21, 2019**, , which includes the following:

1. Buildings:

- ~~**(E) BUILDING 'B' - CLASSROOM BUILDING**~~
  ~~- CLASSROOM MODERNIZATION~~

- ~~**(E) BUILDING 'C' - CLASSROOM BUILDING**~~
  ~~- CLASSROOM MODERNIZATION~~
  ~~- RESTROOM MODERNIZATION~~

- ~~**(E) BUILDING 'D' - CLASSROOM BUILDING**~~
  ~~CLASSROOM MODERNIZATION~~
  ~~RESTROOM MODERNIZATION~~

- ~~**(E) BUILDING 'E' - CLASSROOM BUILDING**~~
  ~~CLASSROOM MODERNIZATION~~

- ~~**(E) BUILDING 'H' - MULTI-PURPOSE BUILDING**~~
  ~~- BUILDING MODERNIZATION~~

- ~~**BUILDING 'F1' - MODULAR CLASSROOM BUILDING**~~
  ~~RELOCATION OF ONE (1) 48' x 40' MODULAR BUILDING; R25/R26 FROM STOCKPILE. A#:02-117846 (PC 02-115726)~~

- ~~**BUILDING 'G' - MODULAR CLASSROOM BUILDING**~~
  ~~RELOCATION OF ONE (1) 48' x 40' MODULAR BUILDING; R27/R28 FROM STOCKPILE. A#:04-118652 (PC 04-116668)~~

  ~~- RELOCATION OF ONE (1) 72' x 40' MODULAR BUILDING; R29/R30/R31 FROM STOCKPILE. - A#:04-118652 (PC 04-116668)~~

  ~~RELOCATION OF ONE (1) 60' x 40' MODULAR BUILDING; R32/R33 FROM STOCKPILE. A#:04-118652 (PC 04-116668)~~

- ~~**BUILDING 'K' - MODULAR ADMINISTRATION/LIBRARY/PARENT CENTER**~~
  ~~CONSTRUCTION OF ONE (1) 60' x 60' MODULAR BUILDING; ADMIN. BASED ON PC 04-116719~~

  ~~- CONSTRUCTION OF ONE (1) 60' x 60' MODULAR BUILDING; LIBRARY BASED ON - PC 04-116719~~

  ~~CONSTRUCTION OF ONE (1) 24' x 40' MODULAR BUILDING; PARENT CENTER BASED ON PC 04-116668~~

- **BUILDING 'L' - MODULAR CLASSROOM / OFFICE**
  - RELOCATION OF ONE (1) 96' x 40' MODULAR BUILDING; R34/R35/R36/R37 FROM STOCKPILE. - A#:04-118652 (PC 04-116668)

2. Sitework, including the following:
    a. **Underground utilities**.
    b. **Modular Building Foundations**
    c. **Earthwork**.
    d. **Paving**.
    e. **Fencing**.

B. Refer to Project Manual Table of Contents, Specifications Divisions 2 thru 49 for listing of Work included.

C. Type of Contract: **Multi-Prime Contract**

1.5 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
    1. Limits: Confine construction operations to area indicated on Drawings.
    2. Driveways and Entrances: Keep driveways, parking areas, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, 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 on-site.

C. Do not unreasonably encumber site with materials or equipment. Confine stockpiling of materials and location of storage areas to areas indicated, or if not indicated, as directed by Architect and Owner.

1.6 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
    1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to normal business working hours of 7:00 AM to 5:00 PM Monday through Friday, except as otherwise indicated.

C. Do not perform work during the following times until written permission from Owner has been obtained:
    1. Weekends.

2. Early mornings before 7:00 AM.
3. Evenings after 5:00 PM.

D. Do not perform the following types of work until written agreement as to allowable times has been obtained from Owner:
1. Work involving utility shutdowns.
2. Core drilling or other noisy activity.

E. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated.
1. Notify Architect and Owner not less than five (5) working days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without written permission from Architect and Owner

F. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
1. Notify Architect and Owner not less than five (5) working days in advance of proposed disruptive operations.
2. Do not proceed with disruptive operations without written permission from Architect and Owner.

G. Use of tobacco products including smoking and other controlled substances on the Project site is prohibited.

1.7 SPECIFICATION AND DRAWING FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 49-division format CSI's "MasterFormat" numbering system, 2010 edition.
1. Division 1 General Requirements: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Abbreviated Language: Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall

be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. 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.
3. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

C. Drawing Coordination: 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:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specification Sections.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 11 00

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for substitutions.
   1. During bidding.
   2. After award of contract.

B. Related Sections include:
   1. Section 01 60 00 “Product Requirements” for requirements for selection of products for use in Project.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
   1. Substitution for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitution 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.

B. Portable Document Format (PDF): 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.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Submittal Format: Submit in the following format:
      a. PDF electronic file: Submit electronic submittals via email as PDF electronic files.
      b. Paper Copies: Submit three (3) copies if requested by Architect.

2. Substitution Request Form: Use forms provided at end of this Section.
    a. For substitution requests during bidding, use form entitled “Substitution Request Form – For Use During Bidding Phase.”
    b. For substitution requests after award of contract, use form entitled “Substitution Request Form – For Use During Construction Phase.”
3. Supporting Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    a. Statement indicating why specified material, product, fabrication, or installation cannot be provided, if applicable
    b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be 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/evaluation reports evidencing compliance with building code in effect for Project, from ICC-ES or other model code organization acceptable to authorities having jurisdiction.
    j. 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.
    k. If occurring after award of contract, include the following:
        i) 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.
        ii) Cost information, including a proposal of change, if any, in the Contract Sum.

iii) 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.

-Attach Substitution Warranty, on Contractor's letterhead, in format matching sample at end of this Section.

iv) Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce intended results.

4. Architect's Action:

a. During Bidding: If proposed substitution is accepted, bidders will be notified by Addendum.

i) Use product specified if Architect does not issue approval of use of proposed substitution in Addendum prior to bid date.

b. After Award of Contract: If necessary, Architect will request additional information or documentation for evaluation within five (5) working days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within ten (10) working days of receipt of request, or five (5) working days of receipt of additional information or documentation, whichever is later.

i) Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.

ii) Use product specified if Architect does not issue a decision on use of 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.

1. Each Contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.

2. If a dispute arises between Contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS DURING BIDDING

A. Submit requests for substitution not later than ten (10) calendar days prior to bid date.

1. Conditions: Architect will consider bidder's request for substitution when the following conditions are satisfied.

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.

2.2 SUBSTITUTIONS AFTER AWARD OF CONTRACT

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

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.

b. Substitution request is fully documented and properly submitted.

c. Requested substitution will not adversely affect Contractor's construction schedule.

d. Requested substitution has received necessary approvals of authorities having jurisdiction.

e. Requested substitution is compatible with other portions of the Work.

f. Requested substitution has been coordinated with other portions of the Work.

g. Requested substitution provides specified warranty.

h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect will consider requests for substitution if received within thirty-five (35) calendar days after issuance of Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of testing and inspection, increased cost of other construction by Owner, and similar considerations. Cost of Owner's additional responsibilities will be deducted from Contract Sum by Change Order.

i) Substitution request will not be considered if necessitated by failure to pursue the Work promptly or coordinate activities in a timely manner.

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.

C. Submittal procedures as specified in Section 01 33 00 "Submittals Procedures," do not constitute an acceptable method of requesting substitutions. Architect's review

of such submittals does not constitute approval of substitutions that may be contained therein.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

IBI GROUP

SUBSTITUTION REQUEST FORM

FOR USE DURING BIDDING PHASE

PROJECT:	Name of Project Line 1 Name of Project Line 2	**REQUEST NO.:** (Office Use)	
OWNER:	Name of Owner Address City, State Zip Code	**DATE:**	
CONTRACTOR:	Name of Contractor Address City, State Zip Code	**ARCHITECT:**	IBI Group Office Address City, State, Zip
PTN:		**PROJECT NO.:**	
OPSC / OSHPD NO.:		**DSA FILE NO.:**	
		APPLICATION NO.:	

Company:	**Work Scope:**

Specification Title:		
Section No.:	**Page:**	**Paragraph:**
Product Description:		
Proposed Substitution:		
Manufacturer:	**Phone No:**	
Address:		

Reason For Substitution: _____
_____

Product Differences:_____
_____

Similar Installations: _____
_____

Per the requirements of Specification Section 01 25 00, attach detailed point by point comparison, product data, samples, cost information, and pertinent test and evaluation reports.

CONTRACTOR:

By:_____ Date:_____

ACCEPTED BY:
IBI Group

By:_____ Date:_____

IBI GROUP

SUBSTITUTION REQUEST FORM

FOR USE DURING CONSTRUCTION PHASE

PROJECT:	Name of Project Line 1 Name of Project Line 2	**REQUEST NO.:** (Office Use)	
OWNER:	Name of Owner Address City, State Zip Code	**DATE:**	
CONTRACTOR:	Name of Contractor Address City, State Zip Code	**ARCHITECT:**	IBI Group Office Address City, State, Zip
PTN:		**PROJECT NO.:**	
OPSC / OSHPD NO.:		**DSA FILE NO.:**	
		APPLICATION NO.:	

Company:	**Work Scope:**

Specification Title:		
Section No.:	**Page:**	**Paragraph:**
Product Description:		
Proposed Substitution:		
Manufacturer:	**Phone No:**	
Address:		

Reason For Substitution: _____
_____

Product Differences:_____
_____

Similar Installations: _____
_____

Savings to Owner: $	**Schedule Impact:** **Days**

Per the requirements of Specification Section 01 25 00, attach detailed point by point comparison, product data, samples, cost information, pertinent test and evaluation reports, and documentation indicating coordination of Work and Schedule.

I certify that the proposed substitution complies with the requirements in the Contract Documents and is appropriate for applications indicated, and waive rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

CONTRACTOR:

By:_____ Date:_____

ACCEPTED BY:
IBI Group

By:_____ Date:_____

SUBSTITUTIONS WARRANTY

In addition to other requirements, Contractor shall warrant in writing that substituted materials shall perform as specified, and assume complete responsibility for same, including responsibility and costs required for modifications to building or other materials or equipment, added tests and inspections, research time of Architect, and any additional coordination with work of other trades. The following is an example of the type of Substitution Warranty which shall be executed by the Contractor, on his own letterhead:

SUBSTITUTION WARRANTY

We propose to provide

_____

(Describe items being proposed for substitution)

for

_____

(List project name)

in lieu of, and as an equivalent to:

_____

(Describe specified product)

as indicated on the drawings and described in Section ##### of the Specifications.

We agree to assume the cost of any modifications to other portions of the work, including additional tests and inspections, and additional time on the part of Architect/Engineer as necessary to accommodate our material(s) and system(s).

We hereby warrant that:

_____

(Provide description)

is the equivalent of

_____

(Specified product)

in every respect and will perform satisfactorily under the conditions and use indicated on the Drawings and described in the Specifications, and will not affect or delay progress schedule unless approved in writing by Architect.

Signed: _____ Date: _____
(Manufacturer/Supplier/Other)

Signed: _____ Date: _____
(Subcontractor)

Signed: _____ Date: _____
(Contractor)

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include:

1. Section 01 25 00 “Substitution Procedures” for administrative procedures for handling requests for substitutions.

a. During bidding.

b. After award of contract.

1.3 DEFINITIONS

A. Portable Document Format (PDF): 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.

1.4 ARCHITECT’S SUPPLEMENTAL INSTRUCTION (ASI)

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on Architect’s standard form “Architect’s Supplemental Instruction.”

1. If Architect’s Supplemental Instructions involve, in Contactor’s opinion, changes to Contract Sum or Contract Time, submit Proposed Change Order as specified in “Proposed Change Orders (PCO)” Article.

1.5 PROPOSAL REQUEST (PR)

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

1. Proposal Requests issued by the Architect are for purpose of soliciting Proposed Change Order. Do not consider them instructions either to stop work in progress or to execute the proposed change.

2. Unless a shorter time period is specified in Proposal Request, within ten (10) working days after receipt of Proposal Request, submit a Proposed Change Order (PCO) in accordance with “Proposed Change Orders (PCO)” Article.
3. Work described in a Proposal Request is not to be commenced until associated Proposed Change Order has been approved in writing with signature of Owner and Architect.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Architect may choose to issue a Construction Change Directive (CCD) when necessary to expedite the Work and avoid or minimize delays. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Work included in a Construction Change Directive is to be performed under the observation of the Project Inspector.

C. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of change, submit a Proposed Change Order with supporting documentation including itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract, including paid invoices and daily labor reports signed by the Project Inspector.

1.7 PROPOSED CHANGE ORDER (PCO)

A. Submit Proposed Change Order in response to the following:
1. Proposal Request issued by Architect.
2. Circumstances Justifying Contractor-Initiated Proposal:
a. Architect’s directive which in Contractor’s opinion, involves changes to Contract Sum or Contract Time.
b. Latent or unforeseen conditions which in Contractor’s opinion involve changes to Contract Sum or Contract Time.
3. Construction Change Directive issued by Architect.

B. Format: Submit Proposed Change Order as PDF electronic file via email, unless requested otherwise.

C. Form and content of Proposed Change Order to comply with the following.
1. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
2. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

3. Include costs of labor and supervision directly attributable to the charge.
4. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
5. Use forms acceptable to Architect.
6. If Contractor-Initiated:
    a. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
    b. Comply with requirements in Section 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

D. Work Described in a Proposed Change Order is not to be commenced until approved in writing with signature of Owner and Architect, with the exception of the following:
    1. Proposed Change Orders for work authorized and completed by means of Construction Change Directive.

1.8 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposed Change Order, Architect will incorporate the Proposed Change Order, including adjustments to Contract Sum and/or Contract Time into subsequent Change Order.
    1. PCO items which involve changes to the structural, accessibility, or life-safety portions of the DSA-approved Contract Documents shall be submitted to and approved by DSA as a Construction Change Document, as required by California Administrative Code, Title 24, Part 1, Section 4-338, prior to commencement of the Work. Architect shall prepare and submit Construction Change Documents to DSA in compliance with DSA Interpretation of Regulation IR A-6.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

IBI GROUP ARCHITECTURE PLANNING
4119 Broad Street, Suite 210
San Luis Obispo, CA 93401
805 546-0433

ARCHITECT'S SUPPLEMENTAL INSTRUCTIONS (ASI)

PROJECT:

DOC. NO.:

OWNER:
(name address)

DATE:

CONTRACTOR:
(name address)

Name of Contractor
Address
City, State Zip Code

ARCHITECT:

IBI Group Architecture Planning
4119 Broad Street, Suite 210
San Luis Obispo, CA 93401

PTN:

PROJECT NO.:

OPSC / OSHPD NO.:

DSA FILE NO.:

APPLICATION NO.:

The work shall be carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents, not involving an adjustment to the Contract Sum or Contract Time. Prior to proceeding in accordance with these instructions, indicate your acceptance of these instructions for minor changes to the Work, as consistent with the Contract Documents, by signing below and returning an executed original to the Architect within ten (10) days of receiving these instructions.

Description:

Attachments:

ISSUED:
IBI GROUP ARCHITECTURE PLANNING

By: _____ Date: _____

ACCEPTED:
<INSERT CONTRACTOR LEGAL NAME>

By: _____ Date: _____

IBI GROUP ARCHITECTURE PLANNING
4119 Broad Street, Suite 210
San Luis Obispo, CA 93401
805 546-0433

CHANGE ORDER (CO)

PROJECT:

C.O. NO: 1

DSA C.O. NO.: 1

DATE:

OWNER:

ARCHITECT: IBI Group Architecture Planning
4119 Broad Street, Suite 210
San Luis Obispo, CA 93401

CONTRACTOR: Name
street
city, state, zip code

PROJECT NO.:

OWNER BID NO.:

PTN:

DSA FILE NO.:

OPSC/O SHPD NO.:

APPLICATION NO.:

CONFORMANCE WITH CONTRACT DOCUMENTS, PROJECT MANUAL, DRAWINGS AND SPECIFICATION : All Change Order work shall be in strict conformance with the Contract Documents, Project Manual, Drawings and Specifications as they pertain to work of a similar nature

ITEM	DESCRIPTION	DEDUCT	ADD
1		$0.00	$0.00
2		$0.00	$0.00
3		$0.00	$0.00
4		$0.00	$0.00

CHANGE ORDER NO. 1, Continued
NAME OF OWNER
PROJECT NAME
#NAME?

ITEM	DESCRIPTION	DEDUCT	ADD
5		$0.00	$0.00
6		$0.00	$0.00
7		$0.00	$0.00
8		$0.00	$0.00
SUB-TOTAL DEDUCTIONS		$0.00	
SUB-TOTAL ADDITIONS			$0.00
NET CHANGE (choose one) (ADDITION/DEDUCTION)			$0.00
ORIGINAL CONTRACT SUM			
NET CHANGE ALL PREVIOUS CHANGE ORDERS			$0.00
ADJUSTED CONTRACT SUM			$0.00
NET CHANGE - CHANGE ORDER NO. 1			$0.00
ADJUSTED CONTRACT SUM THRU THIS CHANGE ORDER			$0.00
COMMENCEMENT DATE			Enter Date
ORIGINAL COMPLETION DATE			Enter Date
TIME EXTENSION ALL PREVIOUS CHANGE ORDERS			Zero Days
ADJUSTED COMPLETION DATE PRIOR TO THIS C.O.			Enter Date
TIME EXTENSION - CHANGE ORDER NO. 1			Zero Days
ADJUSTED COMPLETION DATE			Enter Date

RECOMMENDED FOR APPROVAL:
IBI GROUP ARCHITECTURE PLANNING

By: _____ Date: _____

APPROVED:
CONTRACTOR NAME

By: _____ Date: _____

RECOMMENDED FOR APPROVAL:
CONSULTANT NAME

By: _____ Date: _____

RECOMMENDED FOR APPROVAL:
CONSULTANT NAME

By: _____ Date: _____

APPROVED:
DISTRICT

By: _____ Date: _____

APPROVED:
DIVISION OF THE STATE ARCHITECT

By: _____ Date: _____

IBI GROUP ARCHITECTURE PLANNING
4119 Broad Street, Suite 210
San Luis Obispo, CA 93401
805 546-0433

CONSTRUCTION CHANGE DIRECTIVE (CCDCM)

PROJECT:

CCD NO.:

OWNER:
(name address)

DATE:

CONTRACTOR:
(name address)
Name of Contractor
Address
City, State Zip Code

ARCHITECT:
IBI Group Architecture Planning
4119 Broad Street, Suite 210
San Luis Obispo, CA 93401

PTN:

PROJECT NO.:

OPSC / OSHPD NO.:

DSA FILE NO.:

APPLICATION NO.:

You are hereby directed to make change(s) in this Contract:

PROPOSED ADJUSTMENTS

1a. _____ Lump Sum (increase) (decrease) of _____

1b. _____ Unit Price of _____ per _____

1c. _____ Labor and Material, and percentage of overhead and profit as provided for in the General Conditions.
Other as follows: **(example: Negotiated price based on detailed cost breakdown.)**

_____

2. The Contract Time is proposed to be (increased) (decreased) (unchanged) by ( ) days.

When signed by the Owner and received by the Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive and the Contractor shall proceed with the change(s) described above.

RECOMMENDED FOR APPROVAL:
IBI GROUP ARCHITECTURE PLANNING
ARCHITECT

By: _____ Date: _____

RECOMMENDED FOR APPROVAL:
OWNER

By: _____ Date: _____

Signature by the Contractor indicates the Contractor's agreement with the proposed adjustments in Contract Sum and Contract Time set forth in this Construction Change Directive

CONTRACTOR:

By: _____ Date: _____

IBI GROUP ARCHITECTURE PLANNING
4119 Broad Street, Suite 210
San Luis Obispo, CA 93401
805 546-0433

PROPOSAL REQUEST (PR)

PROJECT:

PRICE REQUEST NO.:

OWNER:
(name address)

DATE:

CONTRACTOR:
(name address)

Name of Contractor
Address
City, State Zip Code

ARCHITECT:

IBI Group Architecture Planning
4119 Broad Street, Suite 210
San Luis Obispo, CA 93401

PTN:

PROJECT NO.:

OPSC / OSHPD NO.:

DSA FILE NO.:

APPLICATION NO.:

Please submit an itemized quotation for changes in the Contract Sum and/or Time incidental to proposed modifications to the Contract Documents described herein.
THIS IS NOT A CHANGE ORDER, NOR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED HEREIN.

ITEM	DESCRIPTION	DEDUCT	ADD

I understand that I am furnishing information for the Owner's consideration only, and that I am not authorized to modify the requirements of the Contract Documents, unless and until covered by a duly authorized change order signed by the Owner.

CONTRACTOR:
<INSERT CONTRACTORS LEGAL NAME>

By: _____ Date: _____

ACCEPTED BY:

By: _____ Date: _____

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include:

1. Section 01 26 00 “Contract Modification Procedures” for administrative procedures for handling changes to the Contract.
2. Section 01 32 00 “Construction Progress Documentation” for administrative requirements governing the preparation and submittal of Contractor’s construction schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.

B. Portable Document Format (PDF): 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.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor’s Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
    a. Application for Payment forms with Continuation Sheets.
    b. Submittals Schedule.
    c. Items required to be indicated as separate activities in Contractor’s Construction Schedule.
2. Submit the Schedule of Values to Architect within 10 ten calendar days after the date of the Notice to Proceed.
    a. Submittal Format: Submit in the following format:

i) PDF electronic file: Submit electronic submittals via email as PDF electronic files.

ii) Paper Copies: Submit three (3) copies if requested by Architect.

B. Format and Content: Use the Project Manual Table of Contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project Identification on the Schedule of Values:
   a. Project name and location.
   b. Name of Architect.
   c. Architect's project number.
   d. Contractor's name and address.
   e. Date of submittal.
2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
   a. Related Specification Section or Division.
   b. Description of the Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent:
      i) Labor.
      ii) Materials.
      iii) Equipment.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual Table of Contents. Provide multiple line items for principal subcontract amounts in excess of five (5) percent of the Contract Sum.
   a. Include separate line items under principal subcontracts for the following Project closeout requirements in an amount totaling five (5) percent of the Contract Sum and subcontract amount:
      i) Operation and maintenance manuals.
      ii) Punchlist activities.
      iii) Project record documents.
      iv) Demonstration and training activities.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
    a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.
6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
8. Schedule Updating: Update and resubmit the Schedule of Values before the next Application for Payment when Change Orders result in a change to the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and Project Inspector and paid by Owner.
    1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Each Application for Payment shall include Project Inspector's acknowledgement and signature indicating the following:
    1. Progress of Work is as indicated on Application.
    2. Record documents as required in Section 01 78 39 "Project Record Documents" are fully updated to reflect current progress of Work indicated on Application.

C. Payment Application Times: Progress payments shall be submitted to as indicated by the General Condition.
    1. Submit draft copy of Application for Payment five (5) working days prior to due date for review by Architect and Project Inspector.

D. Application for Payment Forms: Use AIA Document G702, Application and Certificate for Payment, with AIA Document G703, Continuation Sheet. AIA document originals to be provided by Contractor.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders issued before last day of construction period covered by application.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:
    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

G. Transmittal: Submit one signed, notarized original copy and four copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. Include waivers of lien and similar attachments.
1. Transmit each payment submittal with a transmittal form listing attachments and recording appropriate information about application.

H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers.
1. Submit partial waivers on each item, after deduction for retainage.
    a. Submit Conditional Waiver on each item for amount requested for construction period covered by Application for Payment being submitted.
    b. Submit Unconditional Waiver on each item for amount requested for construction period covered by previous Application.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

I. Updated Contractor's Construction Schedule, as specified in Section 01 32 00 "Construction Progress Documentation," must be submitted prior to submittal of each Application for Payment.

J. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).
4. List of Contractor's staff assignments.
5. List of Contractor's principal consultants.
6. Copies of building permits.
7. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
8. Initial progress report.
9. Report of preconstruction conference.
10. Certificates of insurance and insurance policies.
11. Performance and payment bonds.
12. Data needed to acquire Owner's insurance.
13. Initial settlement survey and damage report if required.

K. Application for Payment at Substantial Completion: After Architect's issuance of the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

L. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of all Project closeout requirements.
    a. Refer to Section 01 77 00 "Closeout Procedures" for closeout requirements.
    b. Refer to Section 01 78 23 "Operation and Maintenance Data" for requirements for submittal of operation and maintenance manuals.
    c. Refer to Section 01 78 39 "Project Record Documents" for record document requirements.
    d. Refer to Section 01 79 00 "Demonstration and Training" for training of Owner's personnel in operation of systems.
2. Evidence of completion of all Project Punchlist items.

3. DSA Form DSA-6, Final Verified Report, fully executed and signed by Contractor, indicating 100% completion.
4. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
5. Updated final statement, accounting for final changes to the Contract Sum.
6. AIA Document G706 “Contractor’s Affidavit of Payment of Debts and Claims.”
7. AIA Document G706A, “Contractor’s Affidavit of Release of Liens.”
8. AIA Document G707, “Consent of Surety to Final Payment.”
9. Evidence that claims have been settled.
10. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when owner took possession of and assumed responsibility for corresponding elements of the Work.
11. Final, liquidated damages settlement statement.

M. Upon completion of the Work of this contract, Contractor shall file affidavit with Owner, sworn to before a Notary Public, stating that all workers and persons employed, all firms supplying materials, and all subcontractors have been paid in full and that there are no bills outstanding against the project for either labor or materials, except those items, if any, to be set forth in such affidavit, covering disputed claims or items in connection with Notices to Withhold (Mechanics Lien or Stop Notice) which have been filed under the provisions of the statutes of the State of California. At the same time, Contractor shall execute a Contractor’s Affidavit of Release of Liens, with separate release or waiver of lien from each subcontractor and material or equipment supplier.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

APPLICATION AND CERTIFICATE FOR PAYMENT AIA DOCUMENT G702 (Instructions on reverse side) PAGE ONE OF PAGES

TO OWNER: PROJECT: APPLICATION NO.: Distribution to:
PERIOD TO: ☐ OWNER
PROJECT NO.: ☐ ARCHITECT
☐ CONTRACTOR
FROM CONTRACTOR: VIA ARCHITECT: IBI Group Architecture Planning CONTRACT DATE: ☐ INSPECTOR
4119 Broad Street Suite 210 ☐ SUP'T SCHOOLS
San Luis Obispo, CA 93401

CONTRACT FOR:

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract. Continuation Sheet, AIA Document G703, is attached.

1. **ORIGINAL CONTRACT SUM** ..... $
2. **Net change by Change Orders** ..... $
3. **CONTRACT SUM TO DATE** (Line 1 ∀ 2) ..... $
4. **TOTAL COMPLETED & STORED TO DATE** ..... $
   (Column G on G703)
5. **RETAINAGE:**
   a. _____% of Completed Work $
      (Columns D + E on G703)
   b. _____% of Stored Materials $
      (Column F on G703)
   Total Retainage (Line 5a + 5b or
   Total in Column I of G703) ..... $
6. **TOTAL EARNED LESS RETAINAGE** ..... $
   (Line 4 less Line 5 Total)
7. **LESS PREVIOUS CERTIFICATES FOR PAYMENT**
   (Line 6 from prior Certificate) ..... $
8. **CURRENT PAYMENT DUE** ..... $
9. **BALANCE TO FINISH, INCLUDING RETAINAGE**
   (Line 3 less Line 6) $

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner		
Total approved this Month		
TOTALS		
NET CHANGES by Change Order		

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of:
County of:
Subscribed and sworn to before
me this day of

Notary Public:
My Commission Expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

RECOMMENDED FOR CERTIFICATION
INSPECTOR:
BY: _____ Date: _____

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED ..... $
(Attach explanation if amount certified differs from the amount applied for. Initial all figures on this Application and on the Continuation Sheet that are changed to conform to the amount certified.)
ARCHITECT:
BY: _____ Date:
This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

CONTINUATION SHEET

BASED ON AIA DOCUMENT G703

AIA Document G702, APPLICATION AND CERTIFICATE FOR PAYMENT,
containing Contractor's signed Certification, is attached
In tabulations below, amounts are stated to the nearest dollar.
Use Column 1 on Contracts where variable retainage for line items may apply.

APPLICATION NO.:
APPLICATION DATE:
PERIOD TO:
ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED		MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D + E + F)	% (G) C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE) RATE
			FROM PREVIOUS APPLICATIONS (D + E)	THIS PERIOD					

MASTER: MERGE\AIAG703.pf

CONTRACTOR'S AFFIDAVIT OF RELEASE OF LIENS

OWNER _
ARCHITECT _
CONTRACTOR _
SURETY _
OTHER _

TO OWNER: **ARCHITECT'S PROJECT NO.:**

CONTRACT FOR:

PROJECT: **CONTRACT DATED**

STATE OF: CALIFORNIA
COUNTY OF:
The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:
1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR:
(Name and Address)

BY: _____
(Signature of authorized representative)

_____

Subscribed and sworn to before me on this date:

Notary Public:

My commission expires:

INSTRUCTION SHEET

CONTRACTOR'S AFFIDAVIT OF RELEASE OF LIENS

A. GENERAL INFORMATION:

1. COMPLETING THIS FORM

GENERAL: The Owner-Contractor Agreement is the usual source of required information, such as the contract date and the name s and addresses of the Owner, Project and Contractor.

ARCHITECT'S PROJECT NO.: This information is typically supplied by the Architect and entered on the form by the Contractor.

CONTRACT FOR: This refers to the scope of the contract, such as "General Construction" or "Mechanical Work."

AFFIDAVIT: Indicate the state and county where the Affidavit is made. This is not necessarily the same location as the Project, but should be the location where the notary is authorized to administer sworn oaths. If there are any EXCEPTIONS to the statement, these should be listed in the space provided; otherwise, enter as "None." It may be a stipulation of the Contract Documents that the Owner has the right to require the Contractor to furnish a bond to cover each exception listed on the Affidavit.

2. EXECUTION OF THE DOCUMENT

The Notary Public should administer a sworn oath to the Contractor referencing the written statements appearing on Affidavit, and should duly sign and seal this document containing the Contractor's signature. Affidavit should be signed by the Contractor or the Contractor's authorized representative.

CONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

NOTICE: THIS DOCUMENT WAIVES THE CLAIMANT'S LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS EFFECTIVE ON RECEIPT OF PAYMENT. A PERSON SHOULD NOT RELY ON THIS DOCUMENT UNLESS SATISFIED THAT THE CLAIMANT HAS RECEIVED PAYMENT.

Identifying Information

Name of Claimant:

Name of Customer:

Job Location:

Owner:

Through Date:

Conditional Waiver and Release

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for labor and service provided, and equipment and material delivered, to the customer on this job through the Through Date of this document. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. This document is effective only on the claimant's receipt of payment from the financial institution on which the following check is drawn:

Maker of Check:

Amount of Check: $

Check Payable to:

Exceptions

This document does not affect any of the following:
(1) Retentions.
(2) Extras for which the claimant has not received payment.
(3) The following progress payments for which the claimant has previously given a conditional waiver and release but has not received payment:
Date(s) of waiver and release:_____
Amount(s) of unpaid progress payment(s): $_____
(4) Contract rights, including (A) a right based on rescission, abandonment, or breach of contract, and (B) the right to recover compensation for work not compensated by the payment.

Signature

Claimant's Signature:

Claimant's Title:

Date of Signature:

UNCONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

NOTICE TO CLAIMANT: THIS DOCUMENT WAIVES AND RELEASES LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. THIS DOCUMENT IS ENFORCEABLE AGAINST YOU IF YOU SIGN IT, EVEN IF YOU HAVE NOT BEEN PAID. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL WAIVER AND RELEASE FORM.

Identifying Information
Name of Claimant:
Name of Customer:
Job Location:
Owner:
Through Date:

Unconditional Waiver and Release

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for labor and service provided, and equipment and material delivered, to the customer on this job through the Through Date of this document. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. The claimant has received the following progress payment:

$_____

Exceptions

This document does not affect any of the following:

(1) Retentions.

(2) Extras for which the claimant has not received payment.

(3) Contract rights, including (A) a right based on rescission, abandonment, or breach of contract, and (B) the right to recover compensation for work not compensated by the payment.

Signature
Claimant's Signature:
Claimant's Title:
Date of Signature:

CONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

NOTICE: THIS DOCUMENT WAIVES THE CLAIMANT'S LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS EFFECTIVE ON RECEIPT OF PAYMENT. A PERSON SHOULD NOT RELY ON THIS DOCUMENT UNLESS SATISFIED THAT THE CLAIMANT HAS RECEIVED PAYMENT.

Identifying Information
Name of Claimant:
Name of Customer:
Job Location:
Owner:

Conditional Waiver and Release

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for labor and service provided, and equipment and material delivered, to the customer on this job. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. This document is effective only on the claimant's receipt of payment from the financial institution on which the following check is drawn:

Maker of Check:
Amount of Check: $
Check Payable to:

Exceptions
This document does not affect any of the following: Disputed claims for extras in the amount of: $

Signature
Claimant's Signature:
Claimant's Title:
Date of Signature:

UNCONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

NOTICE TO CLAIMANT: THIS DOCUMENT WAIVES AND RELEASES LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. THIS DOCUMENT IS ENFORCEABLE AGAINST YOU IF YOU SIGN IT, EVEN IF YOU HAVE NOT BEEN PAID. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL WAIVER AND RELEASE FORM.

Identifying Information
Name of Claimant:
Name of Customer:
Job Location:
Owner:

Unconditional Waiver and Release

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for all labor and service provided, and equipment and material delivered, to the customer on this job. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. The claimant has been paid in full.

Exceptions
This document does not affect any of the following: Disputed claims for extras in the amount of: $

Signature
Claimant's Signature:
Claimant's Title:
Date of Signature:

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative requirements for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. Supervision.
   3. Requests for Information (RFI's).
   4. Project meetings.

B. Related Sections include:
   1. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
   2. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.
   3. Section 32 00 10 "Field Engineering" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.3 DEFINITIONS

A. RFI: Request from Contractor seeking information required by or clarification of the Contract Documents.

B. Portable Document Format (PDF): 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.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.

2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within ten (10) working days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, telephone numbers, including both office and cellular telephone numbers, and email addresses. Provide names, addresses, telephone numbers, and email addresses of individuals assigned as alternates in the absence of individuals assigned to Project.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
1. The manner in which the Specifications are divided into Divisions and Sections is not intended to indicate division of work between trades nor indicate trade union or jurisdictional agreements.
a. Assign and subcontract construction activities, and employ workers in a manner that will not risk jurisdictional disputes that could result in conflicts, delays, claims, or losses.
2. Coordinate structural, mechanical, and electrical elements prior to installation. All penetrations of structural elements must first receive approval of Architect. Rerouting of ductwork, piping, or conduit caused by failure to coordinate beforehand is the responsibility of the affected subcontractor and will not be considered justification for additional cost.
3. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
4. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
5. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor’s Construction Schedule.

2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary facilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property

1.6 SUPERVISION

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

B. Contractor is solely responsible for construction means, methods, techniques, sequences, and procedures for performing Work.

1.7 REQUESTS FOR INFORMATION (RFI's)

A. General: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.

1. Do not submit an RFI until due diligence has been exercised in attempting to locate needed information in Contract Documents. If information requested is apparent from field observations, is contained in the Contract Documents, or is reasonably inferred by them, Contractor shall be responsible to Owner for all reasonable costs charged by Architect for additional services required to provide such information.
2. RFI's shall originate with the Contractor. RFI's submitted by entities other than Contractor, including entities controlled by Contractor, will be returned with no response.
3. Coordinate and submit RFI's in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of RFI: Include a detailed, legible description of item needing interpretation or clarification, and the following:

1. Project name.
2. Date.
3. Name of Contractor.

4. Name of Architect.
5. RFI number, numbered sequentially.
6. RFI topic.
7. Specification Section number and title and related paragraphs, as appropriate.
8. Drawing number and detail references, as appropriate.
9. Field dimensions and conditions, as appropriate.
10. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
11. Contractor's signature.
12. Attachments: Include drawings, 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. RFI Format: Use form acceptable to Architect.
1. Identify each page of attachments with the RFI number and sequential page number.

D. RFI Submittal Procedure: Submit to Architect via email using format as follows:
1. RFI form and attachments in the form of a PDF electronic file.

E. Architect's Action: Architect will review each RFI, determine action required, and respond with reasonable promptness, within a timeframe not impacting critical path affected by the RFI topic, as verified by the Contractor's Construction Schedule. RFI's received after 1:00 P.M. will be considered as received the following working day.
1. No extension of Contract Time will be authorized due to Contractor's failure to allow sufficient time for Architect's RFI review.
2. The following RFI's will be returned without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's mean and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFI's or RFI's with numerous errors.
3. Architect's response may include a request for additional information.
4. Architect's action on RFI's that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Proposed Change

Order (PCO) according to Section 01 26 00 ”Contract Modification Procedures.”

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within five (5) working days of receipt of the RFI response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFI’s organized by the RFI number. Submit log as requested by the Architect. Include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFI’s that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect’s response was received.
8. Identification of related Architect’s Supplemental Instruction (ASI), Construction Change Directive (CCD), and Proposal Request (PR), as appropriate.

G. On receipt of Architect’s action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect five (5) working days if Contractor disagrees with response.

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner Project Inspector, and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved, unless minutes are indicated to be recorded by others. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within four (4) working days of the meeting.

B. Preconstruction Conference: Architect will schedule a preconstruction conference before starting construction. Attend and participate in meetings and conferences. Architect shall conduct conference and provide the following:

1. Conduct the meeting to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers, and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect progress, including the following:
    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Lines of communications.
    f. Procedures for processing field decisions and Change Orders.
    g. Procedures for RFI's.
    h. Procedures for testing and inspecting.
    i. Procedures for processing Applications for Payment.
    j. Distribution of the Contract Documents.
    k. Submittal procedures.
    l. Preparation of record documents.
    m. Use of the premises.
    n. Work restrictions.
    o. Working hours.
    p. Owner's occupancy requirements.
    q. Responsibility for temporary facilities and controls.
    r. Procedures for moisture and mold control.
    s. Procedures for disruptions and shutdowns.
    t. Construction waste management and recycling.
    u. Parking availability.
    v. Office, work, and storage areas.
    w. Equipment deliveries and priorities.
    x. First aid.
    y. Security.
    z. Progress cleaning.
4. Minutes: Record and distribute to parties present and parties not present but requiring the information.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
    1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
    2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFI's.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility problems.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to parties not present but requiring the information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Attend and participate in meetings and conferences at Project site. Architect shall conduct meetings and conferences and provide the following, unless otherwise indicated.

1. Attendees: In addition to representatives of Owner and Architect, Project Inspector, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of

future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
        i) Review schedule for next period.
    b. Review present and future needs of each entity present, including the following:
        i) Interface requirements.
        ii) Sequence of operations.
        iii) Status of submittals.
        iv) Deliveries.
        v) Off-site fabrication.
        vi) Access.
        vii) Site utilization.
        viii) Temporary facilities and controls.
        ix) Work hours.
        x) Hazards and risks.
        xi) Progress cleaning.
        xii) Quality and work standards.
        xiii) Status of correction of deficient work items.
        xiv) Field observations.
        xv) Status of RFI's.
        xvi) Status of Proposal Requests.
        xvii) Pending changes.
        xviii) Status of Change Orders.
        xix) Pending claims and disputes.
        xx) Documentation of information for payment requests.
        xxi) Minutes:
3. Minutes: Architect will record and distribute meeting minutes to parties present and parties not present but requiring the information.

a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

E. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than five (5) days prior to scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers, and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
   a. Preparation of record documents.
   b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
   c. Submittal of written warranties.
   d. Requirements for preparing operations and maintenance data.
   e. Requirements for delivery of material samples, attic stock, and spare parts.
   f. Requirements for demonstration and training.
   g. Preparation of Contractor's punch list.
   h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
   i. Submittal procedures.
   j. Owner's partial occupancy requirements.
   k. Installation of Owner's furniture, fixtures, and equipment.
   l. Responsibility for removing temporary facilities and controls.
4. Minutes: Record and distribute meeting minutes to each party present and to parties not present but requiring the information.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

IBI GROUP ARCHITECTURE PLANNING
4119 Broad Street, Suite 210
San Luis Obispo, CA 93401
805 546-0433

REQUEST FOR INTERPRETATION (RFI)

PROJECT:

RFI NO.:

OWNER:
(name address)

DATE:

CONTRACTOR:
(name address)

Name of Contractor
Address
City, State Zip Code

ARCHITECT:

IBI Group Architecture Planning
4119 Broad Street, Suite 210
San Luis Obispo, CA 93401

PTN:

PROJECT NO.:

OPSC / OSHPD NO.:

DSA FILE NO.:

APPLICATION NO.:

DRAWING REFERENCE: _____

SPECIFICATION REFERENCE: _____

BRIEF TITLE:

DESCRIPTION OF CLARIFICATION REQUIRED (Attach sheets as necessary):

PROPOSED SOLUTION:

INITIATOR:
(signature)

RESPONSE:

RESPONSE BY: _____ DATE: _____

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Preliminary Construction Schedule.
   2. Contractor's Construction Schedule.
   3. Construction schedule updating reports.
   4. Daily construction reports.
   5. Special reports.

B. Related Sections include:
   1. Section 01 29 00 "Payment Procedures" for submitting the Schedule of Values.
   2. Section 01 31 00 "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
   3. Section 01 33 00 "Submittal Procedures" for submitting schedules and reports.
   4. Section 01 32 33 "Photographic Documentation" for submitting construction photographs.
   5. Section 01 41 00 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 REFERENCES

A. Associated General Contractors of America (AGC):
   1. Construction Planning and Scheduling.

1.4 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.

3. Successor Activity: An activity that follows another activity in the network.

B. 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 Project.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.
   1. 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.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
   3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

G. Milestone: A key or critical point in time for reference or measurement.

H. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

I. Portable Document Format (PDF): 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.

1.5 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format.
   1. PDF electronic file.
      a. Submit electronic submittals via email as PDF electronic files.
   2. Paper copies: Submit four copies if requested by Architect.

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

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

D. Daily Construction Reports: Submit at weekly intervals.

1.6 COORDINATION

A. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 15 working days, unless specifically allowed by Architect.

2. Punchlist and Final Completion: Include not more than ten (10) working days for completion of punchlist items and final completion.

C. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

D. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.

2. Unanswered Requests for Information (RFI's).

3. Rejected or unreturned submittals.

4. Notations on returned submittals.

5. Pending modifications affecting the Work and Contract Time.

E. Recovery Schedule: When periodic update indicates the Work is fourteen [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.

F. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 PRELIMINARY CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit startup, horizontal bar-chart-type construction schedule within ten (10) calendar days of date established for the Notice to Proceed.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. CPM Schedule: Prepare Contractor's Construction Schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than five (5) working days after District's return of Preliminary Construction Schedule.

a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.

3. Use "one workday" as the unit of time for individual activities. Indicate non-working days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

a. Preparation and processing of submittals.

b. Mobilization and demobilization.

c. Purchase of materials.

d. Delivery.

e. Fabrication.

f. Utility interruptions.

g. Installation.

h. Work by Owner that may affect or be affected by Contractor's activities.

i. Testing.

j. Punchlist and final completion.

k. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those from interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
    a. Sub-networks on separate sheets are permissible for activities clearly off the critical path.

D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial Completions and occupancies.
19. Substantial Completions authorized.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within 2 working days of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule 1 week before each regularly scheduled progress meeting.

1. 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.
2. 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.
3. As the Work progresses, indicate actual completion percentage for each activity.
4. Applications for Payment as specified in Section 01 29 00 "Payment Procedures," will not be processed until Project Inspector ***[Architect]*** has verified updated schedule has been submitted.

B. Distribution: Distribute copies of approved schedule to Architect, Inspector, Owner, separate contractors, subcontractors, suppliers and fabricators, testing and inspection agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

SECTION 01 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for the Submittal Schedule, and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections include:

1. Section 01 25 00 “Substitution Procedures” for submitting substitution requests.
2. Section 01 26 00 “Contract Modification Procedures” for submitting Proposed Change Orders.
3. Section 01 29 00 “Payment Procedures” for submitting Applications for Payment and the Schedule of Values.
4. Section 01 31 00 “Project Management and Coordination” for submitting Coordination Drawings and RFI’s.
5. Section 01 32 00 “Construction Progress Documentation” for submitting schedules and reports, including Contractor’s Construction Schedule, and Daily Construction Reports.
6. Section 01 32 33 “Photographic Documentation” for submitting construction photographs.
7. Section 01 43 00 “Quality Assurance” for submitting test and inspection reports and for mockup requirements.
8. Section 01 77 00 “Closeout Procedures” for submitting warranties.
9. Section 01 78 23 “Operation and Maintenance Data” for submitting operation and maintenance manuals.
10. Section 01 78 39 “Project Record Documents” for submitting Record Drawings, Record Specifications, and Record Product Data.
11. Section 01 79 00 “Demonstration and Training” for submitting video recordings of demonstration of equipment and training of Owner’s personnel.
12. Divisions 2 through 49 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "Action Submittals."

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

C. 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.

D. Portable Document Format (PDF): 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.

1.4 SUBMITTAL ADMINISTRATIVE REQUREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

1. At Contractor's written request, read-only digital data files can be made available to Contractor.
    a. Architect makes no representations as to the accuracy or completeness of digital data as it relates to the Contract Drawings.
    b. Contractor shall execute an electronic file release agreement in the form of Agreement form provided by or acceptable to Architect.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. 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.
    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow minimum time for submittal review, including time for resubmittals, as follows below. Time for review shall commence on Architect's receipt of submittal, except submittals received after 1:00 PM will be considered as received the following working day. No extension of Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals. Submittal review times indicated below are minimums. Longer review times may occur within timeframe not impacting critical path affected by submittal being reviewed, as verified by Contractor's Construction Schedule.

1. Initial Review: Allow fifteen (15) working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in the same manner as initial submittal.
3. Resubmittal Review: Allow twelve (12) working days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow fifteen (15) working days for initial review of each submittal.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 inches by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:
    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of subcontractor.
    g. Name of supplier.
    h. Name of manufacturer.
    i. Submittal number.
        i) Resubmittal number shall use the original submittal number followed by a decimal point and sequential number (e.g. 15.1 indicates the first resubmittal of Submittal No. 15, 15.2 indicates second resubmittal, etc.).
    j. Number and title of applicable Specification Section.

k. Drawing number and detail references, as appropriate.

l. Location(s) where product is to be installed, as appropriate.

m. Other necessary information.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return without review, submittals received from sources other than Contractor.

a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

i) Submittal number.

ii) Project name.

iii) Date.

iv) Destination (To:)

v) Source (From:)

vi) Name and address of Architect.

vii) Name of Construction Manager.

viii) Name of Contractor.

ix) Name of firm or entity that prepared submittal.

x) Names of subcontractor, manufacturer, and supplier.

xi) Category and type of submittal.

xii) Submittal purpose and description.

xiii) Specification Section number and title.

xiv) Specification paragraph number or drawing designation and generic name for each of multiple items.

xv) Drawing number and detail references, as appropriate.

xvi) Indication of full or partial submittal.

xvii) Submittal and transmittal distribution record.

xviii) Remarks.

b. Paper submittals without proper transmittal forms will be returned without review.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

2. Name file with submittal number or other unique identifier, including revision identifier.

a. File name shall use an identifier indicating submittal number (e.g. sub01). Resubmittals shall include an alphabetic suffix after a decimal point (e.g. sub01.1).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect*.*

4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Owner, containing the following information:

a. Submittal number.

b. Project name.

c. Date.

d. Name and address of Architect.

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.

F. Options: Identify options requiring selection by Architect.

G. 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.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.

2. Note date and content of revision in label or title block and clearly indicate extent of revision.

3. Resubmit submittals until they are marked “No Exceptions Taken” or “Make Corrections Noted” on Architect’s action stamp.

I. 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.

J. Use for Construction; Retain complete copies of submittals on Project site. Use only final action submittals with notation from Architect’s action stamp indicating “No Exceptions Taken” or “Make Corrections Noted.”

1. Make corrections requested by Architect on submittals marked “Make Corrections Noted.”

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections to Architect unless indicated otherwise. Types of submittals are indicated in individual Specification Sections.

1. Submittals Other Than Samples: Submit in the following format, except as indicated otherwise in individual Specification Sections:

a. PDF electronic file:

i) Submit electronic submittals via email as PDF electronic files. Architect will return annotated file.

b. Paper copies:

i) Action Submittals: If requested by Architect, submit five (5) copies unless otherwise indicated. Architect will return (1) copy.

ii) Informational Submittals: If requested by Architect, submit three (3) copies unless otherwise indicated. Architect will not return copies.

2. Sample Submittals: Refer to “Samples” paragraph below for required quantities of Samples.

3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

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

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

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

3. Include the following information, as applicable:
    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.
4. For equipment, include the following in addition to the above, as applicable.
    a. Wiring diagrams showing factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.
6. Format: Submit Product Data in format specified in "General Submittal Procedure Requirements" paragraph above.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Relationship and attachment to adjoining construction clearly indicated.
    g. Seal and signature of professional engineer, if specified.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 inches by 11 inches, but no larger than 30 inches by 42 inches.
3. Format: Submit Shop Drawings in format specified in "General Submittal Procedure Requirements" paragraph above.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: 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.
3. 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.
4. Disposition: Maintain sets of approved Samples at 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.
    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    a. Number of Samples: Submit two (2) full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
6. Samples for Verification: Submit full-size units of 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: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    a. Number of Samples: Submit two (2) sets of Samples. Architect will retain one (1) Sample set; remainder will be returned.
        i) 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. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00 "Construction Progress Documentation."

F. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00 “Payment Procedures.”

G. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 43 00 “Quality Assurance.”

H. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00 “Closeout Procedures.”

I. Maintenance Data: Comply with requirements specified in Section 01 78 23 “Operation and Maintenance Data.”

J. 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.

K. 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.

L. Installer Certificates: Submit written statements on manufacturer’s letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific project.

M. 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.

N. Product Certificates: Submit written statements on manufacturer’s letterhead certifying that product complies with requirements in the Contract Documents.

O. Material Certificates: Submit written statements on manufacturer’s letterhead certifying that material complies with requirements in the Contract Documents.

P. 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.

Q. 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.

R. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.

2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

S. Preconstruction Test Reports: Submit reports 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.

T. 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.

U. Field Quality Control 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.

V. 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.

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. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 "Closeout Procedures."

C. 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 ACTIONS

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect's review is for general conformance with design concept, only, and does not relieve Contractor in any way from compliance with Contract Documents, nor does it in any way constitute a Change Order. Contractor remains solely responsible for details and accuracy, all quantities and dimensions, and selection of fabrication processes.

C. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:

1. No Exceptions Taken: Work covered by submittal may proceed provided it complies with the requirements of the Contract Documents. Compliance with Contract Documents will be a condition of acceptance of Work.
2. Make Corrections Noted: Work covered by submittal may proceed, provided it complies with Architect/Engineer's notations or corrections. Compliance with Contract Documents will be a condition of acceptance of Work.
3. Revise and Resubmit: Do not proceed with Work covered by submittal, including purchasing, fabrication, delivery, or other activity. Revise submittal in accordance with Architect/Engineer's notations and resubmit without delay. Repeat if necessary.
4. Rejected, See Remarks: Do not proceed with Work covered by submittal, including purchasing, fabrication, delivery, or other activity. Revise submittal or prepare new submittal in accordance with Architect/Engineer's notations and resubmit without delay.
5. Remarks Attached: Follow Architect/Engineer's remarks and instructions attached to submittal. Remarks may be in conjunction with one of the four actions listed above.

D. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

E. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

F. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

END OF SECTION 01 33 00

SECTION 01 41 00

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes regulatory requirements.

1.3 GOVERNING REGULATIONS

A. All Work to be in strict conformance with requirements of all applicable codes, ordinances, standards, and other regulations, including the following:
   1. California Code of Regulations, Title 24 - Building Standards.
      a. 2016 California Building Standards Administrative Code (Title 24, Part 1).
      b. 2016 California Building Code (Title 24, Part 2).
      c. 2016 California Electrical Code (Title 24, Part 3).
      d. 2016 California Mechanical Code (Title 24, Part 4).
      e. 2016 California Plumbing Code (Title 24, Part 5).
      f. 2016 California Energy Code (Title 24, Part 6).
      g. 2016 California Historical Building Code (Title 24, Part 8).
      h. 2016 California Fire Code (Title 24, Part 9).
      i. 2016 California Existing Building Code (Title 24, Part 10).
      j. 2016 California Green Building Standards Code (Title 24, Part 11).
      k. 2016 California Referenced Standards Code (Title 24, Part 12).
   2. U.S. Department of Justice 2010 ADA Standards for Accessible Design.
   3. National Fire Protection Association (NFPA):
      a. NFPA 13: Standard for Installation of Sprinkler Systems, 2013 Edition.
      b. NFPA 72: National Fire Alarm Code and Signaling Code, 2013 Edition.

B. Nothing in these Contract Documents shall be construed to permit work not in conformance with applicable codes and regulations. Notify Architect and Project Inspector promptly in writing if there is reason to believe that any portion of Contract Documents is at variance with any applicable codes and regulations.

1.4 INFORMATIONAL SUBMITTALS

A. Permits and Licenses: Submit copies of permits, licenses, inspection reports, certifications, and other similar documents pertaining to compliance with applicable standards and regulations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 41 00

SECTION 01 42 00

DEFINITIONS AND REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes definitions and reference standards.

B. Related Sections include:

1. Section 01 41 00 “Regulatory Requirements” for applicable codes and other regulatory requirements.

1.3 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. “Approved”: When used to convey Architect’s action on Contractor’s submittals, applications, and requests, “approved” is limited to Architect’s duties and responsibilities as stated in the Conditions of the Contract, and does not relieve the Contractor in any way of responsibility for conformance with contract.

C. “Directed”: A command or instruction by Architect. Other terms including “requested,” “authorized,” “selected,” “approved,” “required,” and “permitted” have the same meaning as “directed.”

1. In no way shall any implied meaning be interpreted to extend Architect’s responsibility to construction means and methods or construction site safety.

D. “Indicated”: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including “shown,” “noted,” “scheduled,” and “specified” have the same meaning as “indicated.”

E. “Regulations”: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. “Furnish”: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. “Install”: Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. “Provide”: Furnish and install, complete and ready for the intended use.

I. “Project Site”: Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which the Project is to be built.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.5 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale’s “Encyclopedia of Associations: National Organizations of the U.S.” or in Columbia Books’ “National Trade & Professional Associations of the United States.”

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

1. DIN – Deutsches Institut fur Normung e.V; www.din.de.
2. IAPMO – International Association of Plumbing and Mechanical Officials; www.iapmo.org
3. ICC – International Code Council; www.iccsafe.org.
4. ICC-ES – ICC Evaluation Service, LLC; www.icc-es.org.

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

1. CPSC – Consumer Product Safety Commission; www.cpsc.gov.
2. DOE – Department of Energy; www.energy.gov.

3. EPA – Environmental Protection Agency; www.epa.gov.
4. OSHA – Occupational Safety & Health Administration; www.osha.gov.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is believed to be accurate as of the date of the Contract Documents.
1. CFR – Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. FS – Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
1. CCR; California Code of Regulations; Office of Administrative Law; California Title 24; www.calregs.com.
2. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
3. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 43 00

QUALITY ASSURANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This 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. 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 of this Section.
4. Specific test and inspection requirements are not specified in this Section.

C. Related Sections include:

1. Section 01 32 00 "Construction Progress Documentation" for developing a schedule of required tests and inspections.
2. Section 01 73 29 "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
3. Divisions 2 through 49 Sections for specific test and inspection requirements.

1.3 REFERENCES

A. ASTM International (American Society for Testing and Materials):

1. ASTM E 329: Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

B. Code of Federal Regulations (CFR):

1. 29 CFR 1910, Subpart A, Section 1910.7: Definitions and Requirements for a Nationally Recognized Testing Laboratory.

C. NIST: National Institute of Standards and Technology.

1.4 DEFINITIONS

A. 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.

B. 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.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, 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.

1. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.
2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

D. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

E. 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.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a trade-specific terminology such as “carpentry” 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 trades.

J. Experienced: When used with an entity or individual, “experienced” means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

K. Portable Document Format (PDF): 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.

1.5 CONFLICTING REQUIREMENTS

A. General: If compliance with two 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.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor’s Statement of Responsibility: 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:

1. Seismic-force-resisting systems, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

B. Testing Agency Qualifications: For testing agencies specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.

2. Entity responsible for performing tests and inspections.
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.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified to be performed by Contractor in other Sections. Include the following:
   1. Date of issue.
   2. Project title and number.
   3. Division of the State Architect project application number.
   4. Name, address, and telephone number of testing agency.
   5. Dates and locations of samples and tests or inspections.
   6. Names of individuals making tests and inspections.
   7. Description of the Work and test and inspection method.
   8. Identification of product and Specification Section.
   9. Complete test or inspection data.
   10. Test and inspection results and an interpretation of test results.
   11. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
   12. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
   13. Name and signature of laboratory inspector.
   14. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, and telephone number of technical representative making report.
   2. Statement on condition of substrates and their acceptability for installation of product.
   3. Statement that products at Project site comply with requirements.
   4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.

5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. 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.

1.8 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to product required units.

D. Installer Qualifications: A firm or individual with experience 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.
1. Minimum Experience: 5 years or 5 projects, unless indicated otherwise.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who 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 for this Project.

F. Specialists: 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.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and acceptable to authorities having jurisdiction, where approval by said authorities is required.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:
    a. Provide test specimens representative of proposed products and construction.
    b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups, to adequately demonstrate capability of products to comply with performance requirements.
    d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
2. Testing Agency Responsibilities: Submit a 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.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and description of types of testing and inspecting they are engaged to perform.
2. Notify Project Inspector and testing agencies, at least two (2) working days in advance of time when Work that requires testing or inspecting will be performed.
3. Costs for retesting and reinspecting 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: 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.

1. 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.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify Project Inspector and testing agencies, at least two (2) working days or as indicated otherwise in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, as two paper copies or in PDF electronic form, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report as two hard copies or in PDF electronic form directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Service: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing and submit as hard copies or in PDF electronic form 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 preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activites, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting:

1. Where quality-control services are Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaces or is necessitated by Work that failed to comply with the Contract Documents.
2. Where quality-control services are Owner's responsibility, costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, by way of a deductive Change Order.

F. Testing Agency Responsibilities: Cooperate with Architect Inspector, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, Inspector and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in writing or PDF electronic form, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

G. Associated 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. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.

7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities. Provide timely notice of the Work's readiness for all required tests and inspections.

I. Schedule of Tests and Inspections: 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.

1. Distribution: Distribute schedule to Owner, Architect, Inspector, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency/Special Inspector to conduct special tests and inspections as required by authorities having jurisdiction as the responsibility of Owner, as indicated in DSA Structural Tests and Inspections sheet (DSA Form 103-1at end of this Section, and in individual Specification Sections. Performance of Special Testing and Inspection will include the following:

1. Verification that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notification of Architect, Inspector, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submittal of certified written report of each test, inspection, and similar quality-control service to Architect, Inspector, with copy to Contractor and to authorities having jurisdiction.
4. Submittal of final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpretation of tests and inspections, stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting of corrected work.

1.11 PROJECT INSPECTOR

A. Owner will engage a qualified Inspector acceptable to Architect, and authorities having jurisdiction. Primary duty of the Inspector is to inspect the Work for compliance with the Contract Documents.

1. The duties of the Inspector are defined in Title 24, Part 1, Chapter 4.

2. The Inspector will report to the Owner and Architect.

B. Provide free access to all parts of the Work at all times, so as to allow continuous observation by the Inspector. Presence of the Inspector does not relieve the Contractor in any way from requirement to comply with the Contract Documents.

C. Notify Inspector at least two (2) working days in advance of time when work that requires inspecting will be performed.

D. Provide reasonable facilities for Inspector's use in performing inspection duties, as specified in Section 01 50 00 "Temporary Facilities and Controls."

E. Inspector will alert Owner, Contractor, and Architect in the event of noncompliance with the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or Special Inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's and Inspector's reference.

3.2 REPAIR AND PROTECTION

A. General: 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 43 00

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Sections include:

1. Section 01 10 00 ”Summary of Work” for limitations on utility interruptions and other work restrictions.
2. Section 01 33 00 ”Submittal Procedures” for procedures for submitting copies of implementation and termination schedule and utility reports.
3. Section 01 70 00 ”Field Engineering and Execution Requirements” for progress cleaning requirements.
4. Divisions 2 through 49 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.3 REFERENCES

A. National Fire Protection Association (NFPA):

1. NFPA 10: Standard for Portable Fire Extinguishers.
2. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.

1.4 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.5 USE CHARGES

A. General: Installation and 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, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water-service use charges for water used by all entities for construction operations.

[or]

D. Water Service: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

E. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

[or]

F. Electric Power Service: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.6 ACTION SUBMITTALS

A. Shop Drawing: Project Identification Sign. Show dimensions, graphics, and layout.

1.7 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, enclosures, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo 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.

E. Dust- and HVAC-Control Plan: 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:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

1.8 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.9 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Installer of each permanent service shall 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.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pavement: Hot-laid, hot-mix asphalt plant mixes designed according to Caltrans Standard Specifications Section 39 requirements for Type B asphalt concrete

B. Chain-Link Fencing: Minimum 2-inch, 0.148-inch (9 gage), galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8 inch OD top rail. Provide concrete or galvanized steel bases for supporting posts.

C. Lumber and Plywood:

1. Lumber: Douglas fir-larch, No. 2.
2. Plywood: ½-inch C-D with exterior glue.

D. Steel Studs and Track: ASTM C 645, 0.0209 (25 gage) thickness.

E. Gypsum Board: Minimum ½ inch thick by 48 inches wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36.

1. Provide 5/8 inch thick Type X where temporary partitions are required to be fire-rated.

F. 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.

G. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

H. Paint: Suitable for intended use, as recommended in writing by paint manufacturer.

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, ***[Construction Manager,]*** construction personnel office activities and to acoommodate Project meetings specified in other Division 1 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 120V AC duplex receptacles, with not less than one receptacle on each wall. Furnish room with conference table, chairs, and four-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 at desk height.

C. Project Inspector's Field Office: Provide heated and air-conditioned space of sufficient size to accommodate needs of Project Inspector. Project Inspector's field office space may be combined with Contractor's common-use field office. Furnish and equip as follows:

1. Desk and chair.
2. Layout table.
3. File cabinet.
4. Plan rack with capacity to hold 12 sets of plans.
5. Bookshelf.
6. Wastebasket.

D. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. 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 according to NFPA 10.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

2. 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.

3. 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, and clean HVAC system as required in Section 01 77 00 “Closeout Procedures.”

C. 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.

D. First Aid Supplies: In compliance with governing regulations.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance.

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.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

2. If temporary service is not available, provide mobile or portable solutions, adequate to meet expected demand.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to private system indicated as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

[or]

D. Water Service: Use of or connection to Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

1. Where installation below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.

E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use by construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities. Provide fully stocked supply of toilet tissue, paper towels, and other disposable materials as needed for sanitary facilities.

1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

F. 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.

G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
    a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
    b. 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.
2. 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.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

H. Ventilation and Humidity Control: 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.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

I. Electric Power Service: Use of Owner's existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to Owner.

[or]

J. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead unless otherwise indicated.
2. Connect temporary service to Owner's existing power source, as directed by Owner.

K. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

L. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install ***[one]*** telephone line for each field office.

1. In addition to telephone lines specified above, provide telephone lines for the following:
    a. Provide a dedicated telephone line for each facsimile machine and each computer.
2. At each telephone, post a list of important telephone numbers.
    a. Police and fire departments.
    b. Ambulance service.
    c. Contractor's home office.
    d. Contractor's emergency after-hours telephone number.
    e. Architect's office.
    f. Engineer's offices.
    g. Owner's office.
    h. Principal subcontractors' field and home offices.
3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

M. Electronic Communication Service: Provide a desktop computer in the primary field office, adequate for use by Architect, Inspector, ***[Construction Manager,]*** and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:

1. Processor: Intel Pentium D or Intel CoreDuo, 3.0 GHz processing speed.
2. Memory: 4 gigabyte.
3. Disk Storage: 300 gigabyte hard-disk drive and combination DVD-RW/CD-RW drive.
4. Display: 22-inch LCD monitor with 256-Mb dedicated video RAM.
5. Full-size keyboard and mouse.
6. Network Connectivity: 10/100BaseT Ethernet.
7. Operating System: Microsoft Windows XP Professional or Microsoft Windows Vista Business.
8. Productivity Software:
    a. Microsoft Office Professional, XP or higher, including Word, Excel, and Outlook.
    b. Adobe Reader 7.0 or higher.
    c. WinZip 7.0 or higher.
9. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
10. Internet Service: Broadband modem, router and ISP, equipped with hardwall firewall, providing minimum 384 Kbps upload and 1 Mbps download speeds at each computer.
11. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
12. Backup: External hard drive, minimum 40 gigabyte, with automated backup software providing daily backups.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until near 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 Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: ***[Provide temporary] [Use designated areas of Owner's existing]*** parking areas for construction personnel.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

F. Project Identification and Temporary Signs: Provide Project identification and other signs. Engage an experienced sign company to produce project signs. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.

1. Provide Project identification signs as indicated on Drawings.

[or]

2. Provide minimum dimension ***[6'-0" wide by 3'-0" high]*** sign containing Architect's firm name and related information, with minimum 3 different colors. Install in visible location as approved by Architect.
    a. Architect will provide actual sign dimensions and graphic layout and content prior to sign fabrication.
3. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
    a. Provide temporary, directional signs for construction personnel and visitors.
4. Maintain and touchup signs so they are legible at all times.
5. Conform with all applicable regulations of local authorities.

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 requirements of Section 01 70 00 "Field Engineering and Execution Requirements" for progress cleaning requirements.

1. Comply with requirements specified in Section 01 74 19 "Construction Waste Management" for recycling of construction waste.

H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. 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] [Refer to Division 14 Sections for temporary use of new elevators and lifts]***.

J. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.

1. Do not load elevators beyond their rated weight capacity.
2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

L. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If, despite such protection, stairs become damaged, restore damaged areas so no evidence remains fo correction work.

M. 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.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: 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.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction to comply with environmental regulations and minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 01 11 00 "Summary of Work."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to ***[erosion- and sedimentation-control Drawings] [requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent]***.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with 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: Comply with requirements specified in Section 01 56 39 ”Tree Protection and Trimming.”

[or]

F. Tree and Plant Protection: 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.

G. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring or 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. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

H. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

I. Security Enclosure and Lockup: Install substantial 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.
1. Provide secure lockup for stored materials and equipment which are of value or attractive for theft.

J. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

K. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

L. Covered Walkway: Erect structurally adequate, protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.

1. Construct covered walkways using scaffold or shoring framing.
2. Provide wood-plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
3. Extend back wall beyond the structure to complete enclosure fence.
4. Paint and maintain appearance of walkway for duration of the Work.

M. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

N. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner ***[and tenants]*** from fumes and noise.

1. Construct dustproof partitions with lumber ***[steel studs]*** and gypsum wallboard with joints taped on occupied side, and fire-retardant plywood on construction operations side.

[or]

2. Construct dustproof partitions with two layers of polyethylene sheet on each side. Cover floor with two layers of polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant plywood.
    a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
4. Insulate partitions to provide noise protection to occupied areas.
5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
6. Protect air-handling equipment.
7. Provide walk-off mats at each entrance through temporary partition.

O. Temporary Fire Protection: 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.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and fire-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.
4. 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.
5. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
6. Store combustible materials in containers in fire-safe locations.
7. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: 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:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonable clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.

4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. 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 Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
b. 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.
c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: 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: Maintain facilities in good operating condition until removal.
1. 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. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination and Removal: Remove each temporary facility when need for 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.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project Identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent consruction. 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.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 ”Closeout Procedures.”

END OF SECTION 01 50 00

SECTION 01 56 39

TEMPORARY TREE AND PLANT PROTECTION

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 general protection and pruning of existing trees and plants that are affected by, execution of the Work, whether temporary or permanent construction.

B. Related Sections include:

1. Section 01 50 00 “Temporary Facilities and Protection” for temporary site fencing.
2. Section 31 10 00 “Site Clearing” for removal of existing trees, shrubs, and other plantings, where indicated.

1.3 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI A300: Tree Care Operations – Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices.

B. ASTM International (American Society for Testing and Materials):

1. ASTM F 567: Standard Practice for Installation of Chain-Link Fence.

C. International Society of Arboriculture (ISA).

1.4 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at 6 inches above the ground for trees up to, and including, 4-inch size at this height, and as measured at a height of 12 inches above the ground for trees larger than 4-inch size.

B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated, and indicated on Drawings.

D. Tree Damage: Any bruising, scarring, tearing, or breaking of roots, branches, or trunk.

E. Drip Line: Outermost limits of tree canopy.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.5 PREINSTALLATION MEETING

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:

a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.

b. Arborist's responsibilities.

c. Quality-control program.

d. Coordination of Work and equipment movement with the locations of protection zones.

e. Trenching by hand or with air spade within protection zones.

f. Field quality control.

1.6 ACTION SUBMITTALS

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

B. Shop Drawings:

1. Include plans, elevations, sections, and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones.

2. Detail fabrication and assembly of protection-zone fencing and signage.

3. Indicate extent of trenching by hand or with air spade within protection zones.

C. Samples for Verification: For each type of the following:

1. Organic Mulch: 1-pint volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.

2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components.

3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.

D. Tree Pruning Schedule: Written schedule from Arborist detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree.

2. Location on site plan. Include unique identifier for each.

3. Reason for pruning.

4. Description of pruning to be performed.
5. Description of maintenance following pruning.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Arborist and tree service firm.

B. Certification: From Arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From Arborist, for care and protection of trees affected by construction during and after completing the Work.

D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

E. Quality-control program.

1.8 QUALITY ASSURANCE

A. Arborist Qualifications: Certified Arborist as certified by ISA.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.9 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.

6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Soil: Stockpiled soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs.
1. Type: Consisting of one of the following:
a. Ground or shredded bark.
b. Wood and bark chips.
2. Size Range: 3 inches maximum, 1/2 inch minimum.
3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements:
1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch opening, 0.148-inch-diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch O.D. line posts, and 2-7/8-inch O.D. corner and pull posts; with 0.177-inch-diameter top tension wire, and 0.177-inch-diameter bottom tension wire; with wire ties, hog ring ties, and other accessories for a complete fence system.
a. Height: 6 feet.
2. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shaped galvanized-steel posts spaced not more than 8 feet apart.
a. Height: 4 feet.

3. Gates: Single or double swing access gates matching material and appearance of fencing, leaf width as required to allow for maintenance activities within protection zones.

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:

1. Text: TREE PROTECTION ZONE – DO NOT ENTER
2. Lettering: 3-inch high minimum, of color contrasting with background.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. Prepare written report, endorsed by Arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Flag or tie a 1-inch blue-vinyl tape around each tree trunk at 54 inches above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.

1. Apply 4-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.

3.3 TREE- AND PLANT-PROTECTION ZONES

A. General: Do allow construction activity within protection zones unless approved in writing beforehand by Arborist.

1. Maintain protection zones free of weeds and trash.
2. Do not store construction materials, debris, or excavated material inside protection zones. Do not permit vehicles or foot traffic within protection zones; prevent soil compaction over root systems.
3. Do not use trees as support posts, power poles, or anchorage for ropes, guy wires, or similar items.

4. Do not deposit poisonous or otherwise deleterious material on ground within protection zones.
5. Do not alter surface drainage pattern within dripline of trees.
6. Maintain irrigation of existing trees, shrubs, and other vegetation during construction period.

B. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
3. Access Gates: Install as needed to provide necessary access to each protection-zone. Adjust to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

C. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 50 feet on protection-zone fencing, but no fewer than two signs for each protection zone, each facing a different direction.

D. Maintain protection zones free of weeds and trash.

E. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

F. Maintain protection-zone fencing and signage in good condition acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.
1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by Arborist if a root buffer effective against soil compaction is constructed as directed by Arborist. Maintain roof buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Do not excavate within protection zones unless absolutely necessary.

1. Obtain written approval of Arborist prior to excavating within protection zones.

B. Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements of Section 31 20 00 “Earthwork.”

C. Trenching Near Trees: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as specified in “Root Pruning” Article. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

D. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.

E. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. General: Prune roots only where affected by temporary and permanent construction.

1. Obtain written approval of Arborist prior to pruning roots.

B. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Do not paint cut root ends unless recommended by Arborist.
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible according to requirements in Section 31 20 00 “Earthwork.”

C. Root Pruning at Edge of Protection Zone: Prune roots flush with edge of protection zone, by cleanly cutting all roots to the depth of the required excavation.

D. Root Pruning Within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to root systems. If excavating by hand, use narrow-tine spading forks, comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

A. General: Prune branches only where affected by temporary and permanent construction.

B. Prune branches as follows:

1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
3. Pruning Standard: Prune trees according to ANSI A300 (Part 1).

C. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.

D. Cut branches with sharp pruning instruments; do not break or chop.

E. Do not paint or apply sealants to wounds.

F. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

G. Chip removed branches and dispose of off-site.

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

C. Minor Fill Within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.

2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.

3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size and species as those being replaced for each tree that measures more than 4 inches in caliper size.

2. Plant and maintain new trees as directed by Arborist.

C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 2-inch uniform thickness to remain.

D. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closet than 36 inches to tree trunk. Drill 2-inch diameter holes a minimum of 12 inches deep at 24 inches on center. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of off Owner's property.

END OF SECTION 01 56 39

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include:

1. Section 01 25 00 "Substitution Procedures" for requests for substitutions.
2. Section 01 42 00 "Definitions and References" for applicable industry standards for products specified.
3. Section 01 77 00 "Closeout Procedures" for submitting warranties for Contract closeout.
4. Divisions 2 through 49 Sections for specific requirements for warranties on products and installations specified to be warrantied.

1.3 DEFINITIONS

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

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimensions, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified intent.

1.4 ACTION SUBMITTALS

A. Where Specifications include a list of manufacturers and products preceded by the term “Available Manufacturers” or “Available Products,” and an unnamed manufacturer and product is proposed to be incorporated, submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with requirements specified in Part 2 “Comparable Products” Article.
2. Architect’s Action: If necessary, Architect will request additional information or documentation for evaluation within five (5) working days of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within ten (10) working days of receipt of request, or five (5) working days of receipt of additional information or documentation, whichever is later.
    a. Form of Approval: As specified for action submittals in Section 01 33 00 “Submittal Procedures.”
    b. Use products specified if Architect does not issue a decision on use of a comparable product request within time allocated.
3. Where Specifications include a list of manufacturers or products with the term “or equal,” and an unnamed manufacturer and product is proposed to be incorporated, comply with provisions in Section 01 25 00 “Substitution Procedures.”

1.5 QUALITY ASSURANCE

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

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer’s original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

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

C. Storage:

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

1.7 PRODUCT WARRANTIES

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

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

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. Refer to other Sections in Divisions 2 through 49 for specific content requirements and particular requirements for submitting special warranties.

C. Warranty Requirements:

1. Related Damages and Losses: 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. Reinstatement of Warranty: When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall extend and be equal to the original warranty with an equitable adjustment for depreciation.

3. Replacement Cost: 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. Replace or rebuild defective Work regardless of whether Owner has benefited from use of the Work through a portion of its anticipated useful service life.

4. Owner's Recourse: Written warranties made to the 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.

    a. Rejection of Warranties: Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

    b. 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 part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

D. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

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

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

4. Where products are accompanied by the term "as selected," Architect will make selection.

5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.

6. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

7. Equal Products: For products specified by name and accompanied by the term "or equal," comply with requirements in Section 01 25 00 "Substitution Procedures." Standard submittals procedure is not an acceptable means of obtaining approval of proposed product substitutions.

B. Product Selection Procedures: For each of the following methods of product selection used in other Division 2 through 49 Sections, conform with requirements as indicated.

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

3. Products and Equal Products : Where Specifications include a list of names of both manufacturers and products followed by the statement or item "Equal product," provide one of the products listed that complies with requirements, or comply with provisions in Section 01 25 00 "Substitution Procedures" for consideration of an unnamed product.

4. Manufacturers and Manufacturers of Equal Products: Where Specifications include a list of manufacturer's names, provide a product by one of the manufacturers listed that complies with requirements, or comply with provisions in Section 01 25 00 "Substitution Procedures" for consideration of an unnamed manufacturer.

5. Available Products: Where Specifications include a list of names of both products and manufacturers, preceded by the statement, "products that may be incorporated into the Work include, but are not limited to the following," provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.

6. Available Manufacturers: Where Specifications include a list of manufacturers, preceded by the statement, "manufacturers offering products that may be incorporated into the Work include, but are not limited to the following," provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.

C. Visual Matching Specification: Where Specifications require "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase “as selected from manufacturer’s colors, patterns, textures” or a similar phrase, select a product that complies with other specified requirements.

1. Standard Range: Where Specifications include the phrase “as selected from manufacturer’s standard range” or similar phrase, Architect will select color, gloss, pattern, density, or texture from manufacturer’s product line that does not include premium items.
2. Full Range: Where Specifications include the phrase “as selected from full range of colors, patterns, textures” or similar phrase, Architect will select color, gloss, pattern, density, or texture from manufacturer’s product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions: Architect will consider Contractor’s request for comparable product 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:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 70 00

FIELD ENGINEERING AND EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Multiple-Prime Contracts: Requirements of this Section apply to each Prime Contractor.
   1. The term “Contractor” as used in this Section, applies to each Prime Contractor.

C. Related Sections include:
   1. Section 01 11 00 “Summary of Work” for limits on use of Project site.
   2. Section 01 31 00 ”Project Management and Coordination” for procedures for coordinating field engineering with other construction activities.
   3. Section 01 33 00 ”Submittal Procedures” for submitting surveys.
   4. Section 01 73 29 ”Cutting and Patching” for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
   5. Section 01 77 00 ”Closeout Procedures” for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 REFERENCES

A. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.

1.4 DEFINITIONS

A. Portable Document Format (PDF): 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.

1.5 INFORMATIONAL SUBMITTALS

A. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.6 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Manufacturer's Installation Instruction: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS (Not Used)

PART 3 - PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

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

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a Request For Information to Architect in accordance with Section 01 31 00 “Project Management and Coordination.” Include a detailed description of problem encountered, together with recommendations for modifications, if needed.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project sit.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points, without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements, and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official “property survey.”

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches (8’-0”) in occupied spaces, and 90 inches (7’-6”) in unoccupied spaces.

B. Comply with manufacturer’s written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction forces.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements of NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    a. Use containers intended for holding waste materials of type to be stored.
4. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

B. Site: Maintain Project site free of waste materials and debris.
    1. Dust Control: Palliate dust conditions throughout duration of Project for entire area of work and surrounding site by watering and sprinkling as required to allay dust.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of Work.
    1. Remove liquid spills promptly.
    2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."
    1. Comply with requirements specified in Section 01 74 19 "Construction Waste Management" for recycling of construction waste.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 43 00 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 70 00

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include:

1. Section 02 41 19 “Selective Demolition” for demolition of selected portions of the building.
2. Divisions 2 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other Work.

1.4 INFORMATIONAL SUBMITTALS

A. Cutting and Patching Plan: Submit plan describing procedures at least fifteen (15) working days prior to the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building’s appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work,.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time services and systems will be disrupted.

a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.

7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

A. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection. Structural elements include but are not limited to:

1. Foundation construction.
2. Bearing and retaining walls.
3. Structural concrete.
4. Structural steel.
5. Wood framing.
6. Stair systems.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

1. Primary operational systems and equipment.
2. Fire separation assemblies.
3. Air or smoke barriers.
4. Fire-suppression systems.
5. Mechanical systems piping and ducts.
6. Control systems.
7. Communication systems.
8. Fire-detection and alarm systems.
9. Conveying systems.
10. Electrical wiring systems.
11. Operating systems of special construction.

C. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased

maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtainwall construction.
4. Sprayed fire-resistive material.
5. Equipment supports.
6. Piping, ductwork, vessels, and equipment.
7. Noise- and vibration-control elements and systems.

D. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

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

1.6 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 CUTTING AND PATCHING

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

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

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 11 00 “Summary of Work.”

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer’s written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

1. Thoroughly clean piping, conduit, ductwork, and similar features before paint or other finishes are applied.

END OF SECTION 01 73 29

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include:
   1. Section 02 41 19 “Selective Demolition” for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
   2. Section 31 10 00 ”Site Clearing” for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 REFERENCES

A. ASTM International (American Society for Testing and Materials):
   1. ASTM E 1609: Standard Guide for Development and Implementation of a Pollution Prevention Plan.

1.4 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. EPA: Environmental Protection Agency.

E. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

F. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

G. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

H. USGBC: United States Green Building Council.

1.5 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous 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, including the following:

1. Demolition Waste:
    a. Asphaltic concrete paving.
    b. Concrete.
    c. Concrete reinforcing steel.
    d. Brick.
    e. Concrete masonry units.
    f. Plumbing fixtures.
    g. Piping.
2. Construction Waste:
    a. Site-clearing waste.
    b. Brick and concrete masonry.
    c. Lumber.
    d. Wood sheet materials.
    e. Piping.
    f. Electrical conduit.
    g. Packaging: Regardless of salvage/recycle goal indicated in paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
        i) Paper.
        ii) Cardboard.
        iii) Boxes.
        iv) Plastic sheet and film.
        v) Polystyrene packaging.
        vi) Wood crates.
        vii) Plastic pails.

1.6 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within ten (10) working days of date established for the Notice to Proceed.

1.7 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. 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.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. 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.

F. 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.

1.8 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination" for project management and coordination. Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.

4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.9 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements of this Section. 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. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
1. 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.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: 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 from Section 01 50 00 “Temporary Facilities and Controls.”

B. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 01 50 00 “Temporary Facilities and Controls” for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. 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.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. 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.

C. Procedures: 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.

1. 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.
    a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphaltic Concrete Paving: Grind asphalt to a maximum 1-1/2-inch size.
    1. Crush asphaltic concrete paving and screen to comply with requirements in Section 31 20 00 "Earthwork" for use as fill material or base course material.

B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
    1. Pulverize concrete to maximum 4-inch size.
    2. Crush concrete and screen to comply with requirements in Section 31 20 00 "Earthwork" for use as fill material or base coarse material.

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

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

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

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:
    1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
    2. Polystyrene Packaging: Separate and bag materials.
    3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.

4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Site-Clearing Wastes: Chip brush, branches, and trees at landfill facility.

C. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

3.6 DISPOSAL OF WASTE

A. General: 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 on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Warranties.
   4. Final cleaning.
   5. Repair of the Work.

B. Related Sections include:
   1. Section 01 29 00 “Payment Procedures” for requirements for Applications for Payment for Substantial and Final Completion.
   2. Section 01 32 33 “Photographic Documentation” for submitting Final Completion construction photographic documentation.
   3. Section 01 78 39 “Project Record Documents” for submitting Record Drawings, Record Specifications, and Record Product Data.
   4. Divisions 2 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 DEFINITIONS

A. Portable Document Format (PDF): 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.

1.4 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor’s List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.5 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punchlist), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of ten (10) working days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 1 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record documentation.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of ten (10) working days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
4. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
5. Compete final cleaning requirements, including touchup painting.
6. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of ten (10) working 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 (punchlist), that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
    a. Architect will not perform reinspection until assurance can be provided that incomplete items have been completed.
        i) Compensation for Architect's time in performing more than one reinspection will be deducted from Contract Sum by Change Order.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
    1. Submit a final Application for Payment according to Section 01 29 00 "Payment Procedures."
        a. Include all outstanding Change Orders, if applicable.
    2. Certified List of Incomplete Items: Submit a certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punchlist), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
    3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
    4. Submit pest-control final inspection report.
    5. Submit DSA Form DSA-6, Final Verified Report, fully executed and signed by Contractor, indicating 100% completion.
    6. Submit testing and inspection reports for those tests and inspections designated as responsibility of Contractor.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of ten (10) working days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
    1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
        a. Architect will not perform reinspection until assurance can be provided that incomplete items have been completed.
            i) Compensation for Architect's time in performing more than one reinspection will be deducted from Contract Sum by Change Order.

1.8 LIST OF INCOMPLETE ITEMS

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

1. Organize list of spaces in sequential order, starting with exterior areas first, and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.
4. Submit a list incomplete items in the following format:
    a. PDF electronic file via email.
    b. Paper copies, if requested by Architect.
        i) Number of Copies: three (3).

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-inch by 11-inch size paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: 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.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project.
    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, or rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. 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.
    f. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator in compliance with requirements of Section 01 50 00 "Temporary Facilities and Controls," to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. Comply with safety standards for cleaning. Remove waste materials for Project site and dispose of lawfully.

E. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 74 19 “Construction Waste Management and Disposal.”

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
    a. Do not paint over “UL” or other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out lamps/bulbs, lamps/bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 77 00

WARRANTY

TO: [Recipient Name]
[Address]

WARRANTY for _____

We hereby warrant and the Contractor guarantees that

the _____

_____
{Specify work performed, or installation of material, product or equipment provided}

which we have installed in the **Bessie Owens Jr. High Modular Classroom Buildings 118934** project has been done in accordance with the drawings and specifications and approved modifications thereto, and that the work as installed will fulfill the requirements of the Contract Documents. We agree to repair or replace any or all of our work, together with any other adjacent work which may be displaced by so doing, that may prove to be defective in its workmanship or materials within a period of ONE (1) year from the date of acceptance of the above named structure by the Owner, without any expense whatsoever to the said Owner, ordinary wear and tear and unusual abuse or neglect excepted.

In the event of our failure to comply with the above mentioned conditions within sixty (60) days after being notified in writing by the Owner, we collectively and separately do hereby authorize the Owner to proceed to have said defects repaired and corrected at our expense and we will honor and pay the costs and charges therefore upon demand.

The date of filing the Notice of Completion will be considered the date of acceptance for the guaranty period as defined in the contract documents.

SUBCONTRACTOR (type or print)	CONTRACTOR (type or print)
SUBCONTRACTOR'S SIGNATURE	CONTRACTOR'S SIGNATURE
	DATED

Warranty.doc

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

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

B. Related Sections include:
   1. Section 01 33 00 ”Submittal Procedures” for submitting copies of submittals for operation and maintenance manuals.
   2. Section 01 91 13 01810”General Commissioning Requirements” for verification and compilation of data into operation and maintenance manuals.
   3. Divisions 2 through 49 Sections for specific operation and maintenance manual requirements for the Work of those Sections.

1.3 REFERENCES

A. American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE):
   1. ASHRAE Guideline 4: Preparation of Operating and Maintenance Documentation for Building Systems.

1.4 DEFINITIONS

A. Portable Document Format (PDF): 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. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

C. Subsystem: A portion of a system with characteristics similar to a system.

1.5 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed 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 operations and maintenance submittals are acceptable.

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

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

1. PDF electronic file: Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.

b. Enable inserted reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least ***[20]*** working days before commencing demonstration and training. Architect will comment on whether scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form with corrections and revisions addressing Architect's comments prior to requesting inspection for Substantial Completion and at least ***[10]*** working days before commencing demonstration and training.

E. Submit Operation and Maintenance Documentation Directory.

1.6 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location jto facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.

2. List of systems.

3. List of equipment.

4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. 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.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

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.”

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

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

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

B. Title Page: Include the following information:

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

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

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

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of 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.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch 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 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. Indicate volume number for multiple-volume sets.
2. 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.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-inch by 11-inch white bond paper.
5. Drawings: 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.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. 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.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.

2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
1. Product name and model number. Use designations for systems and equipment indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

A. 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.

B. 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.

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

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

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

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Material and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. 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 warranty and bond information, as described below.

B. 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 drawings or schedule designation or identifier where applicable.

C. Manufacturer's Maintenance Documentation: Manufacturer's maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures.
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: 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.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturer's forms for recording maintenance.

F. Spare Parts and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturer's maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. 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.

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

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturer's Data: Where manuals contain manufacturer's standard printed data, 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 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.

1. Prepare supplementary text if manufacturer's standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: 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.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Section 01 78 39 "Project Record Documents."

G. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

B. Related Sections include:
   1. Section 01 70 00 “Field Engineering and Execution Requirements” for final property survey.
   2. Section 01 77 00 “Closeout Procedures” for general closeout procedures.
   3. Divisions 2 through 49 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 DEFINITIONS

A. Portable Document Format (PDF): 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.

1.4 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Submit one paper copy set of marked-up record Drawing prints, including addenda and contract modifications.
      a. Print each drawing, whether or not changes and additional information were recorded.
   2. Submit PDF electronic files of scanned record Drawing prints.

B. Record Specifications: Comply with the following:
   1. Submit one paper copy of marked-up record Specifications, including addenda and contract modifications.

2. Submit PDF electronic files of scanned record specifications.

C. Record Product Data: Comply with the following:
   1. Submit one paper copy of marked-up record Product Data, including addenda and contract modifications.
   2. Submit PDF electronic files of scanned record Product Data.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities.
   1. Submit one paper copy with scanned PDF electronic file.
   2. Submit PDF electronic files of scanned miscellaneous record submittals.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross-reference record prints to corresponding archive photographic documentation.
   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Depths of foundations below first floor.
      d. Locations and depths of underground utilities.
         i) Indicate sizes and invert elevations of piping below grade or floor line
         ii) Indicate sizes of conduit below grade or floor line.
         iii) Indicate exact locations and sizes of plugged wyes, tees, caps, and manholes.

iv) Indicate locations of valves, pull boxes, and pull boxes.

e. Revisions to routing of piping and conduits.

f. Revisions to electrical circuitry.

g. Actual equipment locations.

h. Duct size and routing.

i. Locations of concealed internal utilities.

j. Changes made by Architect's Supplemental Instruction, Change Order, Construction Change Directive, Request for Information, or other written directive from Architect. Note corresponding reference numbers for each item.

k. Details not on the original Contract Drawings.

l. Field records for variable and concealed conditions.

m. Record information on the Work that is shown only schematically.

3. Indicate location and layout of items by measured dimension to building corners or other permanent features.

4. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings. Use personnel proficient at recording graphic information in production of marked-up record prints.

5. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

6. Mark important additional information that was either shown schematically or omitted from original Drawings.

7. Identification and Dating: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

   a. Record Prints: Organize Record Prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

   b. Identification: As follows:

      i) Project name.

      ii) Date.

      iii) Designation "PROJECT RECORD DRAWINGS."

      iv) Name of Architect.

      v) Name of Contractor.

8. Format: Submit record Drawings in both paper format and scanned PDF electronic format, as specified in Part 1 "Closeout Submittals" Article.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Project Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Indicate changes made by Architect's Supplemental Instruction, Change Order, Construction Change Directive, Request for Information, or other written directive from Architect. Note corresponding reference numbers for each item
6. Format: Submit record Specifications in both paper format and scanned PDF electronic format, as specified in Part 1 "Closeout Submittals" Article.

2.3 RECORD PRODUCT DATA

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

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Indicate changes made by Architect's Supplemental Instruction, Change Order, Construction Change Directive, Request for Information, or other written directive from Architect. Note corresponding reference numbers for each item

B. Format: Submit record Product Data in both paper format and scanned PDF electronic format, as specified in Part 1 "Closeout Submittals" Article.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other 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.

B. Format: Submit miscellaneous record submittals in both paper format and scanned PDF electronic format, as specified in Part 1 "Closeout Submittals" Article.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and modifications to project record documents as they occur; do not wait until the 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 purposes. 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.

1. Record documents are to be maintained continuously in a state of completion reflecting current progress of completed Work at all times. Applications for Payment as specified in Section 01 29 00 "Payment Procedures," will not be processed until Project Inspector has verified record documents are fully updated.

END OF SECTION 01 78 39

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

B. Related Sections include:

1. Section 01 31 00 "Project Management and Coordination" for requirements for preinstruction conferences.
2. Divisions 2 through 49 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 INFORMATIONAL SUBMITTALS

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

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

B. Qualification Data: For instructor/facilitator.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit one copy within 5 working days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:
    a. Name of Project.
    b. Name and address of videographer.
    c. Name of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Date of video recording.
2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for Owner's use, prepared and bound in format matching operation and maintenance manuals.
    a. In addition to bound paper copy, prepare scanned PDF electronic file on compact disc.

1.5 QUALITY ASSURANCE

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

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 43 00 "Quality Assurance," experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructor's personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.

4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

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

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

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCT

2.1 INSTRUCTION PROGRAM

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

1. Fire-protection systems, including fire alarm, fire pumps, and fire-extinguishing systems.
2. Intrusion detection systems.
3. Access-control systems.
4. Electrical service and distribution, including transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
5. Lighting equipment and controls.
6. Communication systems, including intercommunication, surveillance, clocks and programming, voice and data, and audiovisual equipment.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following, as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.

f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project Record Documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.

d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning.
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual organized in coordination with requirements in Section 01 78 23 ”Operation and Maintenance Data.”

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner’s personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish Contractor with names and positions of participants.
      a. Owner’s participants will describe Owner’s operational philosophy.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least 10 working days advance notice

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration or oral performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.

1. Electronic Media: Read-only format compact disc acceptable to Owner, woth commercial-grade graphic label.
2. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following:
    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. Email address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.
    a. Produce segments to present a single significant piece of equipment per segment.
    b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.

c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

F. Transcript: Provide a transcript of the narration. Display images and running time captured from video recording opposite the corresponding narration segment.

G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 01 79 00

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes:
   1. Demolition and removal of selected portions of existing buildings or structures.
   2. Demolition and removal of selected existing site elements.
   3. Salvaging existing items for reinstallation or delivery to Owner.

B. Related Sections include:
   1. Division 1 Section for temporary construction, protection facilities, and environmental-protection measures for selective demolition operations.
   2. Division 1 Section for temporary protection of existing trees and plants that are affected by selective demolition.
   3. Division 1 Section for cutting and patching procedures.
   4. Division 1 Section for construction waste management and administrative and procedural requirements for salvaging and recycling of demolition waste.
   5. Division 1 Section for photographic documentation of existing buildings and sitework prior to selective demolition.
   6. Section 02 41 16 “Building Demolition” for demolition of entire buildings and structures.
   7. Section 31 10 00 “Site Clearing” for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.3 REFERENCES

A. American National Standards Institute (ANSI)/American Society of Safety Engineers (ASSE):
   1. ANSI/ASSE A10.6: Safety Requirements for Demolition Operations.

B. Cal/OSHA Standards - California Code of Regulations, Title 8, Chapter 4, Division of Industrial Safety.

C. Code of Federal Regulations (CFR):
   1. 40 CFR, Part 82: Protection of Stratospheric Ozone.

D. EPA: United States Environmental Protection Agency.

E. National Fire Protection Association (NFPA):
   1. NFPA 51B: Standard for Fire Prevention During Welding, Cutting, and Other Hot Work.
   2. NFPA 241: Standard for Safeguarding Construction, Alteration, and Demolition Operations.

F. Resilient Floor Covering Institute (RFCI):
   1. Recommended Work Practices for Removal of Resilient Floor Coverings.

1.4 DEFINITIONS

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

B. Remove and Salvage: Detach items from existing construction in a manner to prevent damage, and deliver to Owner.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are to be undisturbed and left in place.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.5 MATERIALS OWNERSHIP

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.

1.6 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

1.7 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.
   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review structural load limitations of existing structures.

3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review and finalize protection requirements for areas of existing construction to remain.
6. Review procedures for noise control and dust control.
7. Review procedures for protection of adjacent buildings.
8. Review items to be salvaged and returned to Owner.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Engineering Survey: Submit engineering survey of condition of building.

C. Proposed Protection Measures: 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.

D. Schedule of Selective Demolition Activities: Indicate the following:
1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Coordinate to avoid interruptions to Owner's on-site operations.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Shutoff and capping, and continuation of utility services.
4. Locations of temporary protection of means of egress, including for other tenants affected by selective demolition operations, if applicable.
5. Coordination of Owner's continuing occupancy of portions of existing buildings and of Owner's partial occupancy of completed Work.

E. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective demolition operations. Comply with Division 1 Section for photographic documentation. Submit prior to beginning Work.

F. Record drawings of removed, relocated, or abandoned utilities in accordance Division 1 Section for project closeout requirements.
1. Locate and dimension work with reference to permanent landmarks. Indicate materials and sizes of all components.

G. 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.

H. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.9 CLOSEOUT SUBMITTALS

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

1.10 QUALITY ASSURANCE

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

1.11 FIELD CONDITIONS

A. Owner will occupy portions of the building immediately adjacent to selective demolition areas. Conduct selective demolition so Owner's operations will not be disrupted.

1. Provide not less than 10 working days' notice to Owner of activities that will affect Owner's operations.
2. Maintain access to existing walkways, exits, and other adjacent occupied or used facilities.

B. Owner assumes no responsibility for buildings and structures to be demolished.

1. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as far as practical. Minor variations may occur as a result of Owner's salvaging operations prior to start of selective demolition work.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. It is not expected that hazardous materials will be encountered in the Work.

1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.

F. On-site storage or sale of removed items or materials is not permitted.

G. Utility Service: Maintain existing utilities serving building and protect them against damage during selective demolition operations, unless indicated otherwise.

1. Do not interrupt fire-protection service during selective demolition operations.

1.12 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

B. Review Project Record Documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are the same as those indicated in Project Record Documents.

C. Determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations. If required, engage a professional engineer to perform an engineering survey of condition of building.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

F. Survey of Existing Conditions: Record by use of preconstruction photographs or video, existing conditions that might be misconstrued as damage caused by demolition operations. Comply with requirements of Division 1 Section for photographic documentation.

1. Inventory and record the condition of items to be removed and salvaged.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Utilities to be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
   2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
   3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
      a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
      b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
      c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
      d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
      e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
      f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
      g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.
   4. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.

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

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Protect site improvements and landscaping to remain.
6. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate fumes and noise from selective demolition areas from occupied adjacent portions of building. Comply with Division 1 requirements for temporary facilities.

B. Temporary Shoring: Design, provide and maintain shoring, bracing, or structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Do not damage portions of existing construction indicated to remain. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

4. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
    a. Remove below-grade construction, including basements, foundation walls, and footings, completely.
5. If using cutting torches, comply with applicable requirements of Cal/OSHA Standards (California Code of Regulations, Title 8), Chapter 4 - Division of Industrial Safety, Subchapter 7 – General Industry Safety Orders, Article 88 Fire Prevention in Welding and Cutting Operations, and NFPA 51B.
    a. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
    b. Maintain fire watch during and for at least 1 hour after flame-cutting operations.
    c. Maintain adequate ventilation when using cutting torch
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Equipment: Disconnect equipment indicated to be removed at nearest fitting connection to services, complete with service valves. Remove as whole units, complete with controls.
8. Remove debris from elevated portions by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
    a. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Concrete and Asphalt Paving: Cleanly saw-cut in straight lines, perimeter of area to be removed, then break up and remove portion indicated.
    a. At utility trenches occurring in existing paved areas to remain, remove portion occurring over width of trench.
    b. At concrete paving, use existing joints to define area of removal, unless indicated otherwise.
11. Dispose of demolished items and materials promptly. Comply with requirements in Division 1 Section for construction waste management and disposal.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:
1. Items to be removed and salvaged are indicated on Drawings.
2. Comply with the following:

a. Clean salvaged items of dirt and demolition debris.

b. Remove premanufactured building components as whole units, intact and undamaged.

c. Disconnect equipment at nearest fitting connection to services, complete with service valves. Remove as whole unit, complete with controls.

d. Pack or crate items after cleaning. Identify contents of containers.

e. Store items in a secure area until delivery to Owner.

f. Transport items to storage area designated by Owner.

g. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.

2. Pack or crate items after cleaning and repairing. Identify contents of container.

3. Protect items from damage during transport and storage.

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

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."

E. Structural Steel: Dismantle field connections without bending or damaging steel members.

F. Roofing: Remove not more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. Refer to Division 7 Section for new roofing requirements.

1. Remove existing roof membrane, flashings, copings, and roof accessories.

2. Remove existing roof system down to substrate.

3.7 REPAIRS

A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.

B. Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

C. Restore landscaping plants to condition matching existing appearance prior to start of selective demolition work.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction. Refer to Division 1 Section for construction waste management for additional requirements for salvaging and recycling demolition waste materials.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.9 CLEANING

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

END OF SECTION 02 41 19

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. It is understood that the finish material of the floors in this project are the concrete slab on grade. Therefore, concrete placement technique, finishing and curing among other items is of the utmost importance to the District for the final product.

C. Related Requirements:

1. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: fly ash: materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. 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, forms and form removal limitations, vapor-retarder installation,

anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

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

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

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

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

E. Samples: For vapor retarder.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

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

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Curing compounds – Not Allowed.
7. Floor and slab treatments.
8. Bonding agents.
9. Adhesives.
10. Vapor retarders.
11. Joint-filler strips.
12. Repair materials.

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

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

D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

E. Field quality-control reports.

F. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. 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."

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

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

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

1. Build panel approximately 200 sq. ft. for slab-on-grade in the location indicated or, if not indicated, as directed by Architect in the field.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures. Trial batches are not the responsibility of the District.

1.9 DELIVERY, STORAGE, AND HANDLING

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

1.10 FIELD CONDITIONS

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

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

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

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

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

1. ACI 301.
2. ACI 117.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. 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.

3. Overlaid Finnish birch plywood.

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

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

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

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

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

1. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.

2.3 STEEL REINFORCEMENT

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

B. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.

C. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut 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.

2.5 CONCRETE MATERIALS

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

B. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, Type II/V, gray.
2. Fly Ash: ASTM C 618, Class F.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

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

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
7. Shrinkage Reducing Admixture: ASTM C157

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

2.6 FIBER REINFORCEMENT

A. Synthetic Micro-Fiber: Monofilament polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1 to 2-1/4 inches long.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following
   a. BASF Corporation; Admixture Systems.
   b. Euclid Chemical Company (The); an RPM company.
   c. FORTA Corporation.
   d. GCP Applied Technologies Inc. (formerly Grace Construction Products).
   e. Nycon, Inc.
   f. Propex Operating Company, LLC.

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following
   a. Barrier-Bac; Inteplast Group, Ltd.
   b. Fortifiber Building Systems Group.
   c. GCP Applied Technologies Inc. (formerly Grace Construction Products).
   d. Insulation Solutions, Inc.
   e. Poly-America, L.P.
   f. Raven Industries, Inc.
   g. Reef Industries, Inc.
   h. Stego Industries, LLC.
   i. Tex-Trude, Inc.

2.8 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   a. 102 V-Seal Concrete Sealers, LLC.
   b. AWRC Corporation.
   c. BASF Corporation; Admixture Systems.
   d. ChemMasters, Inc.
   e. ChemTec Int'l.
   f. Concrete Sealers USA.
   g. Curecrete Distribution Inc.
   h. Dayton Superior.
   i. Euclid Chemical Company (The); an RPM company.
   j. Kaufman Products, Inc.
   k. L&M Construction Chemicals, Inc.
   l. Metalcrete Industries.
   m. Moxie International.
   n. NewLook International, Inc.
   o. Nox-Crete Products Group.
   p. PROSOCO, Inc.
   q. SpecChem, LLC.
   r. US SPEC, Division of US MIX Company.
   s. Vexcon Chemicals Inc.

2.9 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

2.10 RELATED MATERIALS

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

B. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.11 REPAIR MATERIALS

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

1. Cement Binder: ASTM C 150/C 150M, 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 or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 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 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, 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 or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.12 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.

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

D. Aggregate combined grading shall be well graded.

E. 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 Shrinkage Reducing admixture in concrete slabs on grade and concrete walls.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Normal-weight concrete.

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

B. Lean Concrete: Normal-weight concrete.

1. Minimum four (4) sack concrete mix.
2. Maximum W/C Ratio: 0.45.
3. Slump Limit: 5 inches, plus or minus 1 inch.

C. Foundation Walls & Retaining Walls: Normal-weight concrete.

1. Minimum Compressive Strength: 3000 psi at 28 days.

2. Maximum W/C Ratio: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

D. Site Work and Slabs-on-Grade: Normal-weight concrete.

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Minimum Cementitious Materials Content: 520 lb/cu. yd..
4. Slump Limit: 4 inches, plus or minus 1 inch.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 1.5 lb/cu. yd..

2.14 FABRICATING REINFORCEMENT

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

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

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

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

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

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

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch for rough-formed finished surfaces.

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

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

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

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

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

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

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

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

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

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

3.2 EMBEDDED ITEM INSTALLATION

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

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of walls and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 36 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

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

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

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

3.4 VAPOR-RETARDER INSTALLATION

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

1. Lap joints 12 inches and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting 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 reduce bond to concrete.

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

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

E. 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.

3.6 JOINTS

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

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by 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 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 as indicated. 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.
7. Use epoxy-bonding adhesive 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. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: 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.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by 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 is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

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.

3.8 FINISHING FORMED SURFACES

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

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

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

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

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

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 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 matches 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 1 part portland cement and 1 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 matches 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.

3.9 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 in one direction.

1. Apply scratch finish to surfaces indicated.

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.

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.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    a. 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.
3. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated. While concrete is still plastic, slightly scarify surface with a fine broom.

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

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, 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.

3.10 MISCELLANEOUS CONCRETE ITEM INSTALLATION

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

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

3.11 CONCRETE PROTECTING AND CURING

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

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

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

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

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

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
3. Curing Compound: Not Allowed.
4. Curing and Sealing Compound: Not Allowed.

3.12 LIQUID FLOOR TREATMENT APPLICATION

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

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 28 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.

3.13 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 three month(s). Do not fill joints until construction traffic has permanently ceased.

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

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

3.14 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 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

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

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by 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 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 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 or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to 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.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 50 cu. yd. or fraction thereof of each concrete mixture placed each day.
    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete;one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C 31/C 31M.
    a. Cast and laboratory cure two sets of three standard cylinder specimens for each composite sample.
    b. Cast and field cure two sets of three standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C 39/C 39M;
    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. Test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

3.16 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 03 30 53

MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes:

1. Cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes, for noncritical applications of concrete and for projects using small quantities of concrete.

B. Related Sections include:

1. Section 02 41 19 “Selective Demolition” for saw cutting and removal of existing concrete slabs.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M 182: Specification for Burlap Cloth Made from Jute or Kenaf.

B. American Concrete Institute (ACI):

1. ACI 117: Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301: Specification for Structural Concrete.
3. ACI 302.1R: Guide for Concrete Floor and Slab Construction.
4. ACI 306.1: Specification for Cold Weather Concreting.

C. ASTM International (American Society for Testing and Materials):

1. ASTM A 82: Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A 185: Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
3. ASTM A 497: Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
4. ASTM A 615: Specification Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
5. ASTM C 31: Practice for Making and Curing Concrete Test Specimens in the Field.
6. ASTM C 33: Specification for Concrete Aggregates.

7. ASTM C 39: Test Method for Compressive Strength of Cylindrical Concrete Specimens.
8. ASTM C 94: Specification for Ready-Mixed Concrete.
9. ASTM C 143: Test Method for Slump of Hydraulic Cement Concrete.
10. ASTM C 150: Specification for Portland Cement.
11. ASTM C 171: Specification for Sheet Materials for Curing Concrete.
12. ASTM C 172: Practice for Sampling Freshly Mixed Concrete.
13. ASTM C 231: Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
14. ASTM C 260: Specification for Air-Entraining Admixture for Concrete.
15. ASTM C 309: Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
16. ASTM C 494: Specification for Chemical Admixtures for Concrete.
17. ASTM C 881: Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
18. ASTM C 1017: Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
19. ASTM C 1064: Test Method for Temperature of Freshly Mixed Portland Cement Concrete.
20. ASTM C 1077: Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
21. ASTM C 1116: Specification for Fiber-Reinforced Concrete and Shotcrete.
22. ASTM C 1315: Specification for Liquid Membrane-Forming Compounds having Special Properties for Curing and Sealing Concrete.
23. ASTM D 1751: Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
24. ASTM D 1752: Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
25. ASTM E 329: Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
26. ASTM E 548: Guide for General Criteria Used in Evaluating Laboratory Competence.

D. Concrete Reinforcing Steel Institute (CRSI):
   1. Manual of Standard Practice.

1.4 SUBMITTALS

A. General: In addition to the following, comply with submittal requirements in ACI 301.

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

C. Design Mixtures: For each concrete mixture.

D. Qualification Data: For testing agency.

E. Concrete Batch Plant Tickets: Load identification tickets for each load of concrete delivered to site. Batch ticket shall bear the following information:

1. Design mix number.
2. Signature or initials of concrete plant representative.
3. Time of batching.
4. Weight of cement, aggregates, water and admixtures in each batch with maximum aggregate size.
5. Total volume of concrete in each batch.
6. Notation indicating equipment was checked for contamination prior to batching.

1.5 QUALITY ASSURANCE

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

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

1. 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.

C. Testing and Inspection: Field quality control testing and inspection will be conducted by Owner's testing agency under terms outlined in General and Supplementary Conditions. Material and installed work may require testing and retesting, as directed by Architect and/or State authorities having jurisdiction, at any time during progress of the Work. Allow free access to material stockpiles and facilities.

D. Source Limitations: Obtain each type of cement 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. Comply with ACI 301, "Specification for Structural Concrete," including the following sections, unless modified by requirements in the Contract Documents.

1. "General Requirements."
2. "Formwork and Formwork Accessories."
3. "Reinforcement and Reinforcement Supports."

4. “Concrete Mixtures.”
5. “Handling, Placing, and Constructing.”

F. Comply with ACI 117, “Specifications for Tolerances for Concrete Construction and Materials.”

G. 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 100 sq ft for slab-on-grade and 25 sq ft for formed surface in 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.

PART 2 - PRODUCTS

2.1 FORMWORK

A. Furnish formwork and formwork accessories according to ACI 301.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

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

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

D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

E. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout Project.
1. Portland Cement: ASTM C 150, Type I or II.

B. Normal-Weight Aggregate: ASTM C 33, graded, 1-1/2-inch nominal maximum aggregate size.

C. Water: ASTM C 94; potable.

D. Synthetic Fiber: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.

2.4 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

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

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.5 RELATED MATERIALS

A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

B. Epoxy Bonding Adhesive: ASTM C 881, Type I, II, IV, and V, Grade 2, Class B and C; two-component epoxy resin, capable of humid curing and bonding to damp surfaces.

1. Available Products: Subject to compliance with requirements, provide one of the following:
    a. Conspec Marketing & Manufacturing Company, Inc.; Spec-Bond 150.
    b. Degussa Building Systems; Concresive 1420.
    c. Edoco Burke; BurkEpoxy MV.
    d. W.R. Meadows, Inc.; Rezi-Weld 1000.
    e. Equal product in accordance with Division 1 requirements for product substitutions.

2.6 CURING MATERIALS

A. Evaporation Retarder; Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz/sq yd when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type I, Class A.

2.7 CONCRETE MIXTURES

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. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:

1. Minimum Compressive Strength: 3500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: Maintain within range permitted by ACI 301. Do not allow air content of floor slabs to receive troweled finishes to exceed 3 percent.

C. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate but not less than a rate of 1.0 lb/cu yd.

2.8 CONCRETE MIXING

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

1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.2 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 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.
2. Install dovetail anchor slots in concrete structures as indicated.

3.3 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.4 JOINTS

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

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

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 with groover tool to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

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

D. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise directed.

3.5 CONCRETE PLACEMENT

A. Comply with ACI 301 for measuring, batching, mixing, transporting, and placing concrete.

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

C. Consolidate concrete with mechanical vibrating equipment.

3.6 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding 1/2 inch.

1. Apply to concrete 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 defective areas. Remove fins and other projections exceeding 1/8 inch.

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

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

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

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 1-1/2 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.

3.7 FINISHING FLOORS AND SLABS

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

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.

1. Do not further disturb surfaces before starting finishing operations.

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

1. Apply scratch finish to surfaces indicated and surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terazzo, and other bonded cementitious floor finishes, unless otherwise indicated.

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

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

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

1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or other type of thin-film finish coating system.

F. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set methods. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

G. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.8 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.

3.9 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 with ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq ft x height 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. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
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.
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.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections, and prepare test reports.

1. Notify Owner's testing agency at least two working days prior to date when observation and testing services are needed.

B. Inspections:

1. Steel reinforcement placing.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain at least one composite sample for each 100 cu yds or fraction thereof of each concrete mix placed each day.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
   4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
   5. Compression Test Specimens: ASTM C 31; cast and field cure one set of three standard cylinder specimens for each composite sample.
   6. Compressive-Strength Tests: ASTM C 39; test one specimen at seven days and two specimens at 28 days.
      a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Correct deficiencies in the Work that test reports and inspections indicate do not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Concrete Batch Plant Tickets: Submit to Project Inspector, load identification tickets for each load of concrete delivered to site. Refer to Part 1 "Submittals" Article for required information for batch tickets.

3.11 REPAIRS

A. Remove and replace concrete that does not comply with requirements in this Section.

END OF SECTION 03 30 53

SECTION 06 41 00

ARCHITECTURAL WOOD CABINETS

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:
   1. Wood-veneer-faced architectural cabinets.
   2. Shop-finishing of wood-veneer-faced cabinets with transparent finish.
   3. Wood furring, blocking, shims, and hanging strips for installing architectural wood cabinets unless concealed within other construction before cabinet installation.

B. Related Sections include:
   1. Section 06 10 00 “Rough Carpentry” for concealed wood blocking and hanging strips in wood stud-framed walls for anchoring cabinets.
   2. Division 22 Sections for plumbing fixtures installed in cabinets.

1.3 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI A208.1: Particleboard.
   2. ANSI A208.2: Medium Density Fiberboard (MDF) for Interior Applications.
   3. ANSI Z124.3: Plastic Lavatories.

B. American National Standards Institute (ANSI)/International Cast Polymer Association (ICPA):
   1. ANSI/ICPA SS-1: Performance Standard for Solid Surface Materials.

C. Architectural Woodwork Manufacturer’s Association of Canada/Woodwork Institute (AWMAC/WI):
   1. North American Architectural Woodwork Standards 3.1.

D. ASTM International:
   1. ASTM 36: Standard Specification for Carbon Structural Steel.
   2. ASTM C97: Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
   3. ASTM C170: Standard Test Method for Compressive Strength of Dimension Stone.

4. ASTM C241: Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic.
5. ASTM C482: Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement.
6. ASTM C484: Standard Test Method for Thermal Shock Resistance of Glazed Ceramic Tile.
7. ASTM C531: Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
8. ASTM C648: Standard Test Method for Breaking Strength of Ceramic Tile.
9. ASTM C650: Standard Test Method for Resistance of Ceramic Tile to Chemical Substances.
10. ASTM C880: Standard Test Method for Flexural Strength of Dimension Stone.
11. ASTM C 920: Standard Specification for Elastomeric Joint Sealants.
12. ASTM C1028: Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dyanamometer Pull-Meter Method.
13. ASTM C1048: Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
14. ASTM D523: Standard Test Method for Specular Gloss.
15. ASTM D570: Standard Test Method for Water Absorption of Plastics.
16. ASTM D635: Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
17. ASTM D638: Standard Test Methods for Tensile Properties of Plastics.
18. ASTM D695: Standard Test Method for Compressive Properties of Rigid Plastics.
19. ASTM D785: Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.
20. ASTM D790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
21. ASTM D792: Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
22. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.

E. Builders Hardware Manufacturers Association (BHMA):
1. BHMA A156.9: Cabinet Hardware.
2. BHMA A156.18: Materials and Finishes.

F. California Air Resources Board:
1. Airborne Toxic Control Measure to Reduce Formaldehyde Emissions From Composite Wood Products.
2. Suggested Control Measure for Architectural Coatings.

G. California Building Code (CBC) – California Code of Regulations, Title 24, Part 2.

H. California Code of Regulations – Title 17 - Public Health.

I. California Department of Public Health (CDPH):
   1. Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1, February 2010.

J. California Green Building Standards Code (CALGreen) – California Code of Regulations, Title 24, Part 11.

K. Code of Federal Regulations (CFR):
   1. 21 CFR, Chapter 1, Part 177, Section 177.2600: Substances for Use Only as Components of Articles Intended for Repeated Use.

L. European Standards (EN):
   1. EN 15804: Sustainability of Construction Works – Environmental Product Declarations – Core Rules for the Product Category of Construction Products.

M. Food and Drug Administration (FDA).

N. Forest Stewardship Council (FSC):
   1. FSC STD-01-001: FSC Principles and Criteria for Forest Stewardship.
   2. FSC STD-40-004: FSC Standard for Chain of Custody Certification.

O. Hardwood Plywood & Veneer Association (HPVA):
   1. HPVA HP-1: Hardwood and Decorative Plywood.

P. Glass Association of North America (GANA):
   1. Glazing Manual.

Q. International Organization for Standardization (ISO):
   1. ISO 14021: Environmental Labels and Declarations – Self-Declared Environmental Claims (Type II Environmental Labeling).
   2. ISO 14025: Environmental Labels and Declarations – Type III Environmental Declarations – Principals and Procedures.
   3. ISO 14040: Environmental Management – Life Cycle Assessment – Principals and Framework.
   4. ISO 14044: Environmental Management – Life Cycle Assessment – Requirements and Guidelines.
   5. ISO 21930: Sustainability in Building Construction – Environmental Declaration of Building Products.

R. International Solid Surface Fabricators Association (ISSFA):
   1. ISSFA-2: Classification and Standards Publication of Solid Surfacing Material.

S. Laminating Materials Association (LMA):

1. LMA EDG-1: Voluntary Product Standard and Typical Physical Properties of Edgebanding Materials.

T. National Electrical Manufacturers Association (NEMA):
1. NEMA LD-3: High-Pressure Decorative Laminates.

U. South Coast Air Quality Management District (SCAQMD):
1. Rule 1113 – Architectural Coatings.
2. Rule 1168 – Adhesive and Sealant Applications.

V. UL Environment:
1. GREENGUARD Gold certification program.

W. Woodwork Institute (WI):
1. Certified Compliance Program.

1.4 DEFINITIONS

A. Composite Wood Product: Manufactured product using derivative wood materials such as strands, chips, particles, or fibers bonded together with a resin binder to form a rigid panel. Composite wood products include medium density fiberboard, particleboard, and hardboard.

B. DSA: Division of the State Architect.

C. Plastic-Laminate: High-pressure decorative laminate.

D. PVC: Polyvinyl chloride.

E. VOC: Volatile organic compound.

1.5 COORDINATION

A. Coordinate sizes and locations of concealed framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that architectural wood cabinets can support loads imposed by installed and fully loaded cabinets.

B. Coordinate locations of utilities that will penetrate countertops or splashes.

C. Coordinate design and fabrication of cabinets to receive and support the following built-in items specified in other Sections. Verify dimensions and weights of all items and locations of all utility connection points and anchorages and indicate on Shop Drawings.
1. Plumbing fixtures specified in Plumbing Drawings.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including:
1. Composite wood products.

2. Cabinet hardware and accessories.
3. High-pressure decorative laminate.
4. Low-pressure decorative laminate.
5. PVC edgebanding material.
6. Sealant.
7. Adhesives for bonding plastic-laminates and wood veneers.
8. Finishing materials and processes.

B. Shop Drawings: Submit shop drawings in conformance with AWI/AWMAC/WI Architectural Woodwork Standards 3.1, Section 1, showing location of each item, dimensioned plans and elevations, large-scale construction details, attachment devices, and other components. Shop drawings shall be reviewed by an independent WI Inspector (not the millwork contractor) and bear the WI Certified Compliance Program label, affixed to the first page of each set of the shop drawings.
   1. Show details full size.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking/backing and reinforcement specified in other Sections.
   3. Show countertop materials, finishes, edge, backsplash, and endsplash profiles, methods of joining, and cutouts for plumbing fixtures and other items occurring in countertop or splash.
      a. Show locations and details of joints.
      b. Show directional pattern, if any.
      c. For acrylic solid-surfacing material, indicate seams.
         i) Indicate orientation of directional pattern of each sheet of material.
         ii) Indicate cross-sectional detail of each seam.
      d. For quartz-based manufactured stone material, indicate seams.
         i) Indicate orientation of directional pattern of each sheet of material.
   4. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, appliances, electrical switches and receptacles, and other items installed in architectural wood cabinets.
   5. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
   6. Include keying schedule with schematic keying diagram indexing each key set to cabinet doors and drawers.

C. Samples for Initial Selection: Manufacturer's full range of colors and patterns for the following, for selection by Architect:
   1. Shop-applied transparent finishes, applied to sample representative of flitches to be used for transparent finish cabinets.
      a. Minimum Number of Colors for Selection: 20.
   2. High-pressure decorative laminate.
      a. Minimum Number of Colors for Selection: 20.

3. PVC edgebanding.
    a. Minimum Number of Colors for Selection: As required to match color of adjacent plastic-laminate facing.
4. Low-pressure decorative laminate.
    a. Minimum Number of Colors for Selection: 2.

D. Samples for Verification:
1. Wood-veneer-faced panel products with transparent finish, 8 inches by 10 inches for each species, cut, and finish. Each sample to be representative of and selected from flitches to be used for wood-veneer-faced cabinets. Include at least one seam between veneer leaves, and one finished edge.
2. High-pressure decorative laminate-clad panel products, 4 inches by 6 inches for each type, color, pattern, and surface finish, with corresponding PVC edgebanding applied to one edge.
3. Low-pressure decorative laminate-surfaced panel products, 4 inches by 6 inches for each type, color, pattern, and surface finish.
4. Cabinet hardware and accessories, one unit for each type and finish.

E. CALGreen Submittals:
1. Manufacturer's product data for adhesives, sealants, and transparent wood finishes indicating compliance with product requirements specified in "CALGreen Requirements" Article.
2. Manufacturer's product data for composite wood products indicating compliance with product requirements specified in "CALGreen Requirements" Article.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator. Demonstrate capabilities and experience.
1. Include list of completed projects with project names, addresses, and names of Owners and Architects.

1.8 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: WI Certified Compliance Program certificates, as specified in "Quality Assurance" Article.

B. Maintenance Data: For acrylic solid-surfacing to include in maintenance manuals. Include manufacturer's written cleaning instructions.

1.9 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of products.

C. Quality Standard: Comply with the AWMAC/WI North American Architectural Woodwork Standards 3.1, for grades of architectural wood cabinets and countertops indicated for construction, finishes, installation, and other requirements.

1. WI Quality Marking: Mark each unit of the following types of architectural wood cabinets and countertops with WI Certified Compliance Label on an unexposed surface, indicating compliance with specified quality grade.
    a. Cabinets.
    b. Acrylic solid-surfacing countertops, splashes.
2. WI Certificate of Compliance: Before delivery to the jobsite, obtain from WI, a Certified Compliance Certificate for materials and workmanship certifying that cabinet products fully meet requirements of the grades specified.
    a. Upon completion of installation, obtain from WI, a Certified Compliance Certificate, certifying that installation is in compliance with specified AWMAC/WI requirements.
3. The Contract Documents may contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.
4. If, for any reason, a reinspection is requested of Work required to be manufactured in accordance with the Architectural Woodwork Standards, and for which a fee is charged, said fee (if millwork is found to be non-conforming in any manner) shall be the responsibility of the Contractor and subsequently deducted from the contract price in form of a deductive change order.

D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials, fabrication, and execution.

1. Build mockups of typical architectural wood base cabinet, countertop, and upper cabinet as shown on Drawings
2. Cabinet sample shall have removable countertop; one drawer; door with one adjustable shelf, toe space/base, complete with hardware as specified.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect cabinets and countertops during transit, delivery, storage, and handling to prevent damage.

B. Do not deliver cabinets until painting and similar operations that could damage cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in “Field Conditions” Article.

C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work in space is complete and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

1. Comply with cabinet fabricator and Installer's recommendations for optimum temperature and humidity conditions for cabinets during storage and installation. Maintain recommended conditions through remainder of construction period.

B. Field Measurements: Where cabinets and countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

2. Verify dimensions of countertops by field measurements after base cabinets are installed, but before countertop fabrication is complete.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Single-Source Manufacturing and Installation Responsibility: Engage a qualified woodworking firm to assume undivided responsibility for production of architectural wood cabinets specified in this Section, including fabrication, and installation and finishing.

1. Engage woodworking firm to assume undivided responsibility for production of wood veneer-faced cabinets with sequence-matched wood veneers] [of same wood species with transparent finish.

a. For wood paneling, refer to Section 06 40 23 "Interior Architectural Woodwork."

b. For wood doors, refer to Section 08 14 16 "Flush Wood Doors."

2.2 CALGREEN REQUIREMENTS

A. General: Conform with all applicable requirements of the California Green Building Standards Code (CALGreen).

B. Provide adhesives and sealants which comply with current VOC content limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168, except as noted otherwise below. Such products shall also comply with Rule 1168 prohibition of the use of certain toxic compounds (chloroform, ethylene, dichloride, methylene chloride, perchloroethylene, and trichloroethyelen).

1. Aerosol adhesives and similar unit sizes of adhesives, and sealants (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC

standards and other requirements, including prohibitions of use of certain toxic compounds, of the California Code of Regulations, Title 17, commencing with Section 94507.

C. Transparent Finishes: Provide transparent finishes that comply with VOC limits in Table 1 of the California Air Resources Board (ARB) Architectural Coatings Suggested Control Measure, unless more stringent local limits apply.

D. Composite Wood Products: Provide architectural wood cabinets and, where applicable, countertops, manufactured from composite wood products which meet requirements of California Air Resources Board "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions From Composite Wood Products" for formaldehyde resin emission limits (in ppm) for composite wood products and as specified below:

1. Particleboard: 0.09.
2. Medium Density Fiberboard: 0.11.

2.3 PERFORMANCE REQUIREMENTS

A. Design wall-hung and -anchored cabinets, storage shelving and connections with sufficient strength to resist stresses imposed by design loads as follows:

1. Vertical Design Loads: Per 2016 California Building Code, Table 1607A.1, Item 36, Minimum Uniformly Distributed Live Loads and Minimum Concentrated Live Loads.
2. Seismic Loads: Earthquake motions determined according to requirements of the California Building Code and Seismic Design Category specific to project.
3. Adjustable Shelf Loading: Provide ***[40] [50]*** lbs/sq ft load bearing capacity, as per AWMAC/WI North American Architectural Woodwork Standards – 3.1, Section 10 (maximum deflection: L/144).

2.4 WOOD-VENEER-FACED CABINETS FOR TRANSPARENT FINISH

A. Quality Standard: Comply with applicable requirements of AWMAC/WI North American Architectural Woodwork Standards 3.1, Section 10 "Casework."

1. Grade: Premium.
2. Where Contract Documents indicate requirements beyond those of specified quality standard, comply with those requirements in addition to the quality standard.

B. AWMAC/WI Construction Style: Frameless.

C. AWMAC/WI Cabinet/Door Interface Style: Flush Overlay.

1. At cabinet doors, exposed-knuckle hinges shall be let (notched) into door edge as required to maintain consistent gap width between adjacent cabinet door panels.

D. Door and Drawer Front Profile: Square edge.

E. Finish by Surface Category (as defined in AWI/AWMAC/WI standard):

1. Exposed Outer Surfaces:
    a. Wood Veneer Species: Select White Maple.
        i) Cut: Plain sliced.
    b. Grain Direction: Run and match grain vertically for drawer fronts, doors, and fixed panels.
    c. Matching of Veneer Leaves: Book.
    d. Veneer Matching Within Panel Face: Running match.
2. Exposed Inner Surfaces (includes open shelving without doors, surfaces around and behind open shelving without doors, behind glass doors, backside of doors, edges of doors and drawers, and underside of exposed shelving): Same species, cut, finish, and grain direction of veneer indicated for exposed exterior surfaces.
3. Semi-exposed surfaces: Low-pressure decorative laminate.
    a. Color: White.
4. Concealed Backs of Panels with Exposed or Semi-Exposed Surfaces: As required by referenced quality standard.

F. Edge Treatment: Veneer edgebanding, matching wood veneer species and cut at face of panel.

2.5 ACRYLIC SOLID-SURFACING COUNTERTOPS

A. Quality Standard: Comply with applicable requirements of AWMAC/WI North American Architectural Woodwork Standards 3.1, Section 11, “Countertops.”
1. Grade: Premium.
2. Where Contract Documents indicate requirements beyond those of specified quality standard, comply with those requirements in addition to the quality standard.

B. Material: Acrylic solid-surfacing material.
1. Provide sheets of acrylic solid-surfacing material from the same production run.

C. Acrylic Solid-Surfacing Material Thickness: 1/2 inch.

D. Fabricate tops in one piece, unless dimensions of counter exceed maximum available dimensions of acrylic solid-surfacing material, in which case, indicate proposed seam locations on Shop Drawings for Architect’s review. Comply with acrylic solid-surfacing material manufacturer’s written recommendations and requirements of referenced quality standard for adhesives, sealers, fabrication, and finishing.
1. Fabricate tops with edges of dimensions and configurations indicated.
2. Fabricate tops with shop-applied splashes, as indicated.
    a. Splash Height: 6 inches.
    b. Splash Profile: Square top, unless indicated otherwise.

E. Install integral sinks in countertops in shop.

1. Sink Dimensions: As indicated on Drawings.

F. Drill holes in countertops for plumbing fittings and other penetrations in shop.

G. Where end of countertop terminates at a wall, provide end splash.

H. Where end of cabinet is exposed (e.g. does not abut a wall), round off front corner of countertop to 3/4 inch radius.

I. Colors/Patterns: As specified in Section 09 06 00 ”Colors and Finishes.”

2.6 CABINET AND COUNTERTOP MATERIALS

A. General: Provide materials that comply with requirements of the AWMAC/WI quality standard for each type of cabinet and quality grade specified, unless otherwise indicated. Modifications of AWMAC/WI standards contained herein, and on the Drawings, shall govern and take precedence over AWMAC/WI grade rules.

B. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
2. Wood Moisture Content: 5 to 10 percent.
3. Certified Wood: Complies with requirements specified in “LEED v4 Requirements” Article.

C. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural wood cabinet and quality grade specified unless otherwise indicated.

1. Medium Density Fiberboard: ANSI A208.2, Grade 130.
   a. Recycled Content:
      i) Preconsumer: 92 percent minimum.
   b. Environmental Product Declaration: Provide medium density fiberboard with valid Environmental Product Declaration, complying with requirements in “LEED v4 Requirements” Article.
2. Particleboard: ANSI A208.1, Grade M-2.
   a. Recycled Content:
      i) Preconsumer: 92 percent minimum.
3. Veneer-Faced Panel Products: HPVA HP-1.
4. Formaldehyde Emissions:

   Complies with requirements specified in “CALGreen Requirements” Article.

D. Low-Pressure Decorative Laminate: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

E. Edgebanding: PVC, of thickness indicated; complying with LMA EDG-1.

1. Manufacturer: Subject to compliance with requirements, provide edgebanding by the following:
    a. Doellken Woodtape.
2. Color(s): Refer to “Plastic-Laminate-Faced Cabinets” Article for colors.

F. Acrylic Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1 and applicable requirements of AWMAC/WI North American Architectural Woodwork Standards 3.1, Section 11, “Countertops.”

1. Products:: Subject to compliance with requirements, provide one of the following:
    a. E.I. du Pont de Nemours and Company; Corian.
2. Type: Standard type.
3. Integral Sink Bowls: Comply with ISSFA-2 and ANSI Z124.3, Type 5 or Type 6, without a precoated finish.
4. Adhesive: Product recommended by acrylic-solid-surfacing manufacturer.
5. Color(s): Refer to “Acrylic Solid-Surfacing Countertops” Article for colors.

2.7 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural wood cabinets, except for items which are specified in Section 08 71 00 “Door Hardware.”

1. Hardware Finishes: Where BHMA finish designations are referenced, provide finish that complies with BHMA A156.18.
    a. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
    b. Satin Stainless-Steel: BHMA 630.

B. Hinges: BHMA A156.9, Grade 1; 2-3/4-inch, 5-knuckle wrap-around type; offset for overlay doors; from .095 inch steel; hospital tips; 270 degree swing; finish: BHMA 652 (satin chromium).

1. Product: Rockford Process Control, Inc.; #374.

C. Drawer Slides for Other Than File Drawers: BHMA A156.9, Grade 1; 150 lb per pair load rating; full-extension; steel ball bearings; progressive movement; rail mount/disconnect; finish: clear zinc.

1. Product: Accuride; #4032.

D. Drawer Slides for File Drawers up to 42 inches wide: BHMA A156.9, Grade 1HD-200; 200 lb per pair load rating; 1-inch overtravel; finish: clear zinc.

1. Product: Accuride; #3640.

E. Pencil Drawer Slides: 45 lb loading capacity; 3/4 extension; for use in shallow drawers underneath tabletops/countertops without supporting sidewall surface; steel ball bearings; friction disconnect; finish: clear zinc.

1. Product: Accuride; #2006.

F. Keyboard Tray Slides: 75 lb loading capacity; 3/4 extension; variable height brackets; for use in supporting keyboard trays underneath tabletops/countertops; steel ball bearings; lever disconnect; finish: clear zinc.

1. Product: Accuride; #2109.

G. Drawer and Door Pulls: Back mounted, solid metal wire pull; 4 inches center-to center, 7/8-inch clearance, 5/16 inch in diameter; finish: BHMA 630 (satin stainless steel).

1. Trimco/Builders Brass Works; #562-4.

H. Door Catches: Magnetic catch, adjustable; self-aligning; pull strength, 5 lbs; finish: aluminum.

1. Door Catches: Ives; #325.

I. Elbow Catches: Designed for use on inactive leaf of pair of locking cabinet doors; finish: BHMA 626.

1. Product: Ives; #2.

J. Adjustable Shelf Supports: Steel with pins for 5 mm diameter drilled holes; provide top pin for shelves occurring 5 feet or higher above floor; finish: satin nickel plated.

1. Product:
    a. Shelves less than 5 feet above floor: Hafele; #282-24-710.
    b. Shelves 5 feet or higher above floor: Hafele; #282-24-720.

K. Cable Grommets: Molded plastic, circular shape, 2 inch diameter; two-piece with removable cap with flip-top access slot; color: ***[matte black]***.

1. Product: Doug Mockett & Company; Model #TG3.

L. Label Frames: Steel frame with open top edge to accept label; dimensions: 93 mm wide by 41 mm high; finish: nickel plated.

1. Product: Hafele; #168.02.770.

M. Locks: Pin tumbler type with retractable bolt; provide manufacturer's standard feature allowing replacement of cylinder without removal of lock assembly; keyed alike within each room, keyed different for each room, masterkeyed alike; finish: BHMA 626 (satin chromium).

1. Product:
    a. Doors: CompX National; #C8173.
    b. Drawers: CompX National; #C8179.

N. Sliding Glass Door Hardware: Manufacturer's glass door track assembly; finish: satin anodized for aluminum parts; consisting of the following components:

1. Top Guide Track: Extruded aluminum, 1-3/16 inches wide by 9/16 inches high; double slot.
    a. Product: Epco; #730-A.

2. Clip Guides: Fabricated from plastic; 1-1/8 inches long; designed to fit over top edge of glass panel for facilitating movement within top guide track.
    a. Product: Epco; #771.
3. Shoe Moulding: Extruded aluminum; 7/16 inches wide by 1 inch high; designed to accept 1/4 inch thick glass panel, concealed roller wheels, plunger lock, and pulls.
    a. Rollers: Steel ball bearing rollers for operation over bottom guide track; quantity as required to achieve 1 foot on center maximum spacing along length of shoe moulding.
    b. Glazing Vinyl: Manufacturer's continuous u-shaped vinyl strip for press fitting glass panel into shoe moulding.
    c. Products:
        i) Shoe Moulding: Epco: #743-A.
        ii) Rollers: Epco; #753.
        iii) Glazing Vinyl: Epco; #2021.
4. Bottom Guide Track:
    a. Guide Tracks: Extruded aluminum, for fitting into track base; provide sufficient vertical clearance above side of track base to allow installation of plunger lock in face of shoe moulding.
    b. Track Base: Extruded aluminum, double slot for receiving two guide tracks; height of vertical legs not to interfere with plunger lock and pulls in face of shoe moulding.
    c. Products:
        i) Bottom Guide Track: Epco; #726.
        ii) Bottom Track Base: Epco; #730.
5. Plunger Lock: Keyed lock; designed for installation in face of bottom portion of shoe moulding; one lock per pair of sliding glass doors.
    a. Product: Epco: G06-C.
6. Pulls: Extruded aluminum; 1 inch wide by 2-3/4 inches high; designed for press fitting onto side edge of glass panel; one per glass door.
    a. Product: Epco; #GP15-A.

O. Shelf Standards and Brackets:
1. Standards: Fabricated from 12 gage steel; allows adjustment of bracket position in one-inch increments; length as indicated; flathead screws for countersunk installation in shelf standard, with 2-inch minimum penetration into solid wood framing or full penetration through metal backing; finish: electroplated (anochrome).
2. Brackets: Manufacturer's heavy-duty steel shelf brackets with single molded nylon cam lock lever; finish: electroplated (anochrome).
3. Products:
    a. Standards: Knape & Vogt; #87 ANO.
    b. Brackets: Knape & Vogt; #187LL ANO.

P. Coat Hooks: Double hook; 1-3/16-inches wide by 1-1/16-inches high, with 1-3/32 inches projection; finish: BHMA 626 (satin chromium).

1. Product: Ives; #582.

Q. Wardrobe Tubing:

1. Tube: Round tubing, 1-5/16 inches outside diameter, wall thickness: 0.109-inches; finish: chrome.
2. Brackets: Surface-mounted, one side with full circular profile to receive tubing, one side with open-ended top to allow tubing to be dropped into place; finish: chrome.
3. Products:
    a. Tubing: Knape & Vogt #770 5.
    b. Brackets: Knape &Vogt #764 and #766.

R. Panel Clips: Two-piece hardware to allow removal of panel, consisting of cleat fitting for mounting on back of removable panel, and support bracket for mounting on frame or substrate; fabricated from polycarbonate.

1. Product: Subject to compliance with requirements, provide the following:
    a. Hafele; Keku System.

S. Panel Clips: Two-piece extruded aluminum mounting cleat hardware designed for concealed installation at backside of panel, and allowing for removal of panel.

1. Product: Subject to compliance with requirements, provide products by one of the following:
    a. Brooklyn Hardware, LLC; Panelclip.
    b. Monarch Metal Fabrication; Z Clips.
    c. Equal product in accordance with Division 1 requirements for product substitutions.

2.8 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: As indicated on Drawings, or if not indicated, select material type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, floors, and elsewhere as required for corrosion-resistance. Provide metal expansion sleeves or expansion bolts for post-installed anchors.

C. Adhesives: Type recommended by adhesive manufacturers to suit products and substrate conditions indicated.

1. VOC Content: Complies with requirements specified in “CALGreen Requirements” Article.
2. VOC Emissions: Complies with requirements specified in “LEED v4 Requirements” Article.

D. Joint Sealant: Silicone joint sealant; ASTM C920, Type S (single-component), Grade NS (nonsag), Class 12.5.

1. Color: White.
2. Where being installed in food-handling areas, FDA-approved for direct contact with food.
    a. Comply with 21 CFR 177.2600.
3. Unless precluded by use in food-handling areas, provide mildew-resistant type, where occurs in areas subject to moisture.
4. VOC Content: Complies with requirements specified in “CALGreen Requirements” Article.

E. Metal Fabrications: Steel plate, ASTM A36; thicknesses as indicated; ground all welds smooth; dimensions as indicated.

1. Anchorage Clips: Bent plate.
2. Connection Bracket at End of Sliding Markerboard Tracks: Welded construction.

2.9 FABRICATION

A. Provide cabinets complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate cabinets to dimensions, profiles, and details indicated.

D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

E. Shop-cut openings, to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of cutout openings in countertop subtops and plastic-laminate-faced countertops with a coat of varnish.

F. Acrylic Solid-Surfacing: Fabricate according to acrylic solid-surfacing material manufacturer’s written instructions for fabrication, seaming, and finishing, and with requirements of referenced quality standard.

1. Cutouts and Holes:

a. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

b. Counter-Mounted Plumbing Fixtures and Appliances: Prepare countertops in shop for field cutting openings for counter-mounted fixtures and appliances.

c. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2. Directional Patterns: Fabricate and assemble sheets such that layout of seams, orientation of directional patterns of adjacent sheets, and cross-sectional detail of seams achieves an overall monolithic appearance to greatest extent possible, in accordance with manufacturer's written instructions.

G. Install glass to comply with applicable requirements in Section 08 81 00 "Glass Glazing," and in GANA's "Glazing Manual."

1. For glass in frames, secure glass with removable stops.

2. For exposed glass edges, polish and grind smooth.

2.10 SHOP FINISHING

A. General: Shop-finish transparent finished interior architectural cabinets at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural wood cabinets, as applicable to each unit of Work.

1. Backpriming: Apply one coat of sealer, compatible with finish coats, to concealed surfaces of cabinets.

C. Transparent Finish:.

1. Quality Standard: Comply with requirements of AWMAC/WI North American Architectural Woodwork Standards 3.1, Section 5 "Finishing."

a. Grade: Premium.

b. Finish System: System - 2, System - 3, Lacquer, Postcatalyzed.

c. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D523.

2. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to cabinets made from closed-grain wood before staining and finishing.

3. Staining: None required

4. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.

D. VOC Limits for Transparent Finish:

1. VOC Content: Complies with requirements specified in "CALGreen Requirements" Article.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before installing architectural cabinets and countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

1. Examine substrates to receive acrylic solid-surfacing material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

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

3.2 PREPARATION

A. Before installation, condition cabinets and countertops to average prevailing humidity conditions in installation areas for not less than 72 hours.

3.3 INSTALLATION

A. Quality Standard: Install cabinets and countertops to comply with requirements of AWMAC/WI North American Architectural Woodwork Standards 3.1 and quality grade specified for each type of cabinet and countertop in Part 2 of this Section.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking/backing built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

1. DSA-Approved Anchorages: Install cabinets in accordance with details shown.

D. Install cabinets and countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

1. Scribe and cut cabinets and countertops to fit adjoining work, refinish cut surfaces and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Maintain veneer sequence matching of cabinets with transparent finish.
4. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches on center with No. 12 screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips, or No. 12 sheet metal screws through metal backing or metal framing behind wall finish.

E. Countertops and Splashes: Anchor securely to base cabinets or other supports as indicated.

1. Install countertops and splashes level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to tolerance of 1/8 inch in 96 inches.
2. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
3. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
4. Plastic-Laminate Countertops:
    a. Anchor plastic-laminate countertops by screwing through corner blocks of base cabinets or other supports into underside of countertop.
    b. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
        i) Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
5. **Acrylic Solid-Surfacing** Countertops:
    a. Anchor acrylic solid-surfacing material countertops to base cabinets and subtops using adhesive recommended in writing by manufacturer.
    b. Align adjacent acrylic solid-surfacing material countertops and form seams to comply with manufacturer's written instructions and referenced quality standard using adhesive in color to match countertop. Install metal splines in kerfs at joints, and fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
    c. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned.
    d. Secure backsplashes and endsplashes to walls and countertop with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
    e. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
        i) Seal edges in particleboard or medium-density fiberboard subtops by saturating with varnish.

6. Seal junctures of tops, splashes, and walls with silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.
    a. Where occurring in food preparation area, use sealant approved for use in such areas.
    b. Where occurring in areas subject to moisture but not involving food preparation, use mildew-resistant sealant.

F. Touch up finishing work specified in this Section after installation of cabinets. Fill nail holes with matching filler where exposed.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets and countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets and countertops on exposed and semiexposed surfaces.
    1. Touch up shop-applied finishes to restore damaged or soiled areas.

D. Protection: Provide kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches on center. Remove protection at Substantial Completion.

3.5 COLOR SCHEDULES

A. Acrylic Solid-Surfacing Material: Acrylic solid-surfacing colors are designated on Drawings as follows:
    1. SS-1: ***[Corian, Canvas]***.
        a. Recycled Content: As specified in “Cabinet and Countertop Materials” Article.
    2. SS-2: ***[Corian, Rye]***.
        a. Recycled Content: As specified in “Cabinet and Countertop Materials” Article.

B. Quartz-Based Manufactured Stone Material: Manufactured stone colors are designated on Drawings as follows:
    1. Refer to Section 09 06 00 “Colors and Finishes”.
        a. Recycled Content: As specified in “Cabinet and Countertop Materials” Article.

END OF SECTION 06 41 00

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes joint sealants and backing materials at the following locations:
   1. Exterior - Including, but not limited to:
      a. Joints between adjacent different materials.
      b. Other miscellaneous exterior joints occurring in exterior envelope.

1.3 REFERENCES

A. ASTM International:
   1. ASTM C 794: Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
   2. ASTM C 834: Standard Specification for Latex Sealants.
   3. ASTM C 919: Standard Practice for Use of Sealants in Acoustical Applications.
   4. ASTM C 920: Standard Specification for Elastomeric Joint Sealants.
   5. ASTM C 974: Standard Practice for Preparing Test Specimens from Basic Refractory Castable Products by Casting.
   6. ASTM C 1021: Standard Practice for Laboratories Engaged in Testing of Building Sealants.
   7. ASTM C 1087: Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
   8. ASTM C 1193: Standard Guide for Use of Joint Sealants.
   9. ASTM C 1248: Standard Test Method for Staining of Porous Substrate by Joint Sealants.
   10. ASTM C 1330: Standard Specification for Cylindrical Sealant Backing for Use With Cold Liquid Applied Sealants.
   11. ASTM C 1521: Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
   12. ASTM E 90: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss for Building Partitions and Elements.

B. California Department of Public Health (CDPH):

1. Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1, February 2010.

C. California Green Building Standards Code (CALGreen) – California Code of Regulations, Title 24, Part 11.

D. Code of Federal Regulations (CFR):

1. 21 CFR, Chapter 1, Part 177, Section 177.2600: Substances for Use Only as Components of Articles Intended for Repeated Use.

E. South Coast Air Quality Management District (SCAQMD):

1. Rule 1168 – Adhesive and Sealant Applications.

1.4 DEFINTIONS

A. Interior Sealant: All sealants occurring within the building waterproofing membrane.

B. Exterior Sealant: Sealants occurring outside and inclusive of the primary and secondary weatherproofing system, including building waterproofing membrane and air- and water-resistive barrier materials.

C. VOC: Volatile organic compounds.

1.5 COORDINATION

A. Refer to Section 09 91 00 ”Painting” for Paint Color Schedule where matching sealant colors to paint color of adjacent wall surface.

1.6 ACTION SUBMITTALS

A. Product Data: For each joint sealant product.

1. Include VOC content.

B. Samples for Initial Selection: Manufacturer’s color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view, for selection by Architect.

1. Minimum Number of Colors for Selection:

a. Silicone Sealants: Two.

b. Urethane Sealants: Two.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint Sealant Schedule: Include the following information:

1. Joint sealant application, joint location, and designation.

2. Joint sealant manufacturer and product name.

3. Joint sealant formulation.

4. Joint sealant colors.

E. CALGreen Submittals:

1. Manufacturer's product data for sealants and sealant primers indicating compliance with product requirements specified in "CALGreen Requirements" Article.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports: For each type of joint sealant, for tests performed by a qualified testing agency.

C. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants.

2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

D. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

E. Field-Adhesion Test Reports: For each sealant application tested.

F. Sample Warranties: For special warranties.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved for installation of sealants by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct testing indicated.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers

1.10 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted joint sealant manufacturer.

2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.11 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 2 years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period:
      a. Silicone Sealants: 20 years from date of Substantial Completion.
      b. Urethane Sealants: 5 years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of joint sealants from the following:
   1. Movement of structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 CALGREEN REQUIREMENTS

A. Provide sealants and sealant primers which comply with current VOC content limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168, except as noted otherwise below. Such products shall also comply with Rule 1168 prohibition of the use of certain toxic compounds (chloroform, ethylene, dichloride, methylene chloride, perchloroethylene, and trichloroethyelen).

2.2 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint sealant manufacturer, based on testing and field experience.

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing

ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

C. Colors of Exposed Joint Sealants: As indicated in Joint Sealant Schedule at end of this Section.

2.3 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50 minimum, Use NT (exposure), Use G, A, O (joint substrate).

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Dow Corning Corporation; 795 Silicone Building Sealant.
    b. Momentive Performance Materials, Inc./GE; SCS2000 SilPruf.
    c. Pecora Corporation; 890 FTS.
    d. Equal product in accordance with Division 1 requirements for product substitutions.
2. Colors: As indicated in Joint Sealant Schedule at end of this Section.

B. Nonstaining Single-Component, Nonsag, Neutral-Curing, Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50 minimum, Use NT (exposure), Use M, G, A, O (joint substrate).

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Dow Corning Corporation; 756 SMS Building Sealant.
    b. Momentive Performance Materials, Inc./GE; SCS9000 SilPruf NB.
    c. Pecora Corporation; 890 FTS.
    d. Equal product in accordance with Division 1 requirements for product substitutions.
2. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
3. Colors: As indicated in Joint Sealant Schedule at end of this Section.

C. Nonstaining Multicomponent, Nonsag, Neutral-Curing, Silicone Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, Use NT (exposure), Use M, G, A, O (joint substrate).

1. Products: Subject to compliance with requirements, provide the following:
    a. Tremco Incorporated; Spectrem 4-TS.
    b. Equal product in accordance with Division 1 requirements for product substitutions.
2. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
3. Colors: As indicated in Joint Sealant Schedule at end of this Section.

2.4 URETHANE JOINT SEALANTS

A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 35 minimum, Use NT (exposure), Use M,A, O (joint substrate).

1. Products: Subject to compliance with requirements, provide one of the following:
    a. BASF Building Systems; MasterSeal NP1.
    b. Pecora Corporation; DynaTrol I-XL.
    c. Sika Corporation, Construction Products Division; Sikaflex – 1a.
    d. Tremco Incorporated; Dymonic 100.
    e. Equal product in accordance with Division 1 requirements for product substitutions.
2. Colors: As indicated in Joint Sealant Schedule at end of this Section.

B. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25 minimum, Use NT (exposure), Use M, A, O (joint substrate).

1. Products: Subject to compliance with requirements, provide one of the following:
    a. BASF Building Systems; MasterSeal NP2.
    b. Pecora Corporation; DynaTrol II.
    c. Sika Corporation, Construction Products Division; Sikaflex – 2c NS.
    d. Tremco Incorporated; Dymeric 240 FC.
    e. Equal product in accordance with Division 1 requirements for product substitutions.
2. Colors: As indicated in Joint Sealant Schedule at end of this Section.

C. Multicomponent, Nonsag, Traffic-Grade Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25 minimum, Use T (exposure), Use M, A, O (joint substrate).

1. Products: Subject to compliance with requirements, provide one of the following:
    a. BASF Building Systems; MasterSeal NP2.
    b. Pecora Corporation; DynaTred.
    c. Sika Corporation, Construction Products Division; Sikaflex – 2c NS.
    d. Tremco Incorporated; Dymeric 240 FC.
    e. Equal product in accordance with Division 1 requirements for product substitutions.
2. Colors: As indicated in Joint Sealant Schedule at end of this Section.

2.5 JOINT SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), as approved in writing by joint sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant substrate tests and field tests.

B. 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 to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    a. Metal.

b. Glass.

c. Porcelain enamel.

d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint sealant manufacturer or as indicated by preconstruction joint sealant substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

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

1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 CLEANING

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

3.5 PROTECTION

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

3.6 JOINT SEALANT SCHEDULE

A. Exterior Joint Sealant Schedule:

1. Perimeter Joints Around Door and Window Frames, Storefront and Curtainwall Systems, and Metal Louvers, Occurring Adjacent to Non-Stone Surfaces:
    a. Sealant Type: One of the following:
        i) Single-component nonsag, neutral-curing silicone joint sealant.
        ii) Nonstaining multicomponent nonsag, neutral-curing silicone joint sealant.
    b. Colors: As selected by Architect from manufacturer's full range.
        i) For bidding purposes, assume ***two*** separate colors, in equal quantities for each color.

2. Other Miscellaneous Joints Occurring in Exterior Envelope:
    a. Sealant Type: One of the following:
        i) Single-component nonsag, neutral-curing silicone joint sealant.
        ii) Nonstaining multicomponent nonsag, neutral-curing silicone joint sealant.
    b. Colors: As selected by Architect from manufacturer's full range.
        i) For bidding purposes, assume ***two*** separate colors, in equal quantities for each color.

END OF SECTION 07 92 00

SECTION 09 06 00

COLORS AND FINISHES

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:

1. Color, pattern, and finish selections for products and materials specified in other specification Sections of this Project Manual.

B. Related Sections: Refer to Color/Finish Schedule in Part 3 for other sections specifying materials and products for which color and finish is specified in this Section.

1.3 SUBMITTALS

A. Samples: Submit Samples in accordance with requirements of individual Specification Sections for review of kind, color, pattern, and texture for Architect's review of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: 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.
3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance for construction associated with each set.
    a. Samples that may be incorporated into the Work are indicated in individual specification sections. Such Samples must be in undamaged condition at time of use.
4. Samples for Initial Selection: Where color/finish is indicated as "selected by Architect," submit manufacturer's color charts or samples showing the full range of colors, textures, and patterns available.

5. Samples for Verification: 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.

PART 2 - PRODUCTS

2.1 COLORS AND FINISHES

A. In addition to Color/Finish Schedule in Part 3 of this Section, refer to Drawings and individual Specification Sections for information indicating extent and location of each color and finish designation specified in this Section.

B. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review. Refer to Division 1 requirements for product substitutions.

PART 3 - EXECUTION

3.1 COLOR/FINISH SCHEDULE

A. Refer to following Color/Finish Schedules, to be used in conjunction with referenced Specification Sections, for color/finish selections. Refer to referenced Specification Section for product/material descriptive and performance criteria.

1. Where color/finish is indicated "As selected by Architect," refer to Part 1 "Submittals" Article for requirements for Samples for initial selection.

Section 06 41 00 – Architectural Wood Cabinets		
Designation	Description	Color/Finish
WD-1	Maple Hardwood	1 Coat Sealer; 3 Coats Water Based Lacquer
WD-2	Maple ¾" plywood	1 Coat Sealer; 3 Coats Water Based Lacquer
EB-1	PVC edge banding	Maple
LPL	Low-pressure laminate (melamine)	White
SS-1	Acrylic solid-surfacing material	DuPont Corian Fossil

Color Schedule

Designation	Locations
WD-1	Cabinets Face Frames
WD-2	Cabinet Body
EB-1	Edge banding at PL-1
LPL	Semi-exposed surfaces of cabinets as defined in Section 06 41 00
SS-1	Countertops and splashes at Classrooms

Section 07 42 13 – Metal Wall Panels

Designation	Description	Color/Finish
FMWP-1	Formed metal wall panel	T.B.D.
FMWP-2	Formed metal wall panel	T.B.D.

Color Schedule

Designation	Locations
FMWP-1	Refer to Drawings (Exterior Elevations)
FMWP-2	Refer to Drawings (Exterior Elevations)

Section 07 92 00 – Joint Sealants

Description	Color/Finish
Silicone joint sealants	Refer to Section 07 92 00
Urethane joint sealants	Refer to Section 07 92 00

Section 09 24 00 – Portland Cement Plaster

Designation	Description	Color/Finish
CP-1	Portland cement finish coat	T.B.D.
CP-2	Portland cement finish coat	T.B.D.
CP-3	Portland cement finish coat	T.B.D.

Color Schedule

Designation	Locations
CP-1	Building G
CP-2	Building H
CP-3	Building K

Section 09 51 13 – Suspended Lay-In Panel Ceilings		
Designation	Description	Color/Finish
LCP-1	Lay-in ceiling panel	Armstrong; #1729 Fine Fissured

Section 09 65 13 – Resilient Base and Accessories	
Description	Color/Finish
Resilient base	Burke Black

Section 09 68 13 – Tile Carpeting		
Designation	Description	Color/Finish
TC-1A	Carpet tile	Collins & Aikman/Tandus, Style-Crayon, Color – outside the lines #48005

Color Schedule

Designation	Locations
TC-1A	Refer to Drawings (Finish Schedule)

Section 09 77 21 – Vinyl-Wrapped Panels	
Description	Color/Finish
Vinyl-wrapped panel facing	T.B.D

Section 09 91 00 – Painting		
Designation	Description	Color/Finish
EP-1	Exterior paint color	Dunn Edwards – Color T.B.D.
EP-2	Exterior paint color	Dunn Edwards – Color T.B.D.
EP-3	Exterior paint color	Dunn Edwards – Color T.B.D.

IP-1	Interior paint color	Dunn Edwards – Color T.B.D.
IP-2	Interior paint color	Dunn Edwards – Color T.B.D.
IP-3	Interior paint color	Dunn Edwards – Color T.B.D.

Color Schedule

Designation	Locations
EP-1	Exterior cement plaster walls
EP-2	Exterior pedestrian canopy framing and decking
EP-3	Exterior hollow-metal doors and frames
IP-1	Interior gypsum board walls and ceilings
IP-2	Interior wood doors and hollow-metal frames

Section 10 14 00 – Signage		
Designation	Description	Color/Finish
SGN-1	Polymer Sign	Campus Standard

Color Schedule

Designation	Locations
SGN-1	Classrooms / Electrical Rooms

Section 10 14 19 – Dimensional Character Signage		
Designation	Description	Color/Finish
SGN-1	Building Fascia Signage	Stainless Steel

Color Schedule

Designation	Locations
SGN-1	Canopy Fascia at Building G

Section 10 21 13 – Solid-Plastic Toilet Compartments	
Description	Color/Finish
Solid-plastic toilet compartments and screens	Black Confetti

Section 32 17 26 – Tactile Warning Surfaces	
Description	Color/Finish
Tactile warning surface	Yellow – Federal Standard No. 595B, Color No. 33538

END OF SECTION 09 06 00

SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

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:
   1. Resilient base.

B. Related Sections include:
   1. Section 09 68 13 “Tile Carpeting” for carpet tile flooring installed with resilient base.

1.3 REFERENCES

A. ASTM International:
   1. ASTM F 710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
   2. ASTM F 1861: Standard Specification for Resilient Wall Base.
   3. ASTM F 2169: Standard Specification for Resilient Stair Treads.
   4. ASTM F 2170: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

B. California Code of Regulations – Title 17, Public Health.

C. California Collaborative for High Performance Schools (CA-CHPS).

D. California Department of Public Health (CDPH):
   1. Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1, February 2010.

E. California Green Building Standards Code (CALGreen) – California Code of Regulations, Title 24, Part 11.

F. Resilient Floor Covering Institute (RFCI):
   1. FloorScore certification program.

G. South Coast Air Quality Management District (SCAQMD):
   1. Rule 1168 – Adhesive and Sealant Applications.

H. UL Environment:
   1. GREENGUARD Gold certification program.

I. California Building Code (CBC):
   1. 2016 CBC Chapter 11B (Title 24, Part 2).

J. United States Department of Justice:
   1. 2010 ADA Standards for Accessible Design.

1.4 DEFINITIONS

A. VOC: Volatile Organic Compounds.

1.5 ACTION SUBMITTALS

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

B. Samples for Initial Selection: Submit manufacturer's full range of colors for each type of resilient base and accessory product indicated, for selection by Architect.
   1. Minimum Number of Colors for Selection:
      a. Resilient base: 76.

C. Samples for Verification:
   1. Resilient Base: Manufacturer's standard size Samples, but not less than 12 inches long, of each resilient base color, texture, and pattern.
   2. Stair Treads: 12-inch long Sample of each stair tread color and texture.
   3. Accessories: Manufacturer's standard size Samples not less than 6 inches long, of each type and color of edge strip, nosing, transition strip, and other resilient flooring accessory.

D. CALGreen Submittals:
   1. Manufacturer's product data for resilient flooring products indicating compliance with product requirements specified in "CALGreen Requirements" Article.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Resilient Base: Not less than 10 linear feet for every ***[500]*** linear feet, or fraction thereof, of each type, color, pattern, and size of resilient base installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for installation of resilient base and accessories.
   1. Engage an Installer who employs workers for this Project that are trained or certified by resilient flooring and accessory manufacturer for installation techniques required.

2.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store resilient base and accessories, and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive resilient base and accessories 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 deg F or more than 95 deg F.

C. Install resilient base and accessories after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 CALGREEN REQUIREMENTS

A. General: Conform with all applicable requirements of the California Green Building Standards Code (CALGreen).

B. Provide adhesives and adhesive primers which comply with current VOC content limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168, except as noted otherwise below. Such products shall also comply with Rule 1168 prohibition of the use of certain toxic compounds (chloroform, ethylene, dichloride, methylene chloride, perchloroethylene, and trichloroethyelen).

1. Aerosol adhesives and similar unit sizes of adhesives, and sealants (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions of use of certain toxic compounds, of the California Code of Regulations, Title 17, commencing with Section 94507.

C. Resilient Base and Accessories: Provide resilient products which meet at least one of the following:

1. Certified under the Resilient Floor Covering Institute (RFCI) FloorScore program.
2. Compliant with the VOC-emission limits specified in the California Department of Public Health Standard Method for the Testing and Evaluation of Volatile

Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, February 2010.

3. Compliant with 2014 California Collaborative for High Performance Schools California (CA-CHPS) Criteria Interpretation for EQ 7.0 and EQ 7.1 (formerly EQ 2.2) and listed in the CHPS High Performance Database.
4. Certified under UL Environment GREENGUARD Gold certification program (formerly Greenguard Children's & Schools Program).

2.2 LEED v4 REQUIREMENTS

A. VOC Emissions of Interior Adhesives: Provide adhesives used inside the weatherproofing system that comply with the testing and product requirements of the California Department of Public Health "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1, February 2010," using the applicable exposure scenario.

B. VOC Content of Interior Adhesives: Provide adhesives, including primers, used inside the weatherproofing system that comply with applicable VOC content limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168.

C. VOC Emissions of Resilient Base and Accessory Products: Provide resilient base and accessory products that comply with the testing and product requirements of the California Department of Public Health "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1, February 2010," using the applicable exposure scenario.

2.3 RESILIENT BASE

A. Resilient Base Standard: ASTM F 1861.
   1. Manufacturer: Subject to compliance with requirements, provide resilient base by one of the following:
      a. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
      b. Roppe Corporation, USA.
      c. Manufacturer of equal products, in accordance with Division 1 requirements for product substitutions.Color***[s]***:
   3. Color***[s]***: As specified in Section 09 06 00 "Colors and Finishes."

B. Material Requirement: TS (rubber, vulcanized thermoset).

C. Manufacturing Method: Group I (solid, homogeneous).

D. Style: Cove (base with toe).

E. Minimum Thickness: 0.125 inch.

F. Height: 4 inches.

G. Lengths: Coils in manufacturer's standard length.

H. Outside Corners: Job formed, except use preformed where indicated in Part 3.

I. Inside Corners: Job formed.

J. Finish: Matte.

K. Surface: Smooth.

L. VOC Emissions:

1. Complies with requirements specified in “CALGreen Requirements” Article.
2. Complies with requirements specified in “LEED v4 Requirements” Article.
3. Certification: RFCI FloorScore.

2.4 RESILIENT MOLDING ACCESSORIES

A. General: Manufacturer’s standard transition/reducer strips of rubber or vinyl, designed for terminating edge of finish flooring materials or providing flush transition joint between different finish flooring materials.

1. Manufacturer: Subject to compliance with requirements, provide resilient molding accessories by one of the following:
   a. Burke Mercer Flooring Products, Division of Burke Industries, Inc.
   b. Roppe Corporation, USA.
   c. Manufacturer of equal products in accordance with Division 1 requirements for product substitutions.

2. Color***[s]***: As specified in Section 09 06 00 ”Colors and Finishes.”
3. Profile and Dimensions: As indicated.
4. Provide two-piece construction consisting of track base for anchorage to substrate, and snap-in top cap.
5. Accessibility Requirements: Bevel transition strips with a slope of not more than 1:2, and comply with requirements per the following:
   a. California Building Code (Title 24, Part 2), Chapter 11B.
   b. United States Department of Justice’s 2010 ADA Standards for Accessible Design.
6. VOC Emissions:
   a. Complies with requirements specified in “CALGreen Requirements” Article.
   b. Certification: RFCI FloorScore.

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement-based or blended hydraulic-cement-based formulation provided or approved by floor covering manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit products and substrate conditions indicated.

1. VOC Content: Complies with requirements specified in “CALGreen Requirements” Article.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, maximum moisture content, and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might show through surface of or interfere with adhesion of resilient flooring and accessories.

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

3.2 PREPARATION

A. Prepare substrates according to resilient base and accessory manufacturer’s written recommendations to ensure adhesion of resilient products.

B. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient flooring and accessory manufacturer. Do not use solvents.

C. Concrete Substrates for Resilient Stair Accessories: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Moisture and Alkalinity Testing: Perform tests recommended by resilient flooring manufacturer and as follows. Proceed with installation only after substrates pass testing.
    a. Perform concrete moisture testing, using the relative humidity in-situ probe test method, in accordance with ASTM F 2170.
        i) Proceed with installation only after substrates show a moisture level of 75 percent relative humidity or less, or as recommended in writing by manufacturer of resilient flooring to be installed.
    b. Perform alkalinity testing in accordance with ASTM F 710.
        i) Proceed with installation only after substrates show a pH level of not less than 7 and not greater than 9, or as recommended in writing by manufacturer of resilient flooring to be installed.
3. Adhesion Testing: Perform tests recommended by resilient flooring manufacturer. Proceed with installation only after substrates pass testing.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

E. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. 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.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners: Except as noted otherwise below, install job-formed corners.

1. Outside Corners: Use straight pieces of maximum lengths possible, and form with returns not less than 3 inches in length. Form without producing discoloration (whitening) at bends.

a. Where project conditions are such that length of base on either side of corner is less than 3 inches, notch back of toe of resilient wall base to facilitate bending around corner, and ensure full coverage is achieved with adhesive at backside of base. Entire length of base shall be tightly adhered.

2. Inside Corners: Use straight pieces of maximum lengths possible, and form with returns not less than 3 inches in length. Form by cutting an inverted V-shaped notch in toe of wall base at point where corner is formed.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.

2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient flooring that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient base and accessories.

B. Perform the following operations immediately after completing resilient base and accessory installation:
1. Remove adhesive and other blemishes from exposed surfaces using cleaner recommended by resilient product manufacturers.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.
a. Do not wash surfaces until after time period recommended by manufacturer.

C. Protect resilient base and accessories from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 09 65 13

SECTION 09 68 13

TILE CARPETING

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 modular carpet tile.

B. Related Sections include:

1. Section 01 74 19 ”Construction Waste Management and Disposal” for recycling of existing carpet materials to be removed.
2. Section 02 41 19 ”Selective Demolition” for removal of existing floor coverings.
3. Section 09 05 65 “Concrete Moisture-Control System” for moisture-vapor-emission control system applied to concrete slab substrates prior to installation of finish flooring.
4. Section 09 65 13 "Resilient Base and Accessories” for the following resilient products used with carpet tile:
    a. Resilient base.
    b. Resilient transition moldings between carpet tile and adjacent finish flooring materials.

1.3 REFERENCES

A. American Association of Textile Chemists and Colorists (AATCC):

1. AATCC 16-E: Test Method for Colorfastness to Light.
2. AATCC 134: Test Method for Electrostatic Propensity of Carpets.
3. AATCC 165: Test Method for Colorfastness to Crocking, Textile Floor Coverings.
4. AATCC 174: Test Method for Antimicrobrial Activity Assessment of Carpets.
5. AATCC 175: Test Method for Stain Resistance for Pile Floor Coverings.

B. ASTM International:

1. ASTM E 648: Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
2. ASTM E 662: Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
3. ASTM E 2471: Standard Test Method for Using Seeded-Agar for the Screening Assessment of Antimicrobrial Activity in Carpets.

4. ASTM F 710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
5. ASTM F 2170: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

C. California Department of Public Health (CDPH):
1. Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1, February 2010.

D. CALGreen: California Green Building Standards Code - California Code of Regulations, Title 24, Part 11.

E. Carpet and Rug Institute (CRI):
1. CRI Carpet Installation Standard.
2. CRI Green Label Plus testing program.

F. Chemical Abstract Service (CAS):
1. Chemical Abstract Registration Number (CASRN).

G. Collaborative for High Performance Schools (CHPS).
1. Criteria Interpretation Library.
a. EQ 7.0 – Low Emitting Materials.
b. EQ 7.1 – Additional Low Emitting Materials.

H. Cradle to Cradle Products Innovation Institute:
1. Cradle to Cradle Certified Product Standard.

I. European Standards (EN):
1. EN 15804: Sustainability of Construction Works – Environmental Product Declarations – Core Rules for the Product Category of Construction Products.

J. GreenScreen for Safer Chemicals:
1. GreenScreen Chemical Hazard Assessment Procedure V1.2.

K. Health Product Declaration Collaborative:
1. Health Product Declaration Open Standard.

L. International Certified Floorcovering Installers Association.
1. Commercial II certification level.

M. International Organization for Standardization (ISO):
1. ISO 14021: Environmental Labels and Declarations – Self-Declared Environmental Claims (Type II Environmental Labeling).
2. ISO 14025: Environmental Labels and Declarations – Type III Environmental Declarations – Principals and Procedures.

3. ISO 14040: Environmental Management – Life Cycle Assessment – Principals and Framework.
4. ISO 14044: Environmental Management – Life Cycle Assessment – Requirements and Guidelines.
5. ISO 21930: Sustainability in Building Construction – Environmental Declaration of Building Products.

N. NSF International/American National Standards Institute (ANSI):
1. NSF/ANSI 140: Sustainability Assessment for Carpet.

O. Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

P. SCS Global Services:
1. Sustainable Carpet Certification.

Q. South Coast Air Quality Management District (SCAQMD):
1. Rule 1168 – Adhesive and Sealant Applications.

1.4 DEFINITIONS

A. VOC: Volatile Organic Compounds.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
a. Delivery, storage, and handling procedures.
b. Ambient conditions and ventilation procedures.
c. Subfloor preparation procedures.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include manufacturer’s written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer’s written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, plans showing the following:
1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Existing flooring materials to be removed.
3. Existing flooring materials to remain.
4. Carpet tile type, color, and dye lot.
5. Type of subfloor.

6. Type of installation.
7. Pattern of installation.
8. Pattern type, location, and direction.
9. Pile direction patterns.
10. Types, color, and locations of insets and borders.
11. Type, color, and location of edge, transition, and other accessory strips.
12. Transition details to other flooring materials.

C. Samples for Initial Selection: Submit manufacturer's full range of colors/patterns for the following items for selection by Architect.
1. Carpet Tile.
a. Minimum Number of Color/Patterns for Selection:
i) Carpet Tile – Type 1: ***[56]***.
ii) Carpet Tile – Type 2: ***[33]***.

D. Samples for Verification: For each of the following 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.
1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch long Samples.

E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

F. CALGreen Submittals:
1. Manufacturer's product data for adhesives and adhesive primers indicating compliance with product requirements specified in "CALGreen Requirements" Article.
2. Manufacturer's product data for carpet tile indicating compliance with product requirements specified in "CALGreen Requirements" Article.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.

2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.9 MAINTENANCE MATERIAL SUBMITTALS

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. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq yds.

1.10 QUALITY ASSURANCE

A. Installer Qualifications: An experienced Installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups at locations and in sizes as shown on Drawings or if not shown, as directed by Architect.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI's "CRI Carpet Installation Standard."

1.12 FIELD CONDITIONS

A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles 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 planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.13 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:
    a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.
    b. Dimensional instability.
    c. Loss of tuft-bind strength.
    d. Excess static discharge.
    e. Loss of face fiber.
    f. Delamination
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CALGREEN REQUIREMENTS

A. General: Conform with all applicable requirements of the California Green Building Standards Code (CALGreen).

B. Provide adhesives and adhesive primers which comply with current VOC content limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168, except as noted otherwise below. Such products shall also comply with Rule 1168 prohibition of the use of certain toxic compounds (chloroform, ethylene, dichloride, methylene chloride, perchloroethylene, and trichloroethyelen).

1. Aerosol adhesives and similar unit sizes of adhesives, and sealants (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions of use of certain toxic compounds, of the California Code of Regulations, Title 17, commencing with Section 94507.

C. Carpet Tile: Provide carpet tile products which meet at least one of the following:

1. Certified as complying with the testing and product requirements of the Carpet and Rug Institute's Green Label Plus program.
2. Compliant with the VOC-emission limits specified in the California Department of Public Health Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, February 2010.
3. Meets requirements of NSF/ANSI 140 for certification at the Gold level or higher.
4. Meets requirements of SCS Global Services Sustainable Carpet Certification program at the Gold level or higher.
5. Compliant with 2014 California Collaborative for High Performance Schools California (CA-CHPS) Criteria Interpretation for EQ 7.0 and EQ 7.1 (formerly EQ 2.2) and listed in the CHPS High Performance Database.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics for Tile Carpeting:

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq cm, as determined by testing identical products according to ASTM E 648.
2. Smoke Density: 450 or less, determined by testing identical products according to ASTM E 662.

2.3 CARPET TILE

A. Modular Carpet Tile ***Type 1***: Modular carpet tile system designed for random installation, such that individual tiles may be installed without regard to pile direction, pattern, or orientation while maintaining a visually continuous and finished overall appearance without any tile appearing improperly positioned.

1. Product: ***Interface, Inc.; Entropy***.
   a. Color***[s]***: As specified in Section 09 06 00 “Colors and Finishes.”
2. Construction: Tufted.
3. Fiber Content: 100 percent nylon Type 6, 6.
4. Fiber Type: Blue Chip.
5. Dye Method: 100 percent solution dyed.
6. Pile Characteristic: Tip-sheared.
7. Pile Height: .21 inch.
8. Stitches: 9.66 per inch.
9. Gage: 1/12 inch.
10. Face Yarn Weight: 20 oz per sq yd.
11. Density: 5,035 oz per cu yd.
12. Primary Backing/Backcoating: Non-woven fiberglass-reinforced PVC.
13. Secondary Backing: Fiberglass-reinforced thermoplastic composite; 100 percent recyclable.
    a. Provide minimum 39 percent recycled content, post-consumer or post-industrial in secondary backing material.
14. Size: 50 cm by 50 cm (19.6 inches square).
15. Applied Soil-Resistance Treatment: Manufacturer’s standard material; 8.0 on the Red 40 Stain Scale, per AATCC 175.
16. Antimicrobial Treatment: Manufacturer’s standard material; passes AATCC 174 (minimum 90 percent reduction of microorganisms according to Part 2; no macroscopic growth according to Part 3); passes ASTM E 2471.
17. Performance Characteristics: As follows:
    a. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.
    b. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) per AATCC 16, Option E.
    c. Electrostatic Propensity: Less than 3.0 kV per AATCC 134.
18. Minimum Recycled Content:

a. Preconsumer: 33 percent.

b. Postconsumer: 33 percent.

19. VOC Emissions:

a. Complies with requirements specified in “CALGreen Requirements” Article.

b. Certification: CRI Green Label Plus.

B. Modular Carpet Tile ***Type 2***: Modular carpet tile system designed for random installation, such that individual tiles may be installed without regard to pile direction, pattern, or orientation while maintaining a visually continuous and finished overall appearance without any tile appearing improperly positioned.

1. Product: ***Interface, Inc.; Cubic***.

a. Color***[s]***: As specified in Section 09 06 00 “Colors and Finishes.”

2. Construction: Tufted.

3. Fiber Content: 100 percent nylon Type 6, 6.

4. Fiber Type: Aquafil.

5. Dye Method: 100 percent solution dyed.

6. Pile Characteristic: Textured loop.

7. Pile Height: .145 inch.

8. Stitches: 8.16 per inch.

9. Gage: 1/12 inch.

10. Face Yarn Weight: 18 oz per sq yd.

11. Density: 6,968 oz per cu yd.

12. Primary Backing/Backcoating: Non-woven fiberglass-reinforced PVC.

13. Secondary Backing: Fiberglass-reinforced thermoplastic composite; 100 percent recyclable.

a. Provide minimum 39 percent recycled content, post-consumer or post-industrial in secondary backing material.

14. Size: 50 cm by 50 cm (19.69 inches square).

15. Applied Soil-Resistance Treatment: Manufacturer’s standard material; 8.0 on the Red 40 Stain Scale, per AATCC 175.

16. Antimicrobial Treatment: Manufacturer’s standard material; passes AATCC 174 (minimum 90 percent reduction of microorganisms according to Part 2; no macroscopic growth according to Part 3).

17. Performance Characteristics: As follows:

a. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.

b. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) per AATCC 16, Option E.

c. Electrostatic Propensity: Less than 3.0 kV per AATCC 134.

18. Minimum Recycled Content:

a. Preconsumer: 45 percent.

19. VOC Emissions:
    a. Complies with requirements specified in “CALGreen Requirements” Article.
    b. Complies with requirements specified in “LEED v4 Requirements” Article.
    c. Certification: CRI Green Label Plus.

2.4 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Primer/Sealer: Carpet manufacturer’s standard sealer material designed to seal gypsum-based underlayment surfaces.

C. Corner Connectors: Manufacturer’s standard adhesively-surfaced 3-inch by 3-inch square tabs for connecting underside of corners of four adjacent carpet tile units to maintain a tight joint on all sides of tile, thereby maintaining an overall stable surface. Tabs are surfaced with pressure-sensitive acrylic adhesive on one side, only, of polyester backing, so as not to adhere tiles to substrate.
    1. Product: Interface, Inc.; TacTiles.

D. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
    1. VOC Content: Complies with requirements specified in “CALGreen Requirements” Article.
    2. VOC Emissions: Complies with requirements specified in “LEED v4 Requirements” Article.

E. Resilient Transition Moldings: As specified in Section 09 65 13 ”Resilient Base and Accessories.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Verify that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might show through surface or interfere with adhesion of carpet tile and accessories

D. For painted subfloors, perform bond test recommended in writing by adhesive manufacturer.

E. For raised access flooring systems, verify the following:

1. Access floor complies with requirements specified in Section 09 69 00 ”Access Flooring.”
2. Access floor substrate is compatible with carpet tile and adhesive, if any.
3. Underlayment surface is flat, smooth, evenly planed, tightly jointed, and free of irregularities, gaps greater than 1/8 inch, protrusions more than 1/32 inch, and substances that may interfere with adhesive bond or show through surface.

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

3.2 PREPARATION

A. General: Comply with CRI’s “CRI Carpet Installation Standard," and with carpet tile manufacturer’s written installation instructions for preparing substrates indicated to receive carpet tile.

B. Concrete substrates: Prepare according to ASTM F 710.

1. 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 adhesive and carpet tile manufacturer.
2. Refer to Section 09 05 65 “Concrete Moisture-Control System” for moisture and alkalinity testing and treatment. Proceed with installation only after substrates pass testing.
3. Adhesion Testing: Perform tests recommended by carpet tile manufacturer. Proceed with installation only after substrates pass testing.

C. Metal Substrates: Clean grease, oil, soil, and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

D. 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 wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer’s written instructions.

E. Apply primer/sealer over gypsum-based cementitious underlayment in accordance with carpet manufacturer’s written instructions and as required to ensure proper adhesion of carpet to underlayment surface.

F. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 CARPET TILE INSTALLATION

A. General: Comply with with CRI’s “Carpet Installation Standard,” Section 18, “Modular Carpet,” and with carpet tile manufacturer’s written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer, and as follows:

1. Glue-down; install every tile with full-spread, releasable pressure-sensitive adhesive.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Maintain carpet tile patterns indicated on Drawings.

E. Cut and fit carpet tile 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 tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. 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.

H. Install pattern parallel to walls and borders.

I. Do not bridge building expansion joints with carpet tiles.

J. At access flooring, stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

K. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet tiles that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile.

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI's "CRI Carpet Installation Standard," Section 20, "Protecting Indoor Installations."

C. Protect carpet tile 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 tile manufacturer.

END OF SECTION 09 68 13

SECTION 10 11 00

VISUAL DISPLAY UNITS

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:
   1. Markerboards.
      a. Wall-mounted, fixed.
   2. Accessories for visual display units.

B. Related Sections include:
   1. Section 06 10 00 ”Rough Carpentry” for concealed wood blocking in wood stud-framed walls for anchoring wall-mounted visual display units.
   2. Section 06 41 00 ”Architectural Wood Cabinets” for cabinets to receive sliding markerboard units.
   3. Section 09 77 21 “Vinyl-Wrapped Panels” for tackable panels prewrapped with vinyl wall covering, and field-installed.
   4. Section 09 91 00 ”Painting” for field painting of kick panels of floor-mounted vertically-sliding display units.

1.3 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. AAMA 611: Voluntary Guide Specification and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
   2. AAMA 2603: Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (With Coil Coating Appendix).

B. American National Standards Institute (ANSI):
   1. ANSI A208.2: Medium Density Fiberboard (MDF) for Interior Applications.

C. ASTM International:
   1. ASTM C 208: Standard Specification for Cellulosic Fiber Insulating Board.
   2. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. ASTM B 221: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. California Air Resources Board:

1. Airborne Toxic Control Measure to Reduce Formaldehyde Emissions From Composite Wood Products.

E. California Department of Public Health (CDPH):

1. Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1, February 2010.

F. California Green Building Standards Code (CALGreen) – California Code of Regulations, Title 24, Part 11.

G. Chemical Fabrics & Film Association, Inc.:

1. CFFA-W-101D: Quality Standard for Vinyl Coated Fabric Wallcovering.

H. Federal Specifications:

1. FS CCC-W-408D: Wall Covering, Vinyl Coated.

I. National Association of Architectural Metal Manufacturers (NAAMM):

1. Metal Finishes Manual for Architectural and Metal Products.

J. Porcelain Enamel Institute (PEI):

1. PEI-1002: Manual and Performance Specifications for Porcelain Enamel Writing Surfaces.

K. South Coast Air Quality Management District (SCAQMD):

1. Rule 1168 – Adhesive and Sealant Applications.

L. Underwriters Laboratory (UL):

1. UL 723: Standard Test for Surface Burning Characteristics of Building Materials.

1.4 DEFINITIONS

A. Markerboard: Framed markerboard assembly.

B. Visual Display Surface: Markerboard and tackboard surfaces.

C. Composite Wood: Wood panel product, including medium-density fiberboard and particleboard, manufactured from wood materials in the form of particles combined with a resin binder and bonded together under heat and pressure.

1.5 COORDINATION

A. Coordinate installation of sliding markerboard assemblies in cabinets with installation of cabinets as specified in Section 06 41 00 “Architectural Wood Cabinets.”

B. Coordinate sizes and locations of concealed framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that visual display units can be supported and installed as indicated.

1.6 PREINSTALLATION MEETING

A. Preinstallation Conference: Conduct conference at Project site to review pertinent issues related to visual display units.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display units.
   1. Include furnished specialties and accessories.
   2. Include individual panel weights for sliding visual display units.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Show location of panel seams and joints, if any. For factory-fabricated units too large to ship in one piece, show locations of field-assembled joints.
   2. Include sections of typical trim members.
   3. Show location and layout of special-purpose graphics for markerboard surfaces.

C. Samples for Initial Selection: Manufacturer's full range of colors/patterns, for selection by Architect, for the following:
   1. Porcelain-enamel face sheet for markerboards.
      a. Minimum Number of Colors for Selection: 2.
   2. Each type of tackboard facing material.
      a. Minimum Number of Colored Cork Colors: 9.
      b. Minimum Number of Vinyl Colors: 23.
      c. Minimum Number of Fabric Colors: 6.

D. Samples for Verification: For each color, finish, and type of the following:
   1. Porcelain Enamel Face Sheet for Markerboards: Not less than 8-1/2 inches by 11 inches.
   2. Tackboard Facing Material: Not less than 8-1/2 inches by 11 inches.
   3. Trim: 6-inch-long sections of each trim profile.
   4. Display Rail: 6-inch long section.
   5. Accessories: Full-size Sample of each type of accessory.

E. CALGreen Submittals:
   1. Manufacturer's product data for adhesives and sealants used in visual display units indicating compliance with product requirements specified in "CALGreen Requirements" Article.
   2. Manufacturer's product data for composite wood products used in visual display units indicating compliance with product requirements specified in "CALGreen Requirements" Article.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of visual display surface facing and core materials.

1.9 CLOSEOUT SUBMITTALS

A. Maintenance Data: For visual display units to include in maintenance manuals. Include manufacturer's written cleaning and stain-removal recommendations for tackboard surfaces.

1.10 QUALITY ASSURANCE

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

1.11 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 impractical to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.12 FIELD 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.

B. Field Measurements: Verify actual dimensions of openings for recessed visual display units by field measurement before fabrication.

1.13 WARRANTY

A. Special Warranty for Markerboard Porcelain-Enamel Face Sheets: Manufacturer's agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
    a. Surfaces lose original writing and erasing qualities.
    b. Surfaces exhibit crazing, cracking, or flaking.
2. Warranty Period: Life of the building.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain visual display units from a single source from a single manufacturer.

2.2 CALGREEN REQUIREMENTS

A. General: Conform with all applicable requirements of the California Green Building Standards Code (CALGreen).

B. Provide adhesives used in visual display units which comply with current VOC content limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168, except as noted otherwise below. Such products shall also comply with Rule 1168 prohibition of the use of certain toxic compounds (chloroform, ethylene, dichloride, methylene chloride, perchloroethylene, and trichloroethyelen).

C. Composite Wood Products: Provide visual display surface backing manufactured from wood composite products which meet requirements of California Air Resources Board “Airborne Toxic Control Measure to Reduce Formaldehyde Emissions From Composite Wood Products” for formaldehyde resin emission limits (in ppm) for composite wood products and as specified below:

1. Particleboard: 0.09.
2. Medium Density Fiberboard: 0.11.
3. Thin Medium Density Fiberboard: 0.13.

2.3 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Visual display surface facings, core, and backing materials shall comply with the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    a. Visual Display Surface Facing Material:
        i) Flame Spread Index: 25 or less.
        ii) Smoke Developed Index: 450 or less.
    b. Visual Display Surface Core or Backing Material:
        i) Flame Spread Index: 25 or less.
        ii) Smoke Developed Index: 450 or less.

2.4 FIXED WALL-MOUNTED VISUAL DISPLAY UNITS

A. Factory-fabricated units consisting of aluminum-framed markerboard panels.

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

a. AARCO Products, Inc.; Series 10-120.

b. Claridge Products & Equipment, Inc.; Series 4.

c. Platinum Visual Systems, a Division of ABC School Equipment, Inc.; DTS Series.

d. Equal product in accordance with Division 1 requirements for product substitutions.

2. Assembly: Markerboard.

3. Dimensions: As indicated on Drawings.

4. Mounting: Direct to wall.

B. Markerboard Panel: Porcelain-enamel-faced markerboard panel.

1. Face Sheet: 0.015-inch (28 gage) thick, porcelain-enamel-coated steel (magnetic) with high-gloss finish.

a. Color: White.

2. Core Material: 7/16-inch thick medium-density fiberboard.

3. Backing Sheet: 0.005-inch thick aluminum foil backing.

C. Aluminum Frame: Fabricated from not less than 0.062-inch-thick, extruded aluminum.

1. Finish: Clear anodized.

2. Face Trim Width: 5/8 inch to 3/4 inch.

3. Corners: Square.

D. Combination Markerboard/Tackboard Assemblies: Provide manufacturer's standard extruded-aluminum H-trim between abutting sections of markerboard and tackboard panels.

E. Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated cork insert, end stops, designed to hold accessories.

1. Size: 1 inch high by full length of tackboard.

2. Plastic-Impregnated Cork Color: As selected by Architect from manufacturer's full range.

3. Map Hooks: Two map hooks for every 48 inches of display rail length or fraction thereof.

4. Flag Holder: One per room.

5. Aluminum Finish: Match visual display unit frame.

F. Pen Tray: Manufacturer's standard, continuous.

1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

2. Aluminum Finish: Match visual display unit frame.

G. Mounting Hardware: Manufacturer's standard L-shaped mounting clips.

2.5 MATERIALS

A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process, uncoated thickness as indicated.

1. Satin Gloss Finish: Low reflective; dry-erase markers wipe clean with dry cloth or standard eraser.

B. Medium-Density Fiberboard: ANSI A208.2, Grade 130.

C. Fiberboard: ASTM C 208 cellulosic fiber insulating board.

D. Extruded Aluminum: ASTM B 221, Alloy 6063.

E. 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.

2.6 ACCESSORIES

A. Display Rail Accessories: Provide accessories designed to clip onto display rail, with ability to adjust location by sliding along rail; clear anodized aluminum finish.

1. Map Hooks and Clips: Map hooks with flexible spring-action metal clips, designed for hanging maps and other large sheet materials; provide two map hooks for every 48 linear inches of display rail.
2. Roller Bracket: Slotted bracket for suspending projection screen cases or tubular map holders; provide threaded knob for fixing bracket in place on display rail; provide two roller brackets per room.
3. Flag Holder: Provide one flag holder per classroom, designed for mounting on display rail.

2.7 FABRICATION

A. Visual Display Panels: Factory-assemble visual display panels, unless otherwise indicated.

1. Trim shall be assembled and attached to visual display panels at manufacturer's factory before shipment.

B. Markerboard Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.

1. Make joints only where total length exceeds maximum manufactured length. If joints are required, fabricate with a minimum number of joints, balanced around center of board as indicated on approved Shop Drawings.
2. Provide manufacturer's standard vertical-joint spline system between abutting sections of markerboards.

3. Provide manufacturer's standard mullion trim at joints between markerboards and tackboards of combination units.
4. Where size of visual display panels or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

D. Aluminum Frames: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.
1. Trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

E. Display Rails:
1. At fixed, wall mounted markerboards and tackboards, mount display rail along top edge trim of unit.
2. At sliding markerboard panels, install display rail on fascia as indicated. Display rail to run continuously for entire length of overhead track.

F. Pen Trays: Install pen tray to run continuously along entire length of markerboard units.
1. At fixed wall-mounted markerboards, install pen tray at bottom edge.
2. At horizontally-sliding markerboards installed in cabinets, install pen tray in conjunction with bottom guide track
3. At horizontally-sliding wall-mounted markerboard units, install pen try on face of lower horizontal frame member.
4. At vertically-sliding wall-mounted markerboard units, install pen tray on face of lower horizontal frame member.
5. At vertically-sliding floor-mounted markerboard units, install pen tray at top edge of kick panel.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "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 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.

2.9 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

B. .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, 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. Examine walls and partitions for suitable framing depth where recessed sliding visual display units will be installed.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

D. Prime wall surfaces indicated to receive visual display units and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.

E. Prepare recesses for sliding visual display units as required by type and size of unit.

3.3 INSTALLATION

A. General: 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.

1. Refer to Drawings for mounting heights of visual display units.

B. Field-Assembled Visual Display Board Assemblies: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints.
2. Where size of visual display board assemblies or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

C. Wall-Mounted Fixed Visual Display Units: Attach concealed clips, hangers, and grounds to solid framing in wall with fasteners of size and at spacings recommended in writing by manufacturer. Secure both top and bottom of units to walls

3.4 ADJUSTING

A. Adjust sliding visual display panels to operate smoothly without warp or bind. Lubricate operating hardware as recommended in writing by manufacturer.

3.5 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one removable cleaning instruction label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 10 11 00

SECTION 10 14 00

SIGNAGE

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:
   1. Polymer panel Signs.
      a. Room identification.
      b. Toilet rooms.
      c. Tactile exit signage.

B. Related Sections include:
   1. Division 23 Section for labels, tags, and nameplates for HVAC systems and equipment.
   2. Division 26 Section for labels, tags, and nameplates for electrical systems and equipment.
   3. Section 32 17 23 “Pavement Markings” for parking striping and symbols; playground striping.

1.3 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. AAMA 611: Voluntary Specifications for Anodized Architectural Aluminum.
   2. AAMA 2603: Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.

B. ASTM International:
   1. ASTM A 53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   2. ASTM A 123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. ASTM B 209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   4. ASTM C 33: Standard Specification for Concrete Aggregates.
   5. ASTM C 94: Standard Specification for Ready-Mixed Concrete.
   6. ASTM C 150: Standard Specification for Portland Cement.

7. ASTM D 4956: Standard Specification for Retroreflective Sheeting for Traffic Control.

C. California Air Resources Board:
   1. Suggested Control Measure for Architectural Coatings.

D. California Building Code (CBC) - California Code of Regulations, Title 24, Part 2.

E. California Department of Public Health (CDPH):
   1. Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1, February 2010.

F. California Green Building Standards Code (CALGreen) – California Code of Regulations, Title 24, Part 11.

G. Federal Standard 595B: Colors.

H. South Coast Air Quality Management District (SCAQMD):
   1. Rule 1113 – Architectural Coatings.
   2. Rule 1168 – Adhesive and Sealant Applications.

I. United States Department of Justice:
   1. 2010 ADA Standards for Accessible Design.

1.4 COORDINATION

A. Coordinate placement of anchorage devices and concealed framing and backing in other Sections with templates for installing signs to ensure that signs can be supported and installed as indicated.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Show fabrication and installation details for signs.
   1. Include elevations and layout for each sign. Show sign message, typestyles, graphic elements, including tactile characters and Braille.
   2. Show sign mounting heights, anchorage details, locations of supplementary supports to be provided by others, and accessories.

C. Samples for Initial Selection: Manufacturer’s color charts showing the full range of colors available for selection by Architect for the following:
   1. Polymer Signs:
      a. Minimum Number of Available Colors: 40.
   2. Include representative Samples of available typeface styles and graphic symbols, if not specified in Contract Documents.

D. Samples for Verification: For each type of sign assembly, for each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:

1. Panel Signs: 6 inches by 6 inches.
2. Reviewed Samples will not be returned for installation in Project.

E. Sign Schedule: Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

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

B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in protective wrapping or packaging to protect from damage during handling and storage.

B. Store and handle in accordance with manufacturer's written instructions.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
    a. Deterioration, including fading, of metal and polymer finishes beyond normal weathering.

b. Deterioration of embedded graphic images.

c. Separation or delamination of sheet materials and components.

2. Warranty Period:

a. Polymer-Based Panel Signs: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of sign through one source from a single manufacturer.

2.2 CALGREEN REQUIREMENTS

A. General: Conform with all applicable requirements of the California Green Building Standards Code (CALGreen).

B. Provide adhesives which comply with current VOC content limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168, except as noted otherwise below. Such products shall also comply with Rule 1168 prohibition of the use of certain toxic compounds (chloroform, ethylene, dichloride, methylene chloride, perchloroethylene, and trichloroethyelen).

C. Paints and Coatings: Provide paints and coatings for panel signs that comply with VOC limits in Table 1 of the California Air Resources Board (ARB) Architectural Coatings Suggested Control Measure, unless more stringent local limits apply.

2.3 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements: Comply with requirements for signage as per the following:

1. California Building Code (Title 24, Part 2), Chapter 11B.

2. United States Department of Justice's 2010 ADA Standards for Accessible Design.

2.4 POLYMER PANEL SIGNS

A. Polymer Panel Signs: Unframed, polymer-based panel sign. Applied text is not acceptable. Panel and text color achieved through applied UV-resistant polyurethane enamel paint.

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

a. ASI Sign Systems, Inc.

b. Corporate Sign Systems.

c. Mohawk Sign Systems.

d. Nova Polymers, Inc

e. Manufacturer of equal products in accordance with Division 1 requirements for product substitutions.

B. Exterior signs to be rated by manufacturer for exterior installation.

C. Thickness: 1/4 inch.

D. Fabricate signs with smooth uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; edges smoothly finished to comply with the following requirements:

1. Edge Conditions: Square cut, with edges eased to 1/32 inch radius.
2. Corner Conditions (Front Elevation View): Square, with corners eased to 1/16 inch radius.

E. Sign Text and Graphic Content: In addition to requirements specified herein, comply with requirements indicated on Drawings for content, typeface styles, sizes, spacing, and layout. Italicized text used in this Section indicates actual text message to be fabricated on sign.

F. Tactile and Braille Copy: Where indicated, provide tactile text characters and corresponding Braille. Fabricate by manufacturer's photopolymer (exterior grade at exterior signs), blast-etching, engraving, or other process to form raised text and Braille dots in conformance with requirements of California Building Code and United States Justice Department's 2010 ADA Standards for Accessible Design, and integral with sign panel. Produce precisely formed characters with clean square-cut edges for text and rounded edges for Braille. Applied text is not acceptable.

1. Tactile Text:
   a. Raised Text Depth: 1/32 inch above background.
   b. Text Character Type: Uppercase, sans serif. Font as indicated.
   c. Text Character Proportions: As indicated, and conforming with the following:
      i) Width-to-Height Ratio: For indicated font, uppercase letter "O" shall have a width which is 60 percent minimum and 110 percent maximum of the height of uppercase letter "I."
      ii) Stroke Thickness: For indicated font, stroke thickness of uppercase letter "I" shall be 15 percent maximum of the height of the character.
   d. Text Character Spacing: Character spacing shall be measured between the two closest points of adjacent raised characters within a message, excluding word spaces.
      i) Characters With Rectangular Cross Sections: Spacing between individual raised characters shall be a minimum of 1/8 inch, and a maximum of 4 times the raised character stroke width.
      ii) Characters With Other Cross Sections: Spacing between individual raised characters shall be a minimum of 1/16 inch, and a maximum of 4 times the raised character stroke width at the base of the cross sections, and a minimum of 1/8 inch, and a maximum of 4 times the raised character stroke width at the top of the cross sections.

iii) Characters shall be separated from raised borders and decorative elements 3/8 inch minimum.

e. Line Spacing: Spacing between baselines of separate lines of tactile text within a message shall be a minimum of 135 percent, and maximum of 170 percent of the raised character height.

f. Format: Text shall be in a horizontal format.

2. Braille Dots: Grade 2 contracted California Braille; domed or rounded.

a. Capitalization: Indication of an uppercase letter or letters shall be used only before the first word of sentences, proper nouns and names, individual letters of the alphabet, initials, and acronyms.

b. Dimensions:

i) Dot Base Diameter: 0.059 inch minimum, 0,063 inch maximum.

ii) Distance Between Two Dots in Same Cell (Measured Center-to-Center): 0.100 inch.

iii) Distance Between Corresponding Dots in Adjacent Cells (Measured Center-to-Center): 0.300 inch.

iv) Dot Height: 0.025 inch minimum, 0.037 inch maximum.

v) Distance Between Corresponding Dots From One Cell Directly Below (Measured Center-to-Center): 0.395 inch minimum, 0.400 inch maximum.

c. Position: Braille shall be positioned directly below corresponding tactile text in a horizontal format, flush left or centered. If text is multi-lined, Braille shall be placed below entire text.

i) Distance Between bottom of tactile characters and top of Braille: 3/8 inch minimum, 1/2 inch maximum.

ii) Distance Between Braille and raised borders or decorative elements: 3/8 inch minimum.

G. Pictograms: Pictograms, where indicated, shall have a field height of 6 inches minimum. Characters and Braille shall not be located in the pictogram field.

1. Contrast: Pictogram shall contrast with background field.

2. Finish: Both pictogram and background field shall have non-glare finish.

3. Corresponding descriptive text and Braille shall be located directly below pictogram field.

H. Colored Coatings for Polymer Sheet: For text and graphics, and background colors, provide acrylic polyurethane enamel paints recommended by polymer manufacturer for optimum adherence to polymer surface and which are UV- and water-resistant for colors and exposures indicated. Paint to fully cover all surfaces of sign.

1. Product: Subject to compliance with requirements, provide the following topcoat material:

a. Matthews Paint Company; Matthews Satin VOC MAP.

2. Primer: As recommended in writing for intended substrate material by manufacturer of topcoat material.

3. Sign Finish: Sign characters and background to have non-glare (matte) finish.

4. Visual Contrast: Provide minimum 70 percent contrast between sign characters and sign background.
5. Sign Colors: As selected by Architect from manufacturer's full range of standard colors.
    a. For bidding purposes, assume three separate colors for sign panel, in equal quantities for each color, and one color for sign text.

I. Sign Mounting: Noncorroding anchors suitable for substrate being mounted to.
1. Anchors to be countersunk flush with face of sign, and finished to match surrounding color of sign face.

J. Polymer Panel Sign Types:
1. Room Identification Signs:
    a. Sign Size and Layout: As indicated on Drawings]
    b. Tactile characters and Braille are required.
    c. Typeface: ***Futura Book***, upper case.
    d. Text Character Height: As indicated on Drawings, but not less than 5/8 inch and not more than 2 inches.
    e. Sign Message Text and Graphics: As indicated on Drawings
    f. Colors:
        i) Background: **District Standard**
        ii) Text: **White**
    g. Mounting Location: Latch side of door, as indicated on Drawings, but not less than 48 inches from finish floor or ground to baseline of lowest Braille cells, and not more than 60 inches from finish floor or ground to baseline of uppermost line of raised tactile characters.
2. Toilet Room Identification Signs (Jamb Sign):
    a. Sign Size and Layout: As indicated on Drawings]
    b. Tactile characters and Braille are required.
    c. Typeface: ***Futura Book***, upper case.
    d. Text Character Height: As indicated on Drawings, but not less than 5/8 inch and not more than 2 inches.
    e. Sign Message Text: *MEN, WOMEN*, or *UNISEX*, as indicated on Drawings.
    f. Pictogram:
        i) Women: International symbol for women adjacent to International Symbol of Accessibility.
        ii) Men: International symbol for men adjacent to International Symbol of Accessibility.
        iii) Unisex: International symbols for both men and women adjacent to International Symbol of Accessibility.
    g. Colors:
        i) Background: **SGN-1**.

ii) Text: **White**

h. Mounting Location: Latch side of door, as indicated on Drawings, but not less than 48 inches from finish floor or ground to baseline of lowest Braille cells, and not more than 60 inches from finish floor or ground to baseline of uppermost line of raised tactile characters.

3. Toilet Room Door Signs:

a. Sign Size and Shape:

i) Women/Girls: 12 inch diameter circle, 1/4 inch thick.

ii) Men/Boys: Equilateral triangle with 12-inch long sides, 1/4 inch thick, vertex pointing up.

iii) Unisex: Equilateral triangle, 1/4 inch thick, vertex pointing up, superimposed within 12 inch diameter circle, 1/4 inch thick.

b. Edges and Vertices of Geometric Shapes.

i) Edges shall be eased or rounded at 1/16 inch.

ii) Vertices shall be radiused between 1/8 inch minimum and 1/4 inch maximum.

c. Tactile characters and Braille not required.

d. Pictograms: None.

e. Colors:

i) Background: **SGN-1**.

ii) Text: **White**

f. Mounting Location: Centered on width of door, 5’-0” above floor to center of sign.

4. Tactile Exit Signs:

a. General:

i) Typeface: ***Futura Book***, upper case.

ii) Tactile characters and Braille are required.

iii) Layout as indicated on Drawings.

iv) Colors:

a) Background: **SGN-1**.

b) Text: **White**

v) Mounting Location: Latch side of door, as indicated on Drawings, but not less than 48 inches from finish floor or ground to baseline of lowest Braille cells, and not more than 60 inches from finish floor or ground to baseline of uppermost line of raised tactile characters.

K. Accessories:

1. Fasteners and Anchors: Manufacturer’s standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

a. Use concealed fasteners and anchors unless indicated to be exposed.

b. For exterior exposure, furnish nonferrous-metal, stainless-steel, or hot-dip galvanized devices unless otherwise indicated.

c. Fastener Heads: For nonstructural connections, use flathead countersunk screws with tamper-resistant slots unless otherwise indicated.

i) Finish exposed portion of fastener head to match surrounding sign color and finish.

d. Furnish inserts to be set by other trades into concrete or masonry work.

2. Adhesive: Silicone adhesive as recommended by sign manufacturer.

a. VOC Content: Complies with requirements specified in "CALGreen Requirements" Article

2.5 ACCESSIBLE FACILITIES IDENTIFICATION

A. Accessible Facility Identification: International Symbol of Accessibility, on opaque UV-resistant, nonreflective vinyl film, 0.0035-inch nominal thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.

1. Size: 6 inches by 6 inches.

2. Colors:

a. Field: Blue, Federal Standard 595B, Color No. 15090.

b. Symbol: White.

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. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify anchor inserts are sized and located to accommodate signs.

D. Verify painting and finishing of wall substrates are complete.

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

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and complying with 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 accessibility standard.

3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

4. 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. Panel Signs: Comply with sign manufacturer's written instructions, except where more stringent requirements apply.

1. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled and countersunk holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.

a. Install silicone-adhesive at perimeter of backside of sign.

3.3 CLEANING AND PROTECTION

A. Remove and replace damaged or deformed signage that does 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 signage according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signage in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 00

SECTION 20 05 00

GENERAL MECHANICAL REQUIREMENTS

1.1 GENERAL

A. The general provisions of the contract including General and Supplementary Conditions apply to the work specified in this Section. The provisions of this section shall apply to sections 22 00 00 and 23 00 00 of these specifications.

1.2 CODES AND STANDARDS

A. All work and materials shall conform 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 Drawings and Specifications shall govern.

B. Applicable codes and standards shall include but are not necessarily limited to:

1. California Code Of Regulations:

   a) Title 8, Industrial Relations

   b) Title 17, Public Health

   c) Title 19, Public Safety

   d) Title 21, Public Works

   e) 2013 Title 24, Energy Regulations

2. 2016 California Building Code.

3. 2016 California Mechanical Code

4. 2016 California Plumbing Code

5. Local Codes and Ordinances

6. American Gas Association (AGA)

7. Air Moving and Conditioning Association (AMCA)

8. American National Standards Institute (ANSI)

9. Air Conditioning and Refrigeration Institute (ARI)

10. American Society of Heating, Refrigerating, and Air Conditioning Engineers

11. American Society of Mechanical Engineers (ASME)

12. American Society for Testing and Materials (ASTM)

13. American Water Works Association (AWWA)

14. Cast Iron Soil Pipe Institute (CISPI)

15. National Electrical Code (NEC)

16. National Electrical Manufacturers Association (NEMA)

17. National Fire Protection Association (NFPA)

18. National Sanitation Foundation (NSF)

19. Occupational Safety and Health Act (OSHA)

20. Plumbing and Drainage Institute (PDI)

21. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

22. Underwriters' Laboratory (UL)

23. Requirements of local, state, and federal enforcing authorities codes and amendments to preceding codes shall be applicable to work performed under this specification.

24. Americans with Disabilities Act. Accessibility Guidelines for Buildings and Facilities. (ADAAG).

1.3 PERMITS AND FEES

A. The Contractor shall take out all permits and arrange for all tests in connection with such work as required. All charges are to be included in the work. All charges or fees for service connections, meters, etc., shall be included in the work.

1.4 COORDINATION OF WORK

A. Before starting any work, thoroughly examine all existing and newly completed underlying and adjoining work and conditions upon which the installation of this work is in any way dependent for the workmanship required by the Contract Documents. Report to the Architect and Engineer in writing any and all conditions which might adversely affect this work and limit ability to perform the required workmanship.

B. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. The actual locations of all materials, piping, ductwork, fixtures, equipment, supports, etc., shall be carefully planned, prior to installation of any work, to avoid all interference 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.

C. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Carefully investigate the mechanical, electrical, structural, architectural drawings and field conditions that could affect the work to be performed and arrange such work accordingly. Provide the required piping and ductwork offsets, fittings, and accessories to meet such conditions.

D. Spaces provided in the design of the building shall be utilized and the work shall be kept within walls or furring lines established on the drawings. Any discrepancy between Architectural or Mechanical drawings with respect to wall or furring locations and dimensions shall be brought to the Architect's attention for resolution before proceeding with installation.

E. Any work which is done as an addition, expansion, or remodel of and existing system shall be compatible with that system.

1.5 MANUFACTURER'S RECOMMENDATIONS

A. All material, equipment, and devices, etc., shall be installed in a manner meeting approval of the manufacturer of the particular item. The Contractor shall make himself / herself available of all installation manuals, brochures, and procedures that the manufacturer issues for the equipment and material. Contractor shall be held responsible for all installations contrary to the manufacturer's recommendations. Contractor shall make all necessary changes and revisions to achieve such compliance.

1.6 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.

1.7 QUIETNESS

A. Piping of all types, ductwork, and equipment shall be arranged and supported so that the vibration is at a minimum and is not transmitted to the building structure.

1.8 DAMAGES BY LEAKS

A. The Contractor shall be responsible for damages caused by leaks in the temporary or permanent piping or mechanical systems prior to completion of work and during the period of the guarantee.

1.9 SUBMITTALS

A. 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 or 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 contract documents. Descriptive literature shall be current manufacturer's brochures and submittal sheets.

2. All shop drawings shall be submitted at one time in a three hole binder with title sheet including Project Title, Architect, Engineer, Contractor, table of contents, and indexed tabs dividing each group of materials or item of equipment. All items shall be identified by the specification paragraph number for which the are proposed. All equipment shall also be identified by the mark number as indicated on drawings. Submittals shall bear the stamp of certification by the Contractor as evidence that the Contract Documents (Specifications and Drawings) have been thoroughly checked.

3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be high-lighted, circled or underlined on the shop drawings. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled or detailed.

B. 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.

1. 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. Submittals for products and equipment offered as an alternate to that specified will require, if accepted by the Engineer, resubmission of the Title 24 Energy Compliance Calculations if the specified product or equipment was included within the scope of the approved calculations on file with the reviewing authority. The cost of preparing resubmission will be the responsibility of the Contractor.

1.10 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. Coring through existing concrete or masonry walls, floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Restoration of all surfaces shall be provided under this Division. Cutting or 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 Architect and Engineer. Cutting or coring in structural members shall be approved by structural engineer and by DSA.

1.11 DEMOLITION

A. Existing equipment, ducts, piping, valves, fittings, devices, etc., requiring removal shall be removed and delivered to the Owner at a location on the job site to be determined by the Owner. Those items determined by the Owner to be of no value shall become the property of the Contractor and shall be removed from the job site by the Contractor at the Contractor's expense.

B. Existing piping, ducts, and services, etc., requiring capping or plugging shall be capped or plugged below floors, behind walls, above ceilings or above roof unless otherwise noted.

C. Removal shall include all supporting elements, anchorage systems, ancillary items related to the components being removed, etc. All surfaces shall be made clean off all mechancil, plumbing, and related items.

1.12 SUPPORTS AND SEISMIC RESTRAINTS.

A. Any structural element required to hang or support piping, ducts or equipment provided under this Division and not shown on the architectural or structural drawings shall be provided under this Division. All black steel structural elements shall be painted with two coats of primer.

1.13 CONTINUITY OF SERVICES

A. All existing services and systems shall be maintained except for short intervals when connections are to be made. The contractor shall be responsible for any interruptions of services and shall repair damage done to any existing service caused by the work.

B. If utilities not indicated on the drawings are uncovered during excavation, the Contractor shall notify the architect immediately for further instructions.

1.14 ELECTRICAL CONNECTIONS

A. Provide under Specification Division 22 05 00 all required control conduit, wiring, controls and control panels as indicated on the drawings or as may be required for system operation.

B. No control device shall be mounted with rigid connections on vibration isolated mechanical equipment. No field furnished control device shall be mounted on any piece of equipment so that it interferes with physical access of air or water flow, or covers any portions of nameplates or access doors.

C. Starters.

1. Magnetic motor starters for all equipment shall be furnished under this Specification except those shown to be in a motor control center on the Electrical Drawings and those located in factory assembled units.

2. Starters shall be of the appropriate horsepower and voltage, equipped with the proper NEMA enclosures for indoor and NEMA 3R enclosures for outdoor, with thermal overloads, necessary auxiliary contacts, and ambient compensated overloads, one in each leg.

3. A circuit breaker shall be mounted in a common enclosure unless the starter is not mounted within sight of the motor, in which case the disconnecting means shall be a separate device provided by the electrical contractor. Mounted in the starter cover shall be "hand-off-automatic" and "reset" control devices. Magnetic switches shall be of pivoted armature design. Starters shall have auxiliary contacts as required by the control system.

D. Motors.

1. Shall be selected for quiet operation, voltage, and rpm to match the project electrical characteristics. Motors shall be open, drip-proof, normal torque and weatherproofed where indicated or required. Motors shall be of the premium efficiency type.

E. Electrical Coordination

1. Prior to commencing construction arrange a conference with the electrical and mechanical trades as well as equipment suppliers and verify types, sizes, locations, voltage requirements, controls and diagrams of all equipment furnished by them. In writing, inform the Architect that all phases of coordination of this equipment have been covered and if there are any unusual conditions or problems they shall be enumerated at this time.

1.15 FLASHING

A. Whenever any part of the Mechanical System(s) must penetrate the roof or outside wall, the openings shall be flashed and counter-flashed absolutely water tight with minimum 22 gauge galvanized sheet metal, prime coated. Flashing aprons shall extend not less than eight inches (8") from the duct, pipe, or supporting member in all directions unless detailed otherwise. All penetrations shall be flashed following the procedures of the National Roofing Contractor's Association.

1.16 PAINTING

A. Paint all black iron supports, hangers, anchors, etc., and all uninsulated black iron pipe work installed in weather exposed locations with one coat of rust resisting primer.

1.17 ACCESS DOORS AND PANELS

A. Provide access doors as required where equipment, piping, valves, ductwork, etc. are not otherwise accessible. Access doors shall match the wall or ceiling finish and fire rating as indicated on the Architectural drawings or as required to match wall construction. 16-gauge steel frame and 14-gauge steel panel with paintable finish, except in ceramic tile, where panel shall be 16-gauge stainless steel with satin finish. Continuous hinge. Screwdriver latch. Deliver panels to the General Contractor for installation. Provide Zurn Z-1460-4 for square doors and Z-1460-5 for rectangular doors, Karp, or equivalent. Unless otherwise noted , the minimum sizes shall be as follows:

1 valve up to 1-1/2"	12"x12"
1 valve up to 3"	16"x16"
Fire damper, VAV box, coil	16"x16"

1.18 SYSTEM IDENTIFICATION

A. Equipment

1. All equipment shall be identified with a plastic laminated engraved nameplate which bears the unit number marked as indicated on the drawings (e.g. AC-4, WH-1) Provide 1/2" high lettering - white on black background. Nameplates shall be permanently secured to the unit. Air conditioning equipment shall be identified as to area served in compliance with California Mechanical Code.

1.19 DEFINITIONS

A. Provide. The term "provide" as used in these specifications or on the Drawing shall mean furnish and install.

B. Piping. The term "piping" as used in these Specifications or on the Drawings shall mean all pipe, fittings, nipples, valves, unions, hangers, and thermal insulation, etc., as may be required for a complete and functional system.

C. Ductwork. The terms "duct" or "ductwork" as used in these Specifications or on the drawings shall mean all ducts, fittings, joints, dampers, hangers, and thermal insulation, etc., and other devices as may be required to make a complete and functional system.

D. Wiring. The term "wiring" shall include the provision of all necessary products which are required for a complete installation and shall include products such as conduit, electrical boxes, connections, transformers, relays and switches.

1.20 PROJECT CLOSE-OUT

A. Operation and Maintenance Manual for Mechanical Systems

1. Provide three (3) copies of Operation and Maintenance Manuals to the Engineer for review and acceptance. Provide the Owner's designated representative with one copy of the approved O & M manual.

2. Bind Operation and Maintenance Manuals for each Mechanical System (Plumbing, Air Conditioning, etc.) in a hard-backed binder. Cover of each binder shall have the following lettering:

OPERATION
AND
MAINTENANCE
MANUAL
BAKERSFIELD CITY SCHOOL DISTRICT
BESSIE OWENS JUNIOR HIGH SCHOOL
MODERNIZATION

3. Provide a transmittal letter at the beginning of the manual on the Contractor's letterhead. Letter shall be signed by a contractor principal (Owner or Corporate Officer) and shall be countersigned by the Owner's designated representative and shall indicate the date when the mechanical systems were shown and explained in detail to the Owner's designated representative. (The Engineers office shall be notified 48 hours minimum prior to the owner-contractor meeting.)

4. Provide a master index at the beginning of Manual showing items included. Use plastic tab indexes for the sections of the Manual.

5. Section 1, General. Provide:

   a) Name of Architect, Mechanical Engineer, Contractor and Mechanical Sub-Contractor.

   b) A complete list of installed equipment with project mark number, indicating name of vendor, address and phone number.

   c) A sub-section with manufacturer's descriptive literature for each item of installed equipment with model, capacities, and all other pertinent information highlighted.

6. Section 2, Operating instructions. Provide:

   a) General description of each separate system and sub-system.

   b) Step by step procedure to follow in putting each piece of mechanical equipment into operation. Start-up sheets must be signed by the owner of the installing contractor certifying that the start-up has been completed per manufacturer’s written instruction.

   c) Schematic as-built control diagrams for each separate system. Diagrams shall bear the date of the acceptance of the project. Include all temperature control panels and their respective functions.

7. Section 3, Maintenance Instructions. Provide:

   a) Summary list of mechanical equipment used indicating name, model, serial number, and nameplate date of each item together with number and name associated with each system item.

   b) Manufacturer's maintenance instructions for each piece of mechanical equipment installed in project. Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment and maintenance and lubrication instructions.

8. Section 4, Air Conditioning System Balance and Test Run Reports. Provide:

   a) One-half size reproduction of air conditioning plans annotated to match tabulated measurements.

b) Tabulated and summarized measurements.

9. Section 5, Acceptance Test Forms and Installation Certificates. Provide:

   a) One copy of all acceptance test forms and installation certificates completed and signed by the contractor.

10. Section 5, Warranties. Provide:

    a) A copy of each manufacturer's warranty statement, completely filled out and indicating date forwarded to the respective manufacturer.

END OF SECTION 20 05 00

SECTION 22 00 00

PLUMBING

PART 1 - GENERAL

1.1 GENERAL MECHANICAL PROVISIONS

A. The General Mechanical Requirements, spec section 20 05 00, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE

A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:

1. Sanitary sewer system.
2. Domestic water system.
3. Fuel gas system.
4. Drain system (including condensate drains).
5. Demolition as indicated on drawings. Where demolition is called for, remove all equipment, piping, braces, housekeeping pads, supports and related items no longer required. Demo and cap to behind existing walls, floors, or ceilings. Cut and patch back construction to match existing
6. Painting of exposed black steel gas piping with 2 coats of rust inhibiting primer.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Water & Gas:

1. Cold Water Piping:

a. Inside Building, Within Five Feet of Building Walls, and All Above Grade:

1) Hard temper seamless copper, ASTM B88. Wrought copper fittings, ANSI B16.22. Type L with brazed joints (1100F, min.). 1-1/2" and smaller above grade may be soldered, 95-5 tin-antimony solder. All nipples shall be red brass (85% copper).

2) “Pro-Press” fitting system with “L” copper pipe per # 1 above.

2. Gas Piping:

a. Inside Building and All Above Grade: 2" and Smaller: Schedule 40 black steel pipe, ASTM A120/A53. 150 psi black steel malleable iron screwed fittings, ANSI B16.3, ANSI B31.8. 2-1/2" through 6": welded pipe and fittings. ASTM A120/A53. Standard weight carbon steel weld fittings, long radius ells, ANSI B16.9. Flexible connections shall be convoluted yellow brass with dielectric couplings, AGA approved.

3. Valves and Specialties:

a. Valves:

1) General: Manufacturer's model numbers are listed to complete description. Equivalent models of Crane, Milwaukee, Nibco, Stockham or Walworth are acceptable. All valves of a particular type or for a particular service shall be by the same manufacturer. Ball valves may be substituted for 2" and smaller gate valves above grade.

2) Ball Valve: Full port. Bronze or brass body, cap, stem, disk and ball. Screwed connection. Lever handle. TFE seat. O-ring seals. 300 psi WOG. Apollo, Jomar.

3) Plug Valve: Valves in gas piping systems must be UL listed for gas distribution. 4" and Smaller: Eccentric bronze or nickel plated semi-steel plug. Semi-steel body. Bronze bushings. Buna-N-rings. 175 psi WOG. DeZurik Series 400. 1-1/2" and smaller may be full port ball valves. Apollo, Jomar.

b. Miscellaneous Specialties:

1) Union: 2" and Smaller: AAR malleable iron, bronze to iron ground seat. 300 psi. Grinnell. Size 2-1/2" and Larger: Grooved pipe, synthetic gasket, malleable iron housing. Victaulic Style 77, Type "E" gasket.

2) Dielectric Coupling: Insulating union or flange rated for 250 psig. EPCO.

3) Gas Pressure Reducing Valve: Capacity and pressure ratings as indicated on drawings. American Meter.

B. Drain Piping (including Condensate):

a. Above Grade - Same as inside building cold water piping.

b. Piping below grade to be schedule 80 PVC.

C. Miscellaneous Piping Items:

1. Pipe Support:

a. Pipe Hanger: Steel "J" hanger with side bolt for piping 4" and smaller; steel clevis hanger for piping 5" and larger. Load and jam nuts. Size and maximum load per manufacturer's recommendation. Felt liner for copper piping. Hanger and rod shall have galvanized finish. B-Line, Grinnell, Unistrut.

b. Isolating Shield: Galvanized steel shell and reinforcing ribs. 1/4" non-conducting hair felt pad. Pipe hanger in accordance with paragraph above. Increase hanger size per manufacturer's recommendation. B-Line, Semco, Superstrut.

c. Construction Channel: 12-gage, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. B-Line, Grinnell, Unistrut.

d. Pipe Block: 100% recycled rubber pad with reflective strips on each side, 1” gap between multiple block systems, 12 gauge strut channel bolted to block, adjustable hinge fitting for sloped roofs. Cooper B-Line DB6 series.

2. Flashing: Vent and other piping flashing shall be prefabricated galvanized steel with16" sq. flange. Provide clamp-on storm collar and seal water tight with mastic.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. General:

1. Piping Layout: Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by the Engineer. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure

unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Vertical lines shall be installed to allow for building settlement without damage to piping. Pipe sizes indicated on the drawings are nominal sizes unless otherwise noted. Provide secondary drain piping where required.

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 suitable or the same alloy as pipe. Brazing filler metal shall have a minimum melting point of 1100F. Welding or brazing shall be performed by a Certified Welder or Brazer as certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.

   c. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.

   d. Electrical Equipment: Piping shall not be run over electrical panels, motor control centers or switchboards.

3. Fittings and Valves:

   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 all sides of automatic valves, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.

   d. Valves: All valves shall be full line size. Provide shut-off valve for each building and each equipment connection. Provide shut-off valve at each point of connection to existing piping. At equipment connections, valves shall be full size of upstream piping, except that gas valves within 18" of the point of connection to the equipment may be the same size as the equipment connection.

e. Valve Accessibility: All valves shall be located so that they are easily accessible. Valves located above ceilings shall be installed within 24" of the ceiling. For situations where this is not practical or where valves are greater than 10' above the floor, chain wheel operators shall be provided. Chain shall extend down to 7' above the floor. All such installations must have prior review by the Engineer.

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. Side beam clamps shall be provided with retaining straps to secure the clamp to the opposite side of the beam. Vertical piping shall be supported with riser clamp at 20' on center (maximum). Support pipe within 12" of all changes in direction. Support individual pipes with pipe hanger. Copper piping systems which protrude through a surface for connection to a fixture stop or other outlet shall be secured with a drop ell, Grinnell No. 9788; nipple through surface shall be threaded brass.

1) Pressure Pipe:

Pipe Size (Inches)	Maximum Spacing* Between Supports (ft.)		
	Copper	Sch. 40 steel	Plastic
1/2	6	6	4
3/4	6	8	4
1	6	8	4
1-1/4	6	10	4
1-1/2	6	10	4
2	10	10	4
2-1/2	10	10	4
3	10	10	4
4	10	10	4

*Based on straight lengths of pipe with couplings only. Provide additional supports for equipment, valves or other fittings. Plastic piping shall be supported per the manufacturer's recommendations. Seismic requirements may reduce maximum spacing.

2) 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. Cold Water Piping: All hot and cold water piping shall have isolating shield; no portion of this piping shall touch the structure without an isolating shield except at anchor points for fixture rough-in.

c. Trapeze: Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for review.

5. Miscellaneous:

a. Escutcheons: Provide chrome plated metal 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" annular clearance between sleeve and pipe for piping 3" and smaller, otherwise 2" annular clearance. Piping through walls below grade shall be sealed with Link-Seal.

c. Pipes Passing through Fire Rated Surfaces: Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe or pipe insulation sealed with fire rated materials in accordance with the requirements of the fire authority having jurisdiction.

d. Dielectric Couplings: Dielectric couplings shall be installed wherever piping of dissimilar metals are joined, except that bronze valves may be installed in ferrous piping without dielectric couplings.

B. Water Piping: Connections to branches and risers shall be made from top of 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. Minimum pipe size shall be 3/4", unless otherwise noted. Exposed fixture stops and flush valves shall be installed with brass nipples for copper piping and galvanized nipples for galvanized piping. Nipples are to extend from outside of wall to fitting at header or drop behind finish wall surfaces. Pipe nipples shall be same size as stop or flush valve. Provide shut off for each building and each connection to equipment. Provide water hammer arrestor with ball valve and screwdriver locked access panel where noted on drawings and upstream of quick-closing manual valves, solenoid valves and flush valves. Only equipment mounted on vibration isolators shall be connected with flexible connections. Underground hot water and cold water piping which run parallel to each other shall be installed a minimum of 3 feet apart.

C. Gas Piping: Installation shall comply with CPC and NFPA 54 (National Fuel Gas Code). Shall be pitched to drain to dirt legs at low points. No unions shall be installed except at connections to equipment. Provide shutoff and dirt leg at each equipment connection. Only equipment mounted on vibration isolators shall be connected with flexible connectors. Under floor piping shall be sleeved and vented.

D. Drain Piping (Including Condensate): Install with constant pitch to receptacle, 1/4" per foot where possible, otherwise 1/8" per foot minimum. Provide TEE with clean-out plug at all changes of direction. Provide trap at each air handling unit to prevent air leakage. Only equipment mounted on vibration isolators shall be connected with flexible connection.

3.2 PIPING INSULATION INSTALLATION:

A. Cold Water Piping-Freeze Protection: All cold water piping exposed to weather shall be wrapped with insulating tape, 50% overlap. Cover valves to stem. Apply at least two coats of protective finish.

3.5 TESTS AND ADJUSTMENTS

A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Engineer. 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 all work 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.

B. Gravity Systems:

1. Sanitary Sewer: All ends of the sanitary sewer system shall be capped and lines filled with water to the top of the highest vent, 10' above grade minimum. This test shall be made before any fixtures are installed. Test shall be maintained until all joints have been inspected, but not less than 2 hours.

2. Drains (Including Condensate): Similar to Sanitary Sewer.

3. Roof Drain Piping: Similar to Sanitary Sewer.

END OF SECTION 22 00 00

SECTION 260519 - LOW-VOLTAGE POWER CONDUCTORS AND CABLES

PART 1 - GENERAL ELECTRICAL

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. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

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

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

C. Copper Conductors: Comply with NEMA WC 70.

D. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN-THWN, and XHHW.

2.2 CONNECTORS AND SPLICES

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.

4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

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

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

I. Class 1 Control Circuits: Type THHN-THWN, in raceway.

J. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.

C. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.

    a. Uninterruptible power supply system.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.

    a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Grounding systems and equipment.

B. Section includes grounding systems and equipment, plus the following special applications:

1. Underground distribution grounding.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.
5. Grounding for sensitive electronic equipment.

B. Qualification Data: For qualified testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NFPA 70B

a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
b. Include recommended testing intervals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.

5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet (19 mm by 3 m) in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100

mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

H. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.

1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches (600 mm) from building's foundation.

I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 3/0 AWG.

1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.5 LABELING

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

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

B. Comply with NFPA 70.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
4. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Hilti Inc.
2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

    a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Cooper B-Line, Inc.; a division of Cooper Industries.
        2) Empire Tool and Manufacturing Co., Inc.
        3) Hilti Inc.
        4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        5) MKT Fastening, LLC.

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

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.

6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete.

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

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

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Qualification Data: For professional engineer.

C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Tube & Conduit; a Tyco International Ltd. Co.
2. O-Z/Gedney; a brand of EGS Electrical Group.
3. Southwire Company.
4. Thomas & Betts Corporation.
5. Wheatland Tube Company; a division of John Maneely Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

G. EMT: Comply with ANSI C80.3 and UL 797.

H. FMC: Comply with UL 1; zinc-coated steel.

I. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

J. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

   a. Material: Steel.
   b. Type: compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

K. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.
6. Condux International, Inc.
7. Electri-Flex Company.
8. Kraloy.
9. Lamson & Sessions; Carlon Electrical Products.
10. Niedax-Kleinhuis USA, Inc.
11. RACO; a Hubbell company.
12. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. ENT: Comply with NEMA TC 13 and UL 1653.

D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

E. LFNC: Comply with UL 1660.

F. Rigid HDPE: Comply with UL 651A.

G. Continuous HDPE: Comply with UL 651B.

H. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.

I. RTRC: Comply with UL 1684A and NEMA TC 14.

J. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

K. Fittings for LFNC: Comply with UL 514B.

L. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard

Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman; a Pentair company.
3. Mono-Systems, Inc.
4. Square D; a brand of Schneider Electric.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Technologies Company; Cooper Crouse-Hinds.
2. EGS/Appleton Electric.
3. Hoffman; a Pentair company.
4. Hubbell Incorporated; Killark Division.
5. O-Z/Gedney; a brand of EGS Electrical Group.
6. RACO; a Hubbell Company.
7. Thomas & Betts Corporation.
8. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

J. Gangable boxes are prohibited.

K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Fiberglass.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

L. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings.

3. Standard: Comply with SCTE 77.
4. Configuration: Designed for flush burial with integral closed bottom unless otherwise indicated.
5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
7. Cover Legend: Molded lettering, "ELECTRIC.".
8. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
9. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.6 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C)

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches (300 mm)of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m)intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from ENT to GRC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

Q. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

V. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
d. Attics: 135 deg F (75 deg C) temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to 2016 CBC-11B requirements. Install boxes with height measured to center of box unless otherwise indicated.

Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

AA. Locate boxes so that cover or plate will not span different building finishes.

BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earthwork" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 312000 "Earthwork."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits but a minimum of 6 inches (150 mm) below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install handholes with bottom below frost line.

E. 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. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.
2. Handholes and boxes.

1.3 DEFINITION

A. RNC: Rigid nonmetallic conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Duct-bank materials, including separators and miscellaneous components.
2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Accessories for manholes, handholes, boxes, and other utility structures.
4. Warning tape.
5. Warning planks.

B. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:

1. Duct entry provisions, including locations and duct sizes.
2. Cover design.
3. Grounding details.

4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.5 INFORMATIONAL SUBMITTALS

A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.

1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
2. Drawings shall be signed and sealed by a qualified professional engineer.

B. Product Certificates: For concrete and steel used in precast concrete handholes, as required by ASTM C 858.

C. Qualification Data: For professional engineer and testing agency.

D. Source quality-control test reports.

E. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Comply with ANSI C2.

C. Comply with NFPA 70.

1.7 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 and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Architect and Owner no fewer than seven days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

1.9 COORDINATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Furnish cable-support stanchions, arms, insulators, and associated fasteners in quantities equal to 5 percent of quantity of each item installed.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. ARNCO Corp.
2. Beck Manufacturing.
3. Cantex, Inc.
4. CertainTeed Corp.; Pipe & Plastics Group.
5. Condux International, Inc.
6. ElecSys, Inc.
7. Electri-Flex Company.
8. IPEX Inc.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT; a division of Cable Design Technologies.
11. Spiraduct/AFC Cable Systems, Inc.

C. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."
3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches (300 by 600 by 76 mm) in size, manufactured from 6000-psi (41-MPa) concrete.

    a. Color: Red dye added to concrete during batching.
    b. Mark each plank with "ELECTRIC" in 2-inch- (50-mm-) high, 3/8-inch- (10-mm-) deep letters.

2.3 PRECAST CONCRETE HANDHOLES AND BOXES

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Christy Concrete Products.
2. Oldcastle Precast Group.
3. Riverton Concrete Products; a division of Cretex Companies, Inc.
4. Utility Concrete Products, LLC.

C. Comply with ASTM C 858 for design and manufacturing processes.

D. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

1. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.

    a. Cover Hinges: Concealed, with hold-open ratchet assembly.
    b. Cover Handle: Recessed.

2. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
3. Cover Legend: Molded lettering, As indicated for each service.
4. Configuration: Units shall be designed for flush burial and have integral closed bottom, unless otherwise indicated.
5. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.

    a. Extension shall provide increased depth of 12 inches (300 mm).
    b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

6. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.

    a. Windows shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
    b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.

c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.

7. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

   a. Type and size shall match fittings to duct or conduit to be terminated.
   b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.

8. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.4 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or the manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-80-PVC, in direct-buried duct bank, unless otherwise indicated.

B. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.

C. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, installed in direct-buried duct bank, unless otherwise indicated.

D. Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.

3.2 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:

1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.
3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.
4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.

3.3 EARTHWORK

A. Excavation and Backfill: Comply with Section 312000 "Earthwork," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Section 017329 "Cutting and Patching."

3.4 DUCT INSTALLATION

A. 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.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches (1220 mm), both horizontally and vertically, at other locations, unless otherwise indicated.

C. Joints: Use solvent-cemented 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 same plane.

D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) ducts, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
3. Grout end bells into structure walls from both sides to provide watertight entrances.

E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet (3 m) outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition.

F. 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 (1.03-MPa) hydrostatic pressure.

G. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in ducts, including spares.

H. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent displacement during backfill

and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches (150 mm) between tiers.

3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Section 312000 "Earthwork" for pipes less than 6 inches (150 mm) in nominal diameter.
4. Install backfill as specified in Section 312000 "Earthwork."
5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches (100 mm) 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, make final duct connections at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earthwork."
6. Install ducts with a minimum of 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and signal ducts.
7. Depth: Install top of duct bank at least 36 inches (900 mm) below finished grade, unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
10. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

11. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried ducts and duct banks, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional planks 12 inches (300 mm) apart, horizontally.

3.5 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Precast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C 891, unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Install handholes with bottom below the frost line.
2. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
3. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

D. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes 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 chimneys after mortar has cured at least three days.

E. Dampproofing: Apply dampproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, dampproof joints and connections and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.

F. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

G. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches (98 mm) for manholes and 2 inches (50 mm) for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

3.6 GROUNDING

A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. 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 duct. If obstructions are indicated, remove obstructions and retest.
3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.8 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 260543

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.4 FLOOR MARKING TAPE

A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.5 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.

3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Tag: Type IID:

1. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 8 mils (0.2 mm).
3. Foil Core Thickness: 0.35 mil (0.00889 mm).
4. Weight: 34 lb/1000 sq. ft. (16.6 kg/100 sq. m).
5. 3-Inch (75-mm)Tensile According to ASTM D 882: 300 lbf (1334 N), and 12,500 psi (86.1 MPa).

2.6 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.7 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.9 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

J. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A, and 120V to ground: Identify with self-adhesive vinyl label. Install labels at 10-foot (3-m) maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. UPS.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Metal-backed, butyrate warning signs.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer or load shedding.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

    a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
    b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Access doors and panels for concealed electrical items.
    d. Switchboards.
    e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
    f. Emergency system boxes and enclosures.
    g. Enclosed switches.
    h. Enclosed circuit breakers.
    i. Enclosed controllers.

j. Variable-speed controllers.
k. Push-button stations.
l. Power transfer equipment.
m. Contactors.
n. Remote-controlled switches, dimmer modules, and control devices.
o. Battery-inverter units.
p. Battery racks.
q. UPS equipment.

END OF SECTION 260553

SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

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 types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.
2. Buck-boost transformers.

1.3 ACTION SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that transformers, accessories, and components will withstand seismic forces. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Qualification Data: For testing agency.

C. Source quality-control test reports.

D. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

C. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

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

E. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.8 COORDINATION

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. General Electric Company.
2. Square D; Schneider Electric.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Copper.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Cores: One leg per phase.

C. Enclosure: Ventilated, NEMA 250, Type 2.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

D. Transformer Enclosure Finish: Comply with NEMA 250.

1. Finish Color: Gray.

E. Taps for Transformers Smaller Than 3 kVA: One 5 percent tap above normal full capacity.

F. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity].

H. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

I. Energy Efficiency for Transformers Rated 15 kVA and Larger:

1. Complying with NEMA TP 1, Class 1 efficiency levels.
2. Tested according to NEMA TP 2.

J. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.

1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
2. Include special terminal for grounding the shield.
3. Shield Effectiveness:

a. Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.
b. Common-Mode Noise Attenuation: Minimum of minus 120 dBA at 0.5 to 1.5 kHz; minimum of minus 65 dBA at 1.5 to 100 kHz.
c. Normal-Mode Noise Attenuation: Minimum of minus 52 dBA at 1.5 to 10 kHz.

K. Fungus Proofing: Permanent fungicidal treatment for coil and core.

2.4 BUCK-BOOST TRANSFORMERS

A. Description: Self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer. Transformers shall comply with NEMA ST 1 and shall be listed and labeled as complying with UL 506 or UL 1561.

B. Enclosure: Ventilated, NEMA 250, Type 2.

1. Finish Color: Gray.

2.5 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each buck-boost transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.6 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

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

3.2 INSTALLATION

A. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Section 260529 "Hangers and Supports for Electrical Systems."

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

C. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

E. Remove and replace units that do not pass tests or inspections and retest as specified above.

F. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.

1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
2. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.
3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

G. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

C. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262200

SECTION 262413 - SWITCHBOARDS

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. Service and distribution switchboards rated 600 V and less.
2. Transient voltage suppression devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.

4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Include evidence of NRTL listing for series rating of installed devices.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
9. Include diagram and details of proposed mimic bus.
10. Include schematic and wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Seismic Qualification Certificates: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. Include the following:

1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log

graft paper; include selectable ranges for each type of overcurrent protective device.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

C. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Comply with NEMA PB 2.

G. Comply with NFPA 70.

H. Comply with UL 891.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Remove loose packing and flammable materials from inside switchboards and install temporary electric heating (250 W per section) to prevent condensation.

C. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.9 PROJECT CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above

switchboards 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.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
    b. Altitude: Not exceeding 6600 feet (2000 m).

C. Service Conditions: NEMA PB 2, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

D. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect and Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Owner's written permission.
4. Comply with NFPA 70E.

1.10 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Square D Company

B. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

C. Nominal System Voltage: 208Y/120 V.

D. Main-Bus Continuous: 600A.

E. Outdoor Enclosures: Nema 3R

F. Enclosure Finish for Outdoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

G. Barriers: Between adjacent switchboard sections.

H. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

I. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

J. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated, with tin-plated aluminum or copper feeder circuit-breaker line connections.
2. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
3. Ground Bus: 1/4-by-2-inch- (6-by-50-mm-) hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors.
4. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
5. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing

circuit neutral cables. Brace bus extensions for busway feeder neutral bus.

6. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

K. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.

L. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.

2.2 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
    f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

2.3 INSTRUMENTATION

A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:

1. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; wound type; double secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
2. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.

2.4 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

2.5 IDENTIFICATION

A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install switchboards and accessories according to NEMA PB 2.1.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch (100-mm) nominal thickness.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to switchboards.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

E. Install filler plates in unused spaces of panel-mounted sections.

F. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

G. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Switchboard will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.

1.9 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.11 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards 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.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect and Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

1.12 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.13 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
d. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
4. Finishes:

a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Same finish as panels and trim.
c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

5. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.

3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by the following: General Electric, A-Series panel

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. General Electric

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. General Electric

C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
    f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

g. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
h. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
i. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
j. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

C. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

G. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

I. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    c. Instruments and Equipment:

        1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Receptacles with integral surge-suppression units.
4. Isolated-ground receptacles.
5. Weather-resistant receptacles.
6. Communications outlets.
7. Pendant cord-connector devices.
8. Cord and plug sets.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

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

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. TVSS Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand (Pass & Seymour)

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

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

a. Cooper; 5351 (single), CR5362 (duplex).
b. Hubbell; HBL5351 (single), HBL5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).

d. Pass & Seymour; 5361 (single), 5362 (duplex).

B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

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

a. Cooper; IG5362RN.
b. Hubbell; IG5362.
c. Leviton; 5362-IG.
d. Pass & Seymour; IG5362.

2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

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

a. Cooper; VGF20.
b. Hubbell; GFR5352L.
c. Pass & Seymour; 2095.
d. Leviton; 7590.

2.5 TVSS RECEPTACLES

A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 1449, and FS W-C-596, with integral TVSS in line to ground, line to neutral, and neutral to ground.

1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

B. Duplex TVSS Convenience Receptacles:

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

   a. Cooper; 5362BLS.
   b. Hubbell; HBL5362SA.
   c. Leviton; 5380.
   d. Pass & Seymour; 5362BLSP.

2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.

2.6 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

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

   a. Cooper; CWL520R.
   b. Hubbell; HBL2310.
   c. Leviton; 2310.
   d. Pass & Seymour; L520-R.

2.7 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.8 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.9 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished, Type 302 stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.10 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Uninterruptible Power System: Orange.
3. TVSS Devices: Blue.
4. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Test straight-blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 27 0000

COMMUNICATIONS GENERAL

Part 1 General

1.1 Related Sections

A General

1 This specification section provides general conditions for all division 27 specifications. All contractors working within the division 27 specification shall adhere to this specification.

- Section 27 0258 – Communication Infrastructure Systems
- Section 27 1000 – Structure Cabling System
- Section 27 2000 – Network Electronics – Owner Provided
- Section 27 2300 – Uninterruptible Power Supply System
- Section 27 3000 – Telephone/Voice System – Owner Provided
- Section 27 4100 – Classroom Audio Visual Systems – Owner Provided
- Section 27 5100 – Intercom/Paging/Clock Systems
- Section 27 5200 – Assistive Listening Systems
- Section 28 1600 – Intrusion Detection/Alarm System
- Section 28 2300 – Surveillance Camera System – Owner Provided

1.2 Statement of Work

A General

1 This document describes the requirements for the contractors, products, and installation relating to furnishing and installing the described low voltage systems.

2 The Contractor will provide a bid including all labor, materials, tools and equipment required for the complete installation of work called for on the Construction Drawings and described in the specification sections. It is the responsibility of the Contractor to provide all material necessary to provide a complete and operable system. If the Contractor feels that the system described is incomplete, they must address this in writing to the Owner's Representative before providing a bid.

3 All questions concerning non-specified products and services will be addressed to the Owner's Representative before the Contractor provides a bid. The Owner expects that by accepting the Contractor's bid proposal that the Contractor has provided a competent bid for a complete solution.

4 Product specifications, general design considerations, and installation guidelines are provided in this document. Typical installation details, and mounting details are provided in the Construction Drawings. The successful vendor shall meet or exceed all requirements for the systems described in this document.

1.3 Regulatory References

A The Contractor will comply with the following:

1 Federal:

- National Electrical Code (NEC) 2008 or latest approved
- Chapter 8: "Communications Systems"
- Article 250: "Grounding"

2 NFPA 70 – National Electric Code

3 FCC – Part 15, Part 68

4 ADA – Americans with Disabilities Act

B State of California
1 CCR, Part 2 – California Building Code
2 CCR, Part 3 – California Electrical Code
3 Occupational Safety and Health Act (OSHA)
4 Title 24, Building Standards, State of California
5 Title 19, California Code of Regulations
6 Title 8, Electrical Safety, State of California

C ANSI Standards
1 ANSI C2-2001 National Electrical Safety Code
2 ANSIC80.3 Specification for Zinc-Coated Electrical Metallic Tubing
3 ANSI/UL 797 Electrical Metallic Tubing
4 ANSI/CEA S-83-596-2001 – Fiber Optic Premises Distribution Cable Technical Requirements

D Industry Standards
1 Telecommunications Industry Associations/Electronics Industry Association (TIA/EIA)
- TIA/EIA-568-C Commercial Building Telecommunications Cabling Standard
- TIA/EIA-568-C.1 General Requirements
- TIA/EIA-568-C.2 Balanced Twisted Pair Cabling Components Standard
- TIA/EIA-568-C.3 Optical Fiber Cabling Components Standard
- TIA/EIA-569-A Commercial Building Standard for Telecom Pathways and Spaces
- TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- TIA/EIA-607 Commercial Building Grounding/Bonding
- TIA/EIA-758 Customer Owned Outside Plant Telecommunications Cabling Standard
- TIA/EIA-758-1 Addendum No. 1 to TIA/EIA-758, Customer Owner Outside Plant Telecommunications Cabling Standard

2 National Electrical Manufactures Association (NEMA)
3 Institute of Electrical and Electronic Engineers (IEEE)
- 802.3 (Ethernet)
- 802.3ab (Gigabit Ethernet over 4-pair Category 5e, 6 & 6A or higher)
- 802.3Z (Gigabit Ethernet over Optical Fiber)

4 Underwriters Laboratories Inc. (UL)
5 International Organization for Standardization/International Electromagnetic Commission (ISO/IEC) ISO 11801 Generic Cabling for Customer Premises
6 Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (TDMM 14th Edition or latest)
7 ASCII – American Standard Code for Information Interchange
8 ASTM – American Society for Testing Materials

E Conflict
1 If there is a conflict between applicable documents, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.
2 This document does not replace any code, either partially or wholly. The Contractor must be aware of and comply with all local codes that may impact this project.

Part 2 Contractor Requirements/Qualifications

2.1 Safety and Indemnity

A General

1 The contractor shall be solely and completely responsible for conditions of the job site, including safety of persons and property during performance of work.

2 The Contractor shall ensure that all personnel working in or anywhere on the site shall be provided a hard hat, safety shoes, a face shield or safety goggles, etc. for their protection.

3 No act, service, drawing review or construction observance by the Owner's Representative or any other party employed by the campus is intended to included review or approval of adequacy of the Contractor's safety measures, in, on or near the construction site.

2.2 Contractor Qualifications

A General

1 Each low voltage contractor/sub-contractor shall submit their qualifications to the district prior to award of contracts.

2 Contractor shall have been in business for no less than five (5) years and have installed a minimum of three (3) projects of similar size and scope.

3 A Manufacture Certified Installer shall complete the System installation. The Contractor shall have completed standards based product and installation training. A copy of the Contractor's Manufacture Certified Installed certificate shall be submitted with their submittal.

4 Sub-Contractor Qualifications

- All Contractors shall submit a list of at least three (3) projects of similar dollar volume completed within the past 24 months for reference purposes.
- The Contractor shall compile detailed information relating to similar work completed, including corporate references sufficient to enable the Owner to evaluate and agree to the Contractor' responsibility, experience and capacity to perform the work.
- Each Contractor to perform telecommunications work on this project shall possess a C-10 or C-7 (formerly C-6) Limited Specialty License for Telecommunications and must be certified for installation, termination, splicing, and testing of copper cables, fiber optic cable, riser cable and inside wiring. The appropriate contractor's license for underground construction and conduit installation is also required.
- An on-site Contractor superintendent must be available at all times. Contact can be by person or telephone.

5 Contractors who do not meet the minimum requirements specified will not be accepted.

2.3 Quality Assurance

A General

1 Contractors are required to comply with the following without exception.

2 The winning Contractor will assign this project to a competent Project Manager who has demonstrated their ability to supervise a telecommunications project of the same size and scope.

- The Contractor will make this person available to the Owner/Owner's Representative before the start of this project for an interview. This person must be deemed acceptable by the Owner and/or their Representative before work can begin.

- Project Manager will be required to be available for scheduled on-site project meetings at no additional cost to the Owner.
- Project Manager will be required to be available to meet on-site with the Owner/Owner's Representative with a minimum of 24 hours' notice for non-emergency issues, and a minimum of 4 hours for emergency issues at no additional cost to the Owner.

3 All material and equipment to be installed on this project shall be "new". If the Owner/Owner's Representative discovers that "used" material or equipment has been installed on this project, the Contractor will be required to replace said materials and/or equipment with "new" products as no additional cost to the Owner.

- "New" – Materials and products manufactured within one (1) year prior to installation, and meet or exceed the latest published specifications of the manufacture. Also these materials and equipment may not have been in use before installation on this project unless directed otherwise in the project documents.

Part 3 Documentation

3.1 Products

A Pre-Approved Equals

1 All pre-approved products shall be listed in the relevant specification section.

B Other Products

1 Contractors wishing to approve a system other than those specified in this document will be required to perform the following:
- Provide system specifications and cut sheets for all system components for the proposed new system(s).
- Provide an itemized comparison to each of the system functions as described in this specification. Include in that document how the proposed system compares to the specified system described in this document on a line-by-line basis, using one of the following three criteria:
  - "exceeds"
  - "matches"
  - "unequal"

2 All other products than those specifically addressed in the bid documents the Contractor is seeking approvals for must be received by the Owner's Representative no later than 10 business days before the bid date. All Approved Equals will be published in addendum form prior to the bid date.

3 Failure to receive written approval for products installed that deviate from the products called for in the specifications and/or in the project drawings, will result in the Contractor replacing the unapproved materials and equipment with the originally specified products at no additional cost to the Owner.

4 All proposed system documentation must be sent to the Owner's Representative via one of the following: mail, fax, or email. The Contractor will include the project name, their contact information, and the specification section number that the proposed system is comparable to.

3.2 Submittal Documentation

A General

1 The successful Contractor shall provide their submittal package in accordance with Section 01 20 00 1.06 Submittal Schedule.

B The Submittal Package will include:
1 All documentation given will be on a digital media device (USB thumb drive or CD/DVD)
2 A coversheet on the Contractor's Company Letterhead including:
- Contractor's Name
- Contractor's License Number
- The Project Name
- The specification Number and Description
- The date documentation was submitted.

3 A spreadsheet with a full material list of products, equipment and software included in the Contractor's bid price. The items on the spread sheet shall be in the same order as listed in the specifications. The spreadsheet will include:
- Manufactures Name
- Part Number
- Description
- Quantity to be installed for each part

4 A legible copy of the Manufacture's Catalog Cut sheet for each part included in the Contractor's Bid.
- The catalog cut sheets shall be placed in the same order as shown on the spread sheet.
- The catalog cut sheets shall have the specified part numbers clearly highlighted.

5 Copies of the Manufacture's Certification for a minimum of the Project Foreman and 50% of the installation crew.
6 The Contractor will provide a sample for each cable identifier to be used on the project. Labeling schemes can be found in the installation details.
7 When submitting multiple submittal sections for review, the contractor shall create digital bookmarks at each specifications section change. The digital book marks shall be easily identified and easily accessible through all standard PDF viewing software (i.e. Adobe, BlueBeam).

C LEED/CHIPS/HPSA (when applicable to the project, provide additional submittal information)
1 Recycled content, segregated by per- and post-consumer percentages.
2 Rapidly renewable material content.
3 VOC Content
4 Distances from site to follow material process locations.
- Raw material harvest, collection or extraction
- Product of component fabrication
- Final materials manufacture, if different than component fabrication.

3.3 Acceptance
A Project Acceptance
1 The Owner and the Contractor shall accept the project as complete based on the following criteria:
- Before executing any performance testing, the Contractor shall present a test plan to the Owner's Representative for their approval.
- The Contractor has completed all testing and delivered copies of all test resulting the Owner's Representative.
- All test results have been examined and approved by the Contractor and Owner's Representative.
- Copies of all documentation required by [close out documents section] have been delivered to the Owner's Representative.

- All punch list items are completed to the satisfaction of the Inspector of Record.
- Manufacturer Warranty Certification Certificates are provided to the Owner.

2 Following completion and/or compliance with the requirements listed above, the Contractor shall issue a Notice of Completion confirming that the project is complete. A 45-day acceptance period shall begin immediately following the issuance of the Notice of Completion.

3 Minor failures shall be responded to at the Owner's discretion or within one (1) business day.

3.4 Warranty

A Manufacturer Warranty

1 The installed 27 1000 Structured Cabling (as applicable for given cable media) System, including both inter-building and intra-building sub-systems, shall be warranted by a manufacturer for a minimum of 15 years.

2 The warranty certified systems will be complete systems comprised of products from a single manufacturer for the entire channel (cords, outlets/connectors, cables, cross-connects, patch panels, etc.). The manufacturer shall administer a follow on program through the Contractor to provide support and service to the Owner. In the event that the certified systems cease to support the certified application(s), whether at the time of cutover, during normal use, or when upgrading, the manufacturer and Contractor shall commit to promptly implement corrective action.

3 The Contractor shall be responsible for correcting any problems and malfunctions that are warranty related for the entire warranty period. In the event that a Contractor should not be in business at the time of an issue, the manufacturer shall be responsible for all corrections, if deemed the responsible party.

4 Copies of an extended material warranties shall be passed through to the Owner.

B Contractor Warranty

1 Contractor must warranty all materials, equipment and labor for a minimum of one (1) year from the Owner's acceptance of the work.

- Warranty will provide repair/replacement of all defective or improperly installed materials at no additional cost to the Owner (including labor, travel time/expenses, shipping, taxes, etc.).
- Contractor is required to keep in stock replacement parts for all items covered in this specification and provide a competent service technician to be on site to repair/replace defective items no later than 24 hours after receiving a trouble call.

2 Warranty will cover normal business hours, 8am-5pm, Monday through Friday. All calls received on a Friday or the day before a holiday will be held until the following regular business day.

3 During the installation and up to the date of final acceptance, the Contractor shall protect all finished and unfinished work against damage and loss. In the event of such damage or loss, the Contractor shall replace or repair such work at no cost to the Owner or any other Trade Partnership working on the project.

3.5 Close-Out Documentation

A Structured Cabling

1 Upon completion of the installation, the telecommunications contractor shall provide two (2) full documentation sets to the Owner's Representative for approval. One (1) to be a hard copy and one (1) to be an electronic copy. Documentation shall include the items detailed in the sub-section below.

- Documentation shall be submitted within thirty (30) days of the completion of each construction phase. This is inclusive of all test results and draft as-built

drawings. Draft as built drawings must include annotations of any changes to the original plans. Machine generated final copies of all drawings shall be submitted within thirty (30) calendar days of the completion of each testing phase. At the request of the Owner's Representative, the telecommunications contractor shall provide copies of the original test results.

- The As-Built drawing are to include conduit routes, utility vault/pull box locations, surface mount enclosure locations, PVC to GRC transition points and the approved labeling identifiers. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronics (DWG, AutoCAD 2008) formats on which as built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.
- The Owner's Representative/Engineer can request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Owner's Representative/Engineer, up to and including 100% re-test. Any re-testes shall be at no additional cost to the Owner.
- Test Result documentation shall be provided in two media, as listed above, one (1) hard copy and one (1) digital copy, within thirty (30) days after the completion of the project. The documentation shall be clearly marked on the outside front cover with the words 'Project Test Documentation', the project name and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) ID, measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, a bi-annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
- Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package.
- When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

B Audio Visual Systems

1 Upon completion of the installation, the contractor shall provide two (2) full documentation sets to the Owner's Representative for review, one (1) copy to be a hard copy and one (1) to be an electronic copy. Documentation shall include the items detailed in the sub-sections below:

- Documentation shall be submitted within ten (10) days of the completion of each testing phase. This includes system single line drawings, maintenance and operations manuals and all warranty information.
- The Device Information documents are to be in Excel spreadsheet format. Each device installed will have individual information entered in the spreadsheet including:
- Manufacture and Model of each device
- Physical location (may include a digital picture) and mount type
- Serial number of the device

- Firmware revision installed
- Address and contact information of the responsible staff.
- Each Device Configuration document shall be provided in both an electronic and text document format. One (1) to be a hard copy and one (1) to be an electronic copy. The Device Configuration documents are to be in a text file format. Each device installed will have the following configuration information included (where applicable):
- Manufacturer and Model of device
- Current installed (running) configuration
- Firmware revision installed
- Installed modules, blades, or accessories
- All System source codes and passwords must be handed over to, and become property of the Owner upon completion of this project.

2 As-Built Drawings
- The As-Built drawings are to include Rack Elevations, Back Board Layout, Equipment Layout and System Single Line Drawings.

C Intercom/Paging/Clock Systems

1 Upon completion of the installation, the contractor shall provide two (2) full documentation sets to the Owner's Representative for review, one (1) copy to be a hard copy and one (1) to be an electronic copy. Documentation shall include the items detailed in the sub-sections below:
- Documentation shall be submitted within ten (10) days of the completion of each testing phase. This includes system single line drawings, maintenance and operations manuals and all warranty information.
- The Device Information documents are to be in Excel spreadsheet format. Each device installed will have individual information entered in the spreadsheet including:
- Manufacture and Model of each device
- Physical location (may include a digital picture) and mount type
- Serial number of the device
- Firmware revision installed
- Address and contact information of the responsible staff.
- Each Device Configuration document shall be provided in both an electronic and text document format. One (1) to be a hard copy and one (1) to be an electronic copy. The Device Configuration documents are to be in a text file format. Each device installed will have the following configuration information included (where applicable):
- Manufacturer and Model of device
- Current installed (running) configuration
- Firmware revision installed
- Installed modules, blades, or accessories
- All System source codes and passwords must be handed over to, and become property of the Owner upon completion of this project.

2 As-Built Drawings
- The As-Built drawings are to include Rack Elevations, Back Board Layout, Equipment Layout and System Single Line Drawings.

D Intrusion Alarm System

1 Upon completion of the installation, the contractor shall provide two (2) full documentation sets to the Owner's Representative for review, one (1) copy to be a hard copy and one (1) to be an electronic copy. Documentation shall include the items detailed in the sub-sections below:

- Documentation shall be submitted within ten (10) days of the completion of each testing phase. This includes system single line drawings, maintenance and operations manuals and all warranty information.
- The Device Information documents are to be in Excel spreadsheet format. Each device installed will have individual information entered in the spreadsheet including:
- Manufacture and Model of each device
- Physical location (may include a digital picture) and mount type
- Serial number of the device
- Firmware revision installed
- Address and contact information of the responsible staff.
- Each Device Configuration document shall be provided in both an electronic and text document format. One (1) to be a hard copy and one (1) to be an electronic copy. The Device Configuration documents are to be in a text file format. Each device installed will have the following configuration information included (where applicable):
- Manufacturer and Model of device
- Current installed (running) configuration
- Firmware revision installed
- Installed modules, blades, or accessories
- All System source codes and passwords must be handed over to, and become property of the Owner upon completion of this project.

2 As-Built Drawings

- The As-Built drawings are to include Rack Elevations, Back Board Layout, Equipment Layout and System Single Line Drawings

END OF SECTION

SECTION 27 0528

COMMUNICATIONS PATHWAYS

Part 1 General

1.1 Statement of Work

A General

1 This document describes the requirements for the contractors, products and installation relating to furnishing and installing Underground Ducts and Raceway systems. All systems described herein shall be governed by the Division 26xxxx specifications, should these two documents be in conflict the more stringent shall prevail.

2 The locations of vaults and pull boxes on the drawings are approximate and reflect the best information available. The Contractor is responsible for locating all existing utilities within the areas to be excavated prior to excavation. Final location of all trenches, communications utility vaults, and pull boxes must be verified and signed off on by the Owner/Owner's Representative.

3 The contractor shall furnish and install all work necessary to make compete systems, whether or not such details are mentioned in these specifications or shown on the drawings, but which are necessary in order to complete working systems, excepting those portions that are specifically mentioned therein or plainly marked on the accompanying drawings as being installed or supplied by others.

1.2 References

A Regulatory References

1 Contractors will comply with all requirements as specified in Section 27 0000 '1.3. – Regulatory References'.

1.3 Safety and Indemnity

A Requirements

1 Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0000 '2.1 – Safety and Indemnity'.

1.4 Contractor Qualifications

A Requirements

1 Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0000 '2.2 – Contractor Qualifications'.

1.5 Quality Assurance

A Requirements

1 Contractors shall comply with all requirements as specified in Section 27 0000 '2.3 – Quality Assurance'.

1.6 Equivalent Products

A Approved Products

1 All products described, and part numbers given in this specification are those of Leviton, Superior Essex and Cooper B-Line unless otherwise noted.

B Pre-Approved Equals
1 Utility Vault Company, Christy Concrete, BES
2 Hoffman, B-Line, Circle AW
3 Carlon, Allied Tubing, MaxCell
4 RANDL Inc., Thomas & Betts, Bridgeport, Appleton, Erico, Minerallac
5 Wiremold, Hubbell

C Other Than Approved Products
1 Contractors wishing to approve a system other than those specified in this document shall do so in accordance with Section 27 000 '3.1 Products'.

1.7 Submittal Documentation
A Requirements
1 The successful contractor shall provide their submittal package in accordance with the Section '01 20 00 – Submittal Schedule' and Section 27 0000 '3.2 – Submittal Documentation'.

1.8 Acceptance
A Requirements
1 The contractor shall comply with all requirements as listed in Section 27 0000 '3.3 – Acceptance'.

1.9 Warranty
A Requirements
1 The contractor shall comply with all requirements as listed in Section 27 0000 '3.4 – Warranty'.

Part 2 Products

2.1 Pathways and Fittings
A Communication Underground Boxes
1 Communication Pull Boxes
- Provide separate pre-cast concrete pull boxes, with lids labeled "communications" (for TV, telephone, data, security).
- Type equal to "Christy N16, N30, N40, N44" steel reinforced solid concrete box, concrete lid & 12" extension box shall be used. See project drawings for locations & additional requirements.
- Shall be constructed out of 3000 PSI steel reinforced concrete.
- Install on 6" gravel pad and provide drain. See project details for more info.
- Pull boxes in traffic areas and along roads shall be designed and installed for H20-44 loading.
- Pull boxes shall be located and provided with grade rings as necessary to ensure that water is drained from conduits.
- Pull boxes shall be installed to minimize surface drainage entry as follows:
  - Pull boxes should not be located in paths or streets. If such location cannot be avoided, pull boxes should not be located in low spots or drainage channels.

- Pull boxes not located in paths or streets should be installed so that the top is approximately 2" above final grade.
- All pull boxes shall be installed with a mow strip minimum of 6”.
- Non-slip lids shall be provided for pull boxes in sidewalk areas. Use concrete or fiberglass-no metal lids in sidewalks.
- Quantity: Contractor will provide pull boxes and covers in the sizes and quantities as shown on the drawings

2 Communication Vaults

- Provide separate pre-cast concrete vault, with lids labeled "communications" (for TV, telephone, data, intrusion alarm).
- Vaults shall be equipped with a cable racking on the long walls suitable to support large copper cables as called for on the design documents.
- Vaults shall include; Anchorage, Lifting Inserts and Racking Devices.
- All Vaults shall be equipped with traffic-rated lids with a locking mechanism. All lids shall have the identification marking of “Communications” permanently affixed to the cover.
- All pull boxes shall be installed with a mow strip minimum of 12”.
- Quantity: Contractor will provide vaults and covers in the sizes and quantities as shown on the drawings.
- Standard Vault size 24”x36”x36” equal to Old Castle 2436-STD
- Large Vault size 36”x60”x36” equal to Old Castle 3660-STD

3 Communication Vault Accessories

- UNDERGROUND CABLE RACK HOOKS
- Lite Duty Extension
  - Formed from 3/16-inch steel
  - Hot dipped galvanized per ASTM A123 / A153
  - Smooth top surface to protect cables from damage
  - Insulator 11A31 fits these hooks
  - Part numbers Inwesco or equal

Catalog Number	Extension from Face of Rack
10A35	4”
10A36	7-1/2”
10A37	10”
10A38	14”
10A39	18”

- Heavy Duty Extension
  - Formed from 10-ga. steel
  - Hot dipped galvanized per ASTM A123 / A153
  - Unique design locks hook into rack
  - Part numbers Inwesco or equal

Catalog No.	Extension from Face of Rack
10C38	14”

- J-Hook Cradle
  - Curved design to cradle cable
  - Available in fusion bonded epoxy coated steel
  - Available in injection molded ABS plastic
  - Steel used is 1/4-inch-thick x 15/16 inch wide
  - ABS plastic hooks are 1-3/8 inch wide
  - ABS plastic hooks furnished with locking tab
    Part numbers Inwesco or equal

Catalog No.	Type	Extension from Face of Rack
10A60	Coated Steel	2-1/2”
10B60	Plastic	2-1/2”
10A61	Coated Steel	5”
10B61	Plastic	5”

4 Surface-Mounted Entrance Cabinets Type 1 & 12
- The Contractor shall provide a minimum of a NEMA 1 type enclosure that meets the UL 50, File No. E27567: Type 1 NEMA/EEMAC Type 1 CSA, File No. LL42184: Type 1 IEC 60529, IP30 standards for indoor applications.
- The Enclosure shall be constructed from 16 awg galvanized steel, with a drip shield top and seam free side, front and back.
- The Enclosure shall have a “slip-on” removable front cover held in place with steel screws.
- Enclose shall incorporate pre-punched knockouts for standard trade size conduits up to 1”.
- The size of cabinets mounted on an outside wall to serve a smaller building shall be as indicated on the construction plans.
- Quantity: Contractor will provide boxes in the sizes and quantities as shown on the drawings.

5 Surface-Mounted Entrance Cabinets Type 3R and 4X
- The Contractor shall provide a minimum of a NEMA 3R type enclosure that meets the UL 50 for outdoor applications.
- The Enclosure shall be constructed from 16 awg galvanized steel, with a drip shield top and seam free side, front and back.
- The Enclosure shall have a “slip-on” removable front cover held in place with steel screws.
- Enclose shall incorporate pre-punched knockouts for standard trade size conduits up to 1”.
- The size of cabinets mounted on an outside wall to serve a smaller building shall be as indicated on the construction plans.
- Quantity: Contractor will provide boxes in the sizes and quantities as shown on the drawings.

B Metallic Pull Boxes and Terminal Cans

1 NEMA Type 1 – Screw Cover Cans
- Used for indoor use only
- NEMA/EEMAC Type 1, IEC 60529, IP30
- UL 50, 50E Listed; Type 1; File No. E27525, cUL Listed per CSA C22.2 No 40; Type 1; File No. E27525
- 16, 14 or 12-gauge steel or plated steel
- ANSI 61 gray polyester powder paint finish inside and out.
- Minimum size 6x6x4
- Pre-Approved Sizes
- Hoffman ASE6X6X4, ASE10X10X4, ASE12X12X4, ASE18X12X4, ASE18X18X4
- Hoffman ASE6X6X6, ASE10X10X6, ASE12X12X6, ASE18X12X6, ASE18X18X6, ASE24X18X6, ASE24X24X6
- Provide “NK” for No Knock-Outs as required.
- Provide “AFE” Flush Covers as required.
- Provide “AFDF” Flush Doors on all cans in user accessible areas IE; Data Closets, Electrical Rooms, Janitor Rooms, and Mechanical Rooms.
- Provide “ACLFDF” Lock Kits for all cans in student areas.

2 NEMA 3R Terminal Cans
- Used for outdoor use under-eve, breezeway or parapet

- NEMA/EEMAC Type 3R, IEC 60529, IP32
- UL 50, 50E Listed; Type 3R; File No. E27567, cUL Listed per CSA C22.2 No 94; Type 3R File No. E27567
- 16-gauge galvanized steel
- ANSI 61 gray polyester powder paint finish inside and out over galvanized steel.
- Minimum size 12x12x6
- Hoffman A12R126HCR, A18R186HCR, A20R208HCR, A30R308HCR

3 NEMA 4 Terminal Cans

- Used for outdoor use vertical or Horizontal under-eve, breezeway or parapet
- 16 or 14-gauge steel (see table)
- Seams continuously welded and ground smooth
- Stainless steel door clamps on three sides of door
- ANSI 61 gray polyester powder paint finish inside and out over galvanized steel.
- Minimum size 16x16x6
- Hoffman A16H16ALP, A20H20ALP, A24H24ALP, A36H24ALP

C Conduit

1 Rigid Steel Conduit

- Rigid steel conduit shall comply with Underwriter's Laboratories UL-6 Specification, ANSI C80.1 and Federal specification WW-C-581E or latest revisions. Conduit shall be hot dip galvanized on the exterior, with zinc or enamel on the interior.
- Couplings, locknuts, and all other fittings shall be galvanized or sheardized, waterproof and threaded type only. Rigid conduit shall terminate with two locknuts; one outside and one inside enclosures and specified bushings. No running threads or chase nipples shall be issued without approval.
- Bushings shall be non-metallic for 1 inch and smaller and insulated metallic for conduits larger than 1 inch.
- **Galvanized rigid steel conduits (GRC)** way be used in all locations. For underground runs in direct contact with earth, conduit shall be wrapped in10mil PVC tape or shall be factory PVC-over-GRS conduit.
- **Intermediate metallic conduit (IMC)** may be used indoor and outdoor locations, not underground.

2 Electrical Metallic Tubing (EMT)

- EMT conduit shall comply with Underwriter's Laboratories UL 797, ANSI C80.3 and Federal Specification WW-C-563 or latest revision. EMT shall be galvanized or sheardized.
- Couplings and connectors for EMT shall be galvanized or cadmium plated and shall be of the compression type requiring the tightening of a nut on a gland ring. No die cast type shall be allowed. All connections shall have permanent insulated throats.
- **Electrical metallic conduit (EMT)** may be used indoor and outdoor locations, not underground, not in areas subject to physical damage, not in concrete slabs, not in hazardous areas, not in masonry walls.

3 Schedule 40 PVC:

- The minimum conduit trade size allowed for this project will 2”. Contractor will increase to the next higher trade size if conduit fill ration will exceed 40%.
- Conduit shall be Carlon or equal, rated for use with 90° C conductors, UL Listed or approved equal. Material shall comply to NEMA Specification TC-2 (Conduit), TC-3 (Fittings) and UL 651 (Conduit) and 514b (Fittings).
- Conduit and fittings shall carry a UL label (Conduit - on each 10 foot length; Fittings - stamped or molded on each fitting).

- Conduit and fittings shall be identified for type and manufacturer and shall be traceable to location of plant and date manufactured. The markings shall be legible and permanent.
- The Conduit shall be made from polyvinyl chloride compound (recognized by UL) which includes inert modifiers to improve weatherability and heat distortion. Clean rework material, generated by the manufacturer's own conduit production, may be used by the same manufacturer, provided the end products meet the requirements of this specification.
- The conduit and fittings shall be homogeneous plastic material free from visible cracks, holes or foreign inclusions. The conduit bore shall be smooth and free of blisters, nicks or other imperfections which could mar conductors or Cables.
- Conduit, fittings and cement shall be produced by the same manufacturer to assure system integrity.
- Testing and Acceptance Criteria: Conduit and fittings shall be tested in accordance with the testing requirements defined in NEMA TC-2, NEMA TC-3 and UL-651 and 514. The acceptance criteria shall be given in the same standards.
- All conduit and fittings shall be solvent cemented in applications in accordance with instructions from the manufacturer.
- Conduit Spacers
- High impact spacers shall be used in all multi-conduit duct banks (five or more conduits). The spacers shall conform to NEMA TC-2, TC-6, TC-8, and ASTM F 512.
- Spacers shall be installed and secured following the manufacturer's suggested guidelines, the BICSI CO-OSP Manual, or TIA/EIA 578, whichever is more stringent.

4 Pipe hangers for individual conduits shall be factory made, consisting of a pipe ring and threaded suspension rod. The pipe ring shall be malleable iron, split and hinged, or shall be interlocked with the suspension rod socket.

5 Pipe racks for a group of parallel conduits shall be galvanized structural steel preformed channels of length as required, suspended on threaded rods and secured thereto with nuts above and below the cross bar. All offsets shall be in the same plane and shall be parallel.

6 Factory made pipe straps shall be one-hole malleable iron or two-hole galvanized clamps.

7 Manufacturer: Appleton, Crouse-Hinds, B-Line, Unistrut, T&B, or an approved equivalent product.

8 Conduit Terminations and Plugs

9 All conduits entering a vault or pull box shall be equipped with a bell-end securely attached to the structure.

- All metal conduits shall be equipped with a bushing or end collar to protect cable during placement.
- All unused conduits placed on this project or cleaned and modified by the Contractor shall be equipped with reusable rubber or plastic expansion seal plugs in all utility vaults/pull boxes and within all buildings.

10 Conduit Flexible Type

- Flexible conduit "Steel Flex or Aluminum Flex" may only be used for attic j-box to device connection, where specified in the project drawings or with consent of the owner/consultant representative.
- Liquidtight flexible conduit may only be used where specified in the project drawings or with consent of the owner/consultant representative.
- GRC & IMC fittings shall be galvanized rigid steel threaded type. Provide insulated grounding bushings at all enclosures.

- EMT fittings shall be die cast or steel set screw type for dry locations, die cast or steel compression type for wet locations. Provide insulated grounding bushings at all enclosures.
- PVC fittings shall be schedule 40 or schedule 80, provide adapters at all enclosures and transitions to GRC, IMC or EMT conduits.
- Flexible fittings shall be die cast or steel type.
- Liquidtight fittings shall be steel compression type.
- Provide insulated screw on bushings on all conduit connections.
- Provide insulated push on bushings for all stub-out conduits.
- Quantity: Contractor will provide conduits in the sizes and quantities as shown on the drawings.

11 Textile Innerduct - MaxCell

- Made from White Polyester and Nylon resin polymer
- Standard Outdoor Textile Innerduct: Micro (33mm), 2-inch, 3-inch and 4-inch single or multi-cell polyester/nylon textile innerduct containing 1250lb polyester flat woven pull tape.
- Detectable Outdoor Textile Innerduct: Micro (33mm), 2-inch, 3-inch and 4-inch single or multi-cell polyester/nylon textile innerduct containing 1250lb polyester flat woven pull tape, and a solid copper, polyvinyl color coated conductor (19AWG minimum) for tracing and rated for a minimum of 6 amps and 600 volts. Conductor shall be placed in the sidewall edge fold of the textile sleeve.
- Indoor Textile Innerduct (Riser-listed): Micro (33mm), 2-inch, 3-inch and 4-inch single or multi-cell nylon textile innerduct containing 1250lb polyester flat woven pull tape which meets UL2024A for flame propagation and smoke density values for general applications.
- Plenum-Listed Textile Innerduct: Micro (33mm), 2-inch and 3-inch single or multi-cell nylon textile innerduct containing 200lb nylon-resin flat woven pull tape which meets UL2024A for flame propagation and smoke density values for use in air handling spaces.
- Conduit Plugs: Compression-type conduit plugs with locking nuts for sealing and securing one or more textile innerducts within a 4-inch inside diameter conduit, e.g.: 4-inch plug with nine holes for cables in a 3 pack (9-cell) configuration
- Termination Bags: Inflation-type bags for sealing and securing around one or more textile innerducts and cables within 2-inch outside diameter or larger conduit.
- Pull Tape: measuring and pulling tape constructed of synthetic fiber, printed with accurate sequential footage marks. Color-coded.
- Duct Water Seal: products suitable for closing underground and entrance conduit openings where innerduct or cable is installed, to prevent entry of gases, liquids, or rodents into the structure.
- Approved Textile Innerduct #'s
  MXC4003, MXR4003
  MXC3456, MXP3456, MXR3456
  MXC2003, MXP2003, MXR2003
  MXC2002, MXP2002, MXR2002

D Duct Bank Locating Cable (Detectable Warning Tape)

1 Warning tape

- Warning Tape shall be a minimum of 3" wide, orange in color, 4 mils thick, and shall have an imprint as follows:
  - "Caution Telephone Cable Buried Below" or,
  - "Caution Fiber Optic Cable Buried Below"

E Inter-duct

1 Plenum

- White or orange Kynar PVDF Resin, a fluoropolymer compound.
- Plenum rated flexible optical fiber/communication raceway.
- Provide wire management in a building for fiber optic and data and communications cabling.
- Recognized per NEC Articles, 770 and 800 for Plenum, Riser and General-Purpose Raceway for optical fiber, and telecommunications cables.
- UL Listed
- Meets UL 910 standards for Plenum Optical Fiber/Communications raceways.
- Provide all fittings to form a complete integrated raceway system.
- Extrude raceway from precision extruded PVDF resin
- 1"-2" diameter raceway shall have a 1/4" wide 1250 lb. tensile pull tape preinstalled.
- Shall be available in ¾" through 2" diameters.
- Footage shall be sequentially marked.
- Threaded Aluminum Coupling: Molded Aluminum fitting which connect two pieces of corrugated tubing equipped with threaded ends.
- Quick-Connect Couplings: Molded Part which allows two pieces of 1" diameter corrugated tubing to be quickly snapped together. Available only in 1" diameter.
- Quick-Connect Threaded Male Adapters: Molded fitting which quickly snaps onto a 1" diameter piece of corrugated tubing to produce a threaded end. Available only in 1" diameter.
- Quick-Connect Male Snap-In Adapters: Molded fitting which snaps onto a 1" diameter piece of corrugated tubing to connect to an outlet or switch box. Available only in 1" diameter.
- Metallic Terminal Adapters: Molded metal part which allows a piece of corrugated tubing to connect to metallic conduit and metallic boxes.
- **Spool Length: Varies**, contractor shall field verify prior to ordering.
- Color: Orange
- **Part #: Carlon**
  ¾" CE4X1-1000
  1" CF4X1C-1000
  1-1/4" CG4X1C-900
  1-1/2" CH4X1C-1200
  2" CJ4X1C-1400

2 Riser

- Orange polyvinyl chloride (PVC)
- Riser rated Flexible Optical Fiber/Communication Raceway.
- Provides wire management for fiber optic and data and communications cabling in Riser applications and/or General-Purpose applications within a building or for direct burial or concrete encasement.
- Recognized per NEC Articles, 770 and 800 for Plenum, Riser and General-Purpose applications for optical fiber, and telecommunications cables.
- UL Listed
- Listed under UL 1666 - Standard for Riser Application for Optical Fiber Raceway.
- Provide all fittings to form a complete integrated raceway system.
- Fabricate Raceway from precision extruded PVC resin.
- Kevlar_ pull tape can be preinstalled in the 1" through 2" diameter.
- The footage shall be sequentially marked.
- Shall be available in ¾" through 2" diameters.
- Threaded Aluminum Coupling: molded Aluminum fitting which connect two pieces of corrugated tubing equipped with threaded ends.
- Quick-Connect Couplings: Molded Part which allows two pieces of corrugated tubing to be quickly snapped together. Available only in ½"-1" diameter.

- Quick-Connect Threaded Male Adapters: Molded fitting which quickly snaps onto a piece of corrugated tubing to produce a threaded end. Available only in ½"-1" diameter.
- Quick-Connect Male Snap-In Adapters: Molded fitting which snaps onto a piece of corrugated tubing to connect to an outlet or switch box. Available only in ½"-1".
- Metallic Terminal Adapters: Molded metal part which allows a piece of corrugated tubing to connect to metallic conduit and metallic boxes.
- Schedule 40 Fittings: Molded fitting that is solvent cemented to the raceways. Schedule 40 fittings are commonly used with PVC Schedule 40 rigid conduit.
- **Spool Length: Varies**, contractor shall field verify prior to ordering.
- Color: Orange
- **Part #: Carlon**
  ¾" DE4X1-1000
  1" DF4X1C-1000
  1-1/4" DG4X1C-900
  1-1/2" DH4X1C-1200
  2" DJ4X1C-700

3 General Purpose for use in Underground Conduit
- Orange polyvinyl chloride (PVC)
- General Purpose is nonmetallic flexible raceway for use in General Purpose applications only. It is UL Listed and available with tape pre-installed.
- General Purpose raceway is listed to UL 2024 in accordance with the National Electrical Code per Articles 725, 770, 800 and 820 for General Purpose and other cabling optical fiber/telecommunication applications.
- For use in General Purpose areas per Articles 725, 770, 800 and 820 of the NEC.
- Available in sizes 3/4" through 2"
- Pull tape can be factory pre-installed in 1" through 2"
- Outside Diameters meet IPS Dimensions
- Footage sequentially marked
- **Spool Length: Varies**, contractor shall field verify prior to ordering.
- Color: Orange
- **Part #: Carlon**
  1" BF4X1B-8000
  1-1/4" BG4X1B-5600
  1-1/2" BH4X1B-4500
  2" BJ4X1B-8000

F Outlet Boxes

1 Outlet boxes (voice, data and audio visual)
- All boxes shall be 5 in. Square x 2.875 in. Deep Metal Box with Cable Management minimum. As required provide 4-11/16" square by 2-1/8" deep.
- Volume: 64 in3 (1050 cm3)
- Side Knockouts: (1) 1"& (1) 1-1/4" each side
- Listing: C ETL US; for use on Class 2 and Class 3 Remote-Control, Signaling and Power-Limited Circuits only.
- Provide **varied depth** mud ring as required to allow no more than 1/8" gap between wall materials.
- Any unused outlet or j-box shall be equipped with a blank cover.
- Approved Outlet box shall be RANDL Inc. T-55 series or Hubbell HBL260/263 Large Capacity Wall Boxes

2 Outlet boxes (wall phone, microphone and other devices)
- All boxes shall be 4-11/16" square by 2-1/8" deep minimum.

- Provide **varied depth** mud ring as required to allow no more than 1/8” gap between wall materials.
- Any unused outlet or j-box shall be equipped with a blank cover.

3 Junction boxes
- All boxes shall be 4-11/16” square by 2-1/8” deep minimum.
- Provide **varied depth** mud ring as required to allow no more than 1/8” gap between wall materials.
- Any unused outlet or j-box shall be equipped with a blank cover.

4 Surface Mount boxes
- base has rectangular KO to enable extension from existing single-gang flush wall box and 1/2" and 1" trade size concentric KOs.
- Accepts NEMA Faceplates
  - One-gang - 4 3/4" H x 3" W x 2 3/4" D equal to Wiremold # 2344
  - Two-gang - 4 3/4" H x 4 7/8" W x 2 3/4" D equal to Wiremold # 2344-2

G Floor Boxes

1 Coordinate with Electrical 26xxxx prior to submittal or ordering of boxes.

2 Coordinate cable and outlet quantities prior to submittal or ordering of boxes.

3 Floor boxes provide the interface between power and communication cabling in an on-grade or above-grade concrete floor where power and communication services are required. Boxes shall provide flush or recessed device outlets that will not obstruct the floor area.

4 Provide floor boxes approved for use in concrete floor construction. Boxes shall be approved for above grade (stamped steel) and on grade (cast iron) applications. Floor boxes shall have been examined and tested by Underwriters Laboratories Inc. to meet UL514A and shall bear the appropriate label. Floor boxes shall conform to the standard set in the National Electrical Code. Multi-compartment box shall have been evaluated by UL to meet the applicable U.S. safety standards for scrub water exclusion when used on tile, terrazzo, wood, and carpet covered floors.

5 Boxes shall be available in one-, two-, or three-gang configurations or a single unit with four independent wiring compartments and available in stamped steel and cast-iron versions. Boxes shall be rectangular in shape and available in deep and shallow versions. Boxes shall provide pre- and post-pour adjustments. Multiple gang boxes shall also provide a removable barrier between the individual compartments for greater capacity when required.

6 Multi-Compartment Boxes: Floor boxes shall be manufactured in stamped steel or cast-iron. Box shall be available in shallow version for stamped steel or cast-iron types and deep version for stamped steel type only. Box shall have four independent wiring compartments that allow up to 4 duplex receptacles and/or communications services.
- Boxes shall permit a tunneling feature that will allow internal wiring to various compartments. The box shall provide various size conduit openings.
- Boxes shall be fully adjustable, providing a maximum of 1-7/8-inch pre-pour adjustment, and a maximum of 3/4 inch post-pour adjustment.
- Boxes shall provide a series of device mounting plates that will accept both duplex power devices, as well as plates that will accommodate connectivity outlets and modular inserts. Where indicated, provide connectivity outlets and modular inserts by Wiremold/Ortronics or approved equal.
- Activation covers shall be die-cast aluminum. Cover finish shall be one of the following, as selected:
  - Textured aluminum finish.
  - Powder coat finish, color shall be Black.
  - Powder coat finish, color shall be Brass,
- Activation covers shall be available in flanged or flangeless versions as selected. Covers shall be available with options for tile or carpet inserts, blank covers, or

covers with one or two 1-inch liquid tight openings for furniture feed applications as applicable.
- Pre-Approved Floor boxes shall be equal to **Wiremold RFB-4, RFB6E-OG & RFB-9** series boxes or equal Hubbell System One.
- Contractor shall provide all required entrance fittings & adapter plates for scope of work depicted.

H Poke Thru Floor device
1 Coordinate with Electrical 26xxxx prior to submittal or ordering of boxes.
2 Coordinate cable and outlet quantities prior to submittal or ordering of boxes.
3 Poke Thru boxes provide the interface between power and communication cabling in an above-grade concrete floor where power and communication services are required. Boxes shall provide flush or recessed device outlets that will not obstruct the floor area.
4 Pre-Approved Poke Thru boxes shall be equal to **Wiremold 6ATCFFNK**

I Surface mount raceway “SMR”
1 Non-metallic raceway is an enclosed pathway used for surface distribution of branch circuit electrical wiring, and cabling for voice, data, multi-media, low voltage, and optical fiber. Raceway is typically installed in existing building structures, or after construction is complete. A complete raceway system includes raceway, covers, mounting hardware, various fittings, and outlet boxes installed at specific locations. Specific codes and standards apply to electrical wires and telecommunications cables that are deployed within non-metallic raceway. Codes that are enforced by the local Authority Having Jurisdiction (AHJ) must be observed during construction.
- Assembly and disassembly of raceway base, cover, and fittings shall require no special tools.
- Installed fittings shall be designed to overlap the raceway junction to cover exposed or uneven edges.
- Security caps shall provide enhanced tamper protection by installing over the assembled raceway in desired locations.
- Raceway shall be designed to accept inline device boxes with either horizontal or vertical faceplate orientations.
- Device boxes shall have a removable knockout portion to permit raceway entry and exit. Device boxes shall serve as an extension box by removing a single knockout.
- Device boxes shall be available in standard NEMA single, double, and 3- gang versions. Device box color shall match raceway color.
- Device boxes shall accommodate various faceplates that accept modular connector inserts or bezels for balanced twisted pair, fiber optic, coaxial, multi-media, and other low voltage cabling connectors.
- Faceplates for device boxes shall accommodate pre-printed labels for proper electrical identification, or telecommunications port identification according to ANSI/TIA/EIA-606-A.
- Faceplates shall be available in colors that match the device box and raceway.
- Category rated communications jacks installed in surface box faceplates shall have provisions for snap-in icons for further identification.

2 5400 Series
- The raceway shall be a two-piece design with a base and Snap-On covers. The raceway base shall accept both a single cover that spans the entire base or two individual TwinSnap™ covers. Total width shall be 5.25" [133mm] by 1.75" [44.5mm] deep with an approximate thickness of .095" [2.4mm]. The base and cover shall be available in 8' [2.4m] lengths. The raceway shall be available with two (5400TB) or three (5400TBD) wiring channels.

- The 5400TB Series Base shall have two wiring channels separated by one integral barrier. Each channel must be large enough to accept standard power and communication devices without restricting capacity of the adjacent channel. The 5400TBD Series Base shall have three wiring channels separated by two integral barriers forming 1/2, 1/4, and 1/4 compartments. One channel must be large enough to accept standard power and communication devices without restricting capacity of the other channels. The 5400C Series Cover shall span the entire width of the base concealing all of the wiring channels. The 5400TC Series Cover shall have flanges for snapping onto the base side walls and center barrier. The cover shall span one-half the width of the base, providing independent access to services.
- A complete line of full capacity corner elbows and tee fittings must be available to maintain a controlled 2" [51mm] cable bend radius which meets the specifications for Fiber Optic and UTP/STP cabling and exceeds the TIA / EIA 569-A requirements for communications pathways. They shall be manufactured of a rigid PVC compound. A full complement of fittings must be available including, but not limited to tees, entrance fittings, cover clips, and end caps. They shall be manufactured of a rigid PVC compound. The fittings shall have a matte texture, in ivory or white colors to match the base and cover. They shall overlap the cover and base to hide uneven cuts. All fittings shall be supplied with a base where applicable to eliminate mitering. A transition fitting shall be available to adapt to other Wiremold series raceways.
- Device brackets shall be available for mounting standard devices in-line or offset from the raceway. A device bracket shall provide up to three single-gang openings at one location. Faceplates shall be 5507 Series that match and fit flush in the device plate. They shall be manufactured of rigid PVC compound.
- The raceway manufacturer will provide a complete line of connectivity outlets and modular inserts for UTP, STP (150 ohm), fiber optic, coaxial and other cabling types with faceplates and bezels to facilitate mounting. A complete line of preprinted station and port identification labels, snap-in icon buttons, as well as write-on station identification labels shall be available.

2.2 Cable Tray Systems

A Provide cable tray system to route power and communications cable distribution for utility needs. Cable tray system shall consist of cable tray and appropriate fittings for a complete installation.

1 Cable tray is to be utilized in locations only as covered in Article 392 of the National Electric Code, as adopted by the National Fire Protection Association and as approved by the American National Standards Institute.

2 Trays shall be constructed of 6063 T6 and T5 aluminum alloys and shall utilize center lines to indicate all areas where after field cutting of tray, new holes need to be drilled or screws inserted (Center Spine, Twin Spine, Ladder Style and Wall Mounted Trays).

3 Ladder Tray: Cable tray shall be constructed to form an open and accessible compartment to hold the necessary cables. The tray shall be constructed of two components, (1) two longitudinal support rails (side rails) and (2) the rungs. The rail shall be a single aluminum extrusion with extending flanges that provide rung support. The rungs shall have 7/8-inch cable laying surface and be attached with sheet metal screws to the two side rails on 6 inch, 9 inch or 12 inch centers, creating a cable laying area between the rails.

4 Wall Mounted Cable Tray: Cable tray shall be constructed to form an open and accessible compartment to hold the necessary cables which also enables full viewing of the compartment. The tray shall be wall mounted allowing cable lay-in where applicable.

- Trays shall be constructed with two components, (1) the main support which is the spine and (2) the rungs. The spine shall be a single aluminum extrusion designed with a lower cavity which has extending wings and provides rung support.
- Rungs shall have a 1-inch cable laying surface, and be attached on 6 inch, 9 inch or 12 inch centers, and protrude from the spine only on one side. The end of the rungs shall be bent upward to the height of 3 inches, 4 inches or 6 inches as applicable forming a 90-degree angle. This creates a cable laying area between the spine and the vertical portion of the rung. The rung shall be designed with a center screw groove along its length to provide a direct connection for rung mounted accessories. The ends of all rungs shall be fitted with a plastic cap to prevent damage to the cable and injury to the installer.
- For multi-tier wall mounted trays, the lower rungs shall be mounted through the entire vertical distance of the spine and project down, be bent outward, then up from one side only, forming a 'J' hook shape. These rungs shall be fixed in place with a sheet metal screw through the top of the spine which allows for replacement or expansion of the tray area.
- Top and bottom rungs shall form two or three tiers of cable tray, one above the other, attached to one single support member or spine.
- Tray shall not have side rails and shall offer an open view of the cables.

5 A full complement of fittings for the cable tray shall be available including, but not limited to, 45 and 90-degree flat, vertical inside and outside elbows, tee and cross fittings, couplings for joining sections of the tray, hangers, end blanks, field-installed dividers and all other components necessary to make the system perform as intended. The fittings and accessories shall be of a compatible material.

6 Ladder Rack Cable Runway
- Stringers shall be fabricated from ASTM A513 Steel tubing.
- Rungs shall be fabricated from 3/8"x1 ½" steel channel welded
- Rungs shall be spaced at 12.0" center to center
- Ladder Rack shall have a powder coat finished.
- Ladder Rack shall be individually boxed
- Ladder rack shall be a part of a total system that includes: manufacture bends, wall supports, joining hardware, etc.
- Ladder Rack shall be grounding per the TIA/EIA 607-A.
- Ladder Rack shall be UL listed- File number E60548
- Color: Ladder Rack will be BLACK
- Quantity: See Drawing for quantity and installation details.
- Part**#:** Cooper B-Line Ladder Rack, PN# SB17U12BFB or equal by CPI

7 Wire Basket Cable Runway
- Wire mesh cable tray shall be manufactured from round carbon steel wires that are 5 mm and 6 mm in diameter. Wires shall be welded at intersections to form a 2" x 4" grid pattern. The tray shall be U-shaped with equal height sidewalls.
- Individual tray sections shall be 10' long and 4", 6", 8", 12", 16", 18", 20", or 24" wide. Sidewalls shall be 4" high, as specified below.
- Wire mesh cable tray shall be zinc electroplated after fabrication, galvanized before fabrication (pre-galvanized) or painted black with powder coat paint, as specified below.
- Wire mesh cable tray that is 6" wide or wider shall be UL Classified for suitability as an equipment grounding conductor only. Pre-galvanized trays shall be UL Classified in the United States. Painted tray shall be UL Classified in the United States.
- Ladder Rack shall be grounding per the TIA/EIA 607-A.
- Color: Zinc Electroplate
- Quantity: See Drawing for quantity and installation details.

- Part#: Equal to Chatsworth Products OnTrac
  - Part Number 34821-504, 4” High x 4” Wide x 10’ Long.
  - Part Number 34821-506, 4” High x 6” Wide x 10’ Long.
  - Part Number 34821-508, 4” High x 8” Wide x 10’ Long.
  - Part Number 34821-512, 4” High x 12” Wide x 10’ Long.
  - Part Number 34821-516, 4” High x 16” Wide x 10’ Long.
  - Part Number 34821-518, 4” High x 18” Wide x 10’ Long.
  - Part Number 34821-520, 4” High x 20” Wide x 10’ Long.
  - Part Number 34821-524, 4” High x 24” Wide x 10’ Long.
- Provide all installation hardware required for installation whether shown on the plans or not. Some of the supports may require design build application and shall be included by the contractor without notice.
  - OnTrac Standard Splice Kit
  - OnTrac Splice Bar
  - OnTrac Splice Washer & Bolt Kit
  - OnTrac Spring Splice Kit
  - OnTrac Clamp Washer
  - OnTrac Carriage Bolt Hardware Kit
  - OnTrac 90° Splice Bar Kit
  - OnTrac Rack-Mount Hook
  - OnTrac Pedestal Clamp Bracket
  - Split Bolt Grounding Clamp
  - OnTrac Cable Tray Divider
  - OnTrac Cover
  - OnTrac Cable Tray Bottom Insert
  - OnTrac Cable Tray Liner
  - OnTrac Tool-Less Radius Drop
  - OnTrac Large Radius Drop
  - OnTrac Vertical Radius Bracket
  - OnTrac Electrical Box Bracket
  - OnTrac Conduit Bracket
  - OnTrac Auxiliary Side Bracket
  - OnTrac Section Support Bracket
  - OnTrac Label Holder
  - OnTrac Cable Tray Cutting Tool
  - Threaded Rod, 3/8-16
  - Threaded Rod Coupling Kit, 3/8-16
  - Threaded Rod I-Beam Clamp, 3/8-16
  - Hex Nut, 3/8-16
  - Split Lock Washer, 3/8”
  - Washer, 3/8”
  - Hex Lag Screw, 3/8-7 x 2” Long
  - Hex Lag Screw, 1/4-10 x 2” Long
  - Split Lock Washer, 1/4”
- Provide all support systems required for installation whether shown on the plans or not. Some of the supports may require design build application and shall be included by the contractor without notice.
  - OnTrac Wire Mesh Cable Tray System Supports
  - OnTrac Ceiling Center Support Bracket
  - OnTrac Ceiling Edge Hanger
  - OnTrac Ceiling Trapeze Support Bracket
  - OnTrac Wall/Ceiling C-Support Bracket
  - OnTrac Wall L-Support Bracket
  - OnTrac Wall Triangle Support Bracket
  - OnTrac Wall-Mount Angle
  - OnTrac Under Floor Support

- OnTrac Under Floor C-Bracket
- OnTrac Pedestal Clamp Bracket Kit

B Cabling Support System

1 Telco Backboards

- Backboards shall be 4’ x 8’ x .75” void free plywood (ACX Plywood with the “A” side turned out).
- The plywood shall be painted with two coats of white fire-retardant paint.
- Cut full size sheet to required size for application type, minimum 6” larger than equipment installed.

2 J-Hooks

- Cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed.
- Cable supports shall have flared edges to prevent damage while installing cables.
- Cable support system shall provide fasteners that allow them to be mounted to wall, concrete, joist, tee-bar wire, treaded rod, beams and raised floor supports.
- Fasteners shall have the ability to either be factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.
- Fastener to with one non-continuous cable support, factory or jobsite assembled.
- Color: NA
- Quantity: Contractor will provide quantities of j-hooks and hanger accessories in the amount necessary to support all horizontal cabling every 4-5 feet.
- Part**#:** ERICO CAT425, Cooper B-Line BCH12, BCH21, BCH32, BCH64 and accessories.

C Pull Rope

1 Pulling Ropes (Mule tape)

- Pull ropes shall be 1/2" flat tape with a minimum tensile strength of 1200 lbs.
- Ropes shall be pre-lubricated, woven polyester or aramid fiber tape made from low friction, high abrasion resistant yarns providing a low coefficient of friction. Tape shall be printed with sequential footage markings for accurate measurements.

2 Empty Conduits

- Pull rope shall be new 1/4” polypropylene over polyester rope with a minimum 1200 lb. tensile strength.
- Every empty conduit shall be equipped with a pull rope secured to the duct plug at each end.

3 Installed with Cables:

- Pull rope shall be new 1/8” polypropylene string with a minimum 750 lb. tensile strength.
- Contractor will be required to install a pull string into every conduit that they pull cabling.

2.3 Fire-Stop Systems

A General

1 Sleeves shall be 2”, 3” or 4" EMT or smaller. All cables penetrating walls must be sleeved.

2 Sleeves shall maintain a 40% conduit fill ratio.

3 Sleeves must be supported or attached at walls by apparatuses meant to do so. All sleeves shall be rigidly and properly supported.

4 Sleeves must extend past inaccessible areas.

5 Sleeves must be protected by a U.L. rated system at all firewalls designated on the construction drawings.

6 Fire stopping shall be a material, or combination of materials, to retain the integrity of time-rated construction by maintaining an effective barrier against the spread of flame, smoke, and gases. It shall be used in specific locations as follows:
- Duct, cables, conduit, piping, and cable tray penetrations through floor slab and through time-rated partitions or fire walls.
- Openings between floor slab and curtain walls, including inside hollow curtain walls at the floor slab.
- Penetrations of vertical service shafts.
- Openings and penetrations in time-rated partitions of fire walls containing fire doors.
- Locations where specifically shown on the drawings or where specified in other sections of the Standards.

7 Fire stopping materials shall be asbestos free and capable of maintaining an effective barrier against flame, smoke, and gasses in compliance with requirements of ASTM E 814, and UL 1479. Only listed fire stopping material acceptable to State, County, and City codes shall be used.

8 The rating of the fire stops shall in no case be less than the rating of the time rated floor or wall assembly.

9 All Fire stopping Locations (FSL) shall be labeled within 12" of the fire stopping material on each side of the penetrated fire barrier. The format for the Fire stopping Location identifier shall display the Telecom Room floor number, the Fire stopping Location number, and the hour rating of the fire rating system (e.g. 1-FLS001 (2)). Each fire stopping location shall be identified with a fire stopping warning label. The label shall include the manufacturer of the product, the installer and company name, the UL number for the product, the rating of the material, the installation date, and the number and type of cables passing through the opening. The fire stopping warning label can include the fire stopping location identifier, eliminating the need for a separate label. Penetration modifications requiring the repair/re-installation of the fire stopping material require the addition of a new fire stopping warning label. No previous fire stopping warning labels shall be removed or obscured by new labels. In the event the penetration is completely cleaned of existing fire stopping material, and new material is installed, the previous label shall be removed or obscured completely.

10 Manufacturers; Specified Technologies Inc., 3M & Hilti
- SSS - intumesant sealant
- SSP - putty and putty pads
- SSAMW - mineral wool
- IC 15WB+ - intumesant sealant
- CP 25WB+ - intumesant sealant
- Fire Barrier Moldable Putty+ - putty and putty pads
- FS-ONE - intumesant sealant
- CP 618 - putty and putty pads.

B Re-Enterable Smoke/Acoustic Stop System

1 EZ -Path Smoke & Acoustical Pathway is a pathway device designed to allow cables to penetrate nonrated walls and floors without the need for smoke sealing. This device features a built-in smoke sealing system that automatically adjusts to the amount of cables installed. Once installed in a barrier, cables can be easily added or removed at any time without the need to remove or reinstall caulking materials.

2 Its profile allows a maximum number of cables to be installed in a relatively small area. The pathway measures approximately 4.5" (114 mm) x 4.5" (114 mm) and is adjustable to accommodate wall and floor thicknesses between 4" (102 mm) and 8" (203 mm).

3 EZ-Path Smoke & Acoustical Pathways have been tested to measure air leakage. Leakage ratings per device are <1 CFM empty and <2.5 CFM at maximum 100% visual fill, attesting to the ability of the device to provide necessary sealing function in various applications. Acoustical testing confirmed that the product can restore the STC (Sound Transmission Classification) Ratings to walls that have been penetrated with a maximum STC of 61.
4 No additional fire stopping material shall be required to obtain proper Smoke/Acoustic stopping.
5 The system shall be self-contained, and shall automatically adjust to differing cable loads.
6 The system shall allow add, moves, and changes without additional materials.
7 All penetrations through unrated building structures (walls and floors) shall be sealed with an appropriate re-enterable Smoke/Acoustic stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow unrated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall use the proper fire stop equipment.
8 Smoke/Acoustic stop systems shall be UL Classified to Plenum UL2043.
9 The system shall be gang-able using wall plates for additional capacity.
10 Quantity: See Drawing for quantity and installation details.
11 Part #: Equal to STI
- PN# NEZ33
- PN# NEZDP233
- PN# NEZDP433

C Single Entry System
1 The fire stop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure.
2 Fire stop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.
3 All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall use the proper fire stop equipment.
4 Fire stop systems shall be UL Classified to ASTM E814 (UL 1479).
5 Quantity: See Drawing for quantity and installation details.
6 Part#: Equal to STI, PN# SSS100

D Re-Enterable Fire Stop System
1 The re-enterable fire stop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure.
2 No additional fire stopping material shall be required to obtain proper fire stopping.
3 The system shall offer full fire resistance whether it is empty or 100% visually filled.
4 The system shall be self-contained, and shall automatically adjust to differing cable loads.
5 The system shall allow add, moves, and changes without additional materials.
6 All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate re-enterable fire stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and

sleeves, cables, conduit, cable tray, and raceways, etc. shall use the proper fire stop equipment.

7 Fire stop systems shall be UL Classified to ASTM E814 (UL 1479).
8 The system shall be gang-able using wall plates for additional capacity.
9 Quantity: See Drawing for quantity and installation details.
10 Part #: Equal to STI
- STI PN# EZDP33FWS
- STI PN# EZDP33WR

2.4 Grounding/Bonding Systems

A Grounding and Bonding Equipment

1 Telecommunications Main Grounding Busbar (TMGB)
- Telecommunications Main Grounding Busbar (TMGB) shall be constructed of .25" (6.4 mm) thick solid copper bar.
- The buss bar shall be 4" (100 mm) high and 12" (300 mm) long and shall have 18 attachment points (two rows of 9 each) for two-hole grounding lugs.
- The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 15 lugs with 5/8" (15. 8 mm) hole centers and 3 lugs with 1" (25.4 mm) hole centers.
- The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4" (100 mm) standoff from the wall.
- The busbar shall be UL Listed as grounding and bonding equipment.
- Design Make shall be:
- Chatsworth Products, Inc. (CPI),
- Telecommunications Main Grounding Busbar: Part Number 40153-012, 12" x 4" (300 mm x 100 mm) Telecommunications Main Grounding Busbar, UL Listed.

2 Telecommunications Grounding Busbar (TGB)
- Telecommunications Grounding Busbar (TGB) shall be constructed of .25" (6.4 mm) thick solid copper bar.
- The busbar shall be 2" (50 mm) high and 10" (250 mm) long and shall have 7 attachment points (one row) for two-hole grounding lugs.
- The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 4 lugs with 5/8" (15.8 mm) hole centers and 3 lugs with 1" (25.4 mm) hole centers.
- The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4" (100 mm) standoff from the wall.
- The busbar shall be UL Listed as grounding and bonding equipment.
- Design Make shall be:
- Chatsworth Products, Inc. (CPI),
- Telecommunications Grounding Busbar:
- Part Number 13622-010, 10" x 2" (250 mm x 50 mm) Telecommunications Grounding Busbar, UL Listed.

3 Horizontal Rack Busbar
- Horizontal rack-mount busbar shall be constructed of 3/16" (4.7 mm) thick by 3/4" (19.1 mm) high hard-drawn electrolytic tough pitch 110 alloy copper bar.
- Bar shall be 19" EIA or 23" rack mounting width (as specified below) for mounting on relay racks or in cabinets.
- Bar shall have eight 6-32 tapped ground mounting holes on 1" (25.4 mm) intervals and four 0.281" (7.1 mm) holes for the attachment of two-hole grounding lugs.
- Each bar shall include a copper splice bar of the same material (to transition between adjoining racks) and two each 12-24 x ¾" copper-plated steel screws and flat washers for attachment to the rack or cabinet.

- Bar shall be UL Listed as grounding and bonding equipment.
- Design Make shall be:
- Chatsworth Products, Inc. (CPI),
- Horizontal Rack Busbar: Part Number 10610-019, Ground Bar for 19” Rack.

4 Two Mounting Hole Ground Terminal Block
- Ground terminal block shall be made of electroplated tin aluminum extrusion.
- Ground terminal block shall accept conductors ranging from #14 AWG through 2/0.
- The conductors shall be held in place by two stainless steel set screws.
- 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.
- Ground terminal block shall be UL Listed as a wire connector.
- Design Make shall be:
- Chatsworth Products, Inc. (CPI),
- Two Mounting Hole Ground Terminal Block:
- Part Number 40167-001, Two Mounting Hole Ground Terminal Block, 1 each
- Compression Lugs
- Compression lugs shall be manufactured from electroplated tinned copper.
- 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.
- Compression lugs shall be sized to fit a specific size conductor, sizes #6 to 4/0, as stated below.
- Compression lugs shall be UL Listed as wire connectors.
- Design Make shall be:
- Chatsworth Products, Inc. (CPI),
- Compression Lugs:
  - Part Number 40162-901, Compression Lug, #6 Awg, 5/8” (15.8 mm) hole spacing, 1 each.
  - Part Number 40162-903, Compression Lug, #6 Awg, 1” (25.4 mm) hole spacing, 1 each.
  - Part Number 40162-904, Compression Lug, #2 Awg, 5/8” (15.8 mm) hole spacing, 1 each.
  - Part Number 40162-907, Compression Lug, #2 Awg, 1” (25.4 mm) hole spacing, 1 each.
  - Part Number 40162-909, Compression Lug, 2/0 Awg, 1” (25. 4 mm) hole spacing, 1 each.
  - Part Number 40162-911, Compression Lug, 4/0 Awg, 1” (25.4 mm) hole spacing, 1 each.

5 Antioxidant Joint Compound
- Oxide inhibiting joint compound for copper-to-copper, aluminum-to-aluminum or aluminum-to-copper connections.
- Design Make shall be:
  - Chatsworth Products, Inc. (CPI),
  - Antioxidant Joint Compound:
  - Part Number 40168-101, Antioxidant Joint Compound, Copper-to-Copper Connections, .5 oz, 1 each.
  - Part Number 40168-801, Antioxidant Joint Compound, Copper-to-Copper Connections, 8 oz, 1 each.
  - Part Number 40166-101, Antioxidant Joint Compound, Aluminum-to-Aluminum or Aluminum-to-Copper Connections, .5 oz, 1 each.
  - Part Number 40166-801, Antioxidant Joint Compound, Aluminum-to-Aluminum or Aluminum-to-Copper Connections, 8 oz, 1 each.
  - Part Number 40168-150, Antioxidant Joint Compound, Copper-to-Copper Connections, .5 oz, 50 each.

- Part Number 40168-812, Antioxidant Joint Compound, Copper-to-Copper Connections, 8 oz, 12 each.
- Part Number 40166-150, Antioxidant Joint Compound, Aluminum-to-Aluminum or Aluminum-to-Copper Connections, .5 oz, 50 each.
- Part Number 40166-812, Antioxidant Joint Compound, Aluminum-to-Aluminum or Aluminum-to-Copper Connections, 8 oz, 12 each.

6 C-Type, Compression Taps
- Compression taps shall be manufactured from copper alloy.
- 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
- Compression taps shall be sized to fit specific size conductors, sizes #2 AWG to 4/0, as stated below.
- Compression taps shall be UL Listed.
- Design Make shall be:
  - Chatsworth Products, Inc. (CPI),
  - Compression Taps:
  - Part Number 40163-001, Compression Tap, #6 AWG Solid Run to #6 AWG Solid Tap, 1 each.
  - Part Number 40163-007, Compression Tap, 2/0 Stranded Run to 2/0 Stranded Tap, 1 each.

7 Pipe Clamp with Grounding Connector
- Pipe clamp shall be made from electroplated tinned bronze. Installation hardware will be stainless steel.
- 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.
- Pipe clamp installation hardware shall be sized to attach to pipes, sizes 1” to 6” (.75” to 6.63” in diameter), as stated below.
- Pipe clamp shall be UL Listed as grounding and bonding equipment.
- Design Make shall be:
- Chatsworth Products, Inc. (CPI),
- Pipe Clamps:
  - Part Number 40170-002, Pipe Clamp, for 1” to 1-1/4” pipe, 1 each.
  - Part Number 40170-003, Pipe Clamp, for 1-1/2” to 2” pipe, 1 each.
  - Part Number 40170-004, Pipe Clamp, for 2-1/2” to 3” pipe, 1 each.
  - Part Number 40170-005, Pipe Clamp, for 3-1/2” to 4” pipe, 1 each.
  - Part Number 40170-006, Pipe Clamp, for 5” to 6” pipe, 1 each.

8 Equipment Ground Jumper Kit
- 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.
- Ground conductor is an insulated green/yellow stripe #6 AWG wire
- Lugs are made from electroplated tinned copper and have two mounting holes spaces .5” to .625” apart that accept 1/4” screws.
- Jumper will be made with UL Listed components
- Design Make shall be:
  - Chatsworth Products, Inc. (CPI),
  - Equipment Ground Jumper Kit:
  - Part Number 40159-010, Equipment Ground Jumper Kit, 1 each.

B Communications raceways, backboards and rack systems

1 The conduit system must be permanently and effectively grounded, in accordance with Title 24 of the California Code of Regulations, California Electric Code #250, and

National Electric Code or as required by local AHJ. If in confusion or conflict the most stringent specification shall apply.

2 Provide as a minimum a #1/0awg THHN conductor in conduit from the main building grounding point to a ¼" x 4" x 5.25" telecommunications grounding bus bar(TGB) at every backboard.

3 Provide as a minimum #6awg green THHN conductor from each equipment rack, cable tray or wall mounted equipment to a TGB.

2.5 Concrete for Telecom System

A All Concrete

1 Refer to Section 03xxxx Concrete; all concrete shall be governed by this specification.

2 Furnish to the AHJ a mix design showing the proposed weights of water, aggregate and cement per cubic foot of concrete a minimum of 7 days prior to beginning placement.

3 Proportion the cement, water and aggregate to obtain concrete with good workability.

4 Use Type I Portland Cement for slurry mix and Type II for riprap grout. according to ASTM C 150.

B Concrete Slurry

1 Fine aggregate for concrete slurry shall completely pass the 3/8" sieve with no more than 5% passing the No. 100 sieve. The fine aggregate shall contain no silt, loam, clay or organic particles.

C Concrete RipRap Grout

1 Fine aggregate for riprap grout shall completely pass the No. 4 sieve with no more than 5% passing the No. 100 sieve.

D General Concrete Notes

1 Ensure that the concrete slurry develops a 12-hour compressive strength of 500 psi and a slump of 7 inches, +/- 1 inch for concrete slurry; the riprap grout requires a 28-day minimum strength of 3000 psi and a slump of 4 inches +/- 1 inch. Furnish concrete for specimens.

2 Concrete shall be placed as nearly as practical to its final position to avoid flow causing segregation of the aggregate. Concrete should not be dropped more than 5 feet vertically without the use of a tremie or similar device. Do not place concrete in a manner that will cause the pipe to float. Vibrate or rod the concrete as necessary to remove voids.

Part 3 Execution

3.1 General

A Permits and Licensing

1 Contractor is responsible to procure all necessary permits before the commencement of their work to the city or state agencies as required. It is the contractor's responsibility to provide all documentation to the AHJ.

2 Contractor is responsible to procure all necessary licenses for the city or state they are commencing the work in, before the commencement of their work begins.

3 Contractor to procure all encroachment permits as it pertains to the work described in these documents.

4 No person may access or enter in any way, an underground vault or confined space without the training, staff, and safety equipment defined on the confined space permit. Accessing these spaces without a valid permit or without the required

support services will be cause for an order to stop work until all violations are resolved and may result in a fine or suspension of the workers involved.

B Safety

1 All federal (OSHA), state, and local safety rules, will be enforced at all times during the duration of the project. It is the responsibility of the Contractor to conduct frequent inspections of the job site to ensure compliance.

3.2 Installation

A Intra-Building Pathways

1 Communications Vaults

- Site Access
  - The general contractor shall be responsible for providing adequate access to the site to facilitate hauling, storage and proper handling of the precast concrete units.
- Installation
  - Precast concrete units shall be installed to the lines and grades shown in the contract documents or otherwise specified.
  - Precast concrete units shall be lifted by suitable lifting devices at points provided by the precast concrete producer.
  - Precast concrete units shall be installed in accordance with applicable industry standards. Upon request, the precast concrete producer shall provide installation instructions.
  - Field modifications to the product shall relieve the precast producer of liability regardless if such modifications result in the failure of the precast concrete unit.
- Water Tightness
  - Where water tightness is a necessary performance characteristic of the precast concrete unit's end use, watertight joints, pipe-entry connectors and inserts should be used to ensure the integrity of the entire system.

2 Conduit

- All conduit shall be routed parallel or perpendicular to walls.
- All conduit shall be installed in accordance with NEMA "Standard of Installation" and shall meet applicable local and national building and electrical codes or regulations.
- Conduit runs shall not exceed 100 feet or contain more than two 90-degree bends without utilizing appropriately sized pull boxes. No conduits may enter a pull box at a 90-degree angle. They are not to be installed into the side of a pull box. All conduits must enter the ends of the pull box.
- All conduits entering a building from outside shall be plugged with reusable stoppers to eliminate the entrance of water or gases into the entrance room. Building entrance conduits shall slope downward away from the building to reduce the potential of water entering the building. All building penetrations are to be sealed from wall to wall and on the outside and inside of the penetrations.
- All conduits penetrating a fire or smoke barrier shall be fully sealed between the conduit and the actual penetration following manufacturer's recommendations. Contractor shall label each fire stop location with the manufacturer's identification number of the product used and shall provide the inspector copies of each products system configuration.
- No communications outlet boxes shall be "daisy-chained." Each communications outlet shall be served by a separate 1-inch (minimum) conduit.
- In rooms with a drop or false ceiling, communications outlets shall be served by a 1-inch conduit stubbed six inches above the false ceiling, angled toward the

cable tray or open access area, and be equipped with a compression fitting and plastic bushing. All stubs shall be marked “Comm”.

- All conduit shall be equipped with an approved water or barrier seal in building access points.
- No communications conduit shall contain more than 180 degrees of bend without the use of a pull box. Pull boxes must be approved by Engineer of Record to ensure proper sizing and conduit entry placement.
- In areas where hard lid ceilings are in place, all conduits are to run to accessible location or to cable tray.
- Provide labels at both ends of conduits to identify location of far end.

3 Station Cable Support System

- All station cable support systems shall be braced for zone four seismic activity.
- In suspended ceiling and raised floor areas where duct, cable trays, or conduit are not available, station cables shall be bundled with Velcro straps at appropriate distances.
- Velcro straps shall not be over tightened to the point of deforming or crimping the cable sheath.
- Velcro straps shall be UL listed, rated for low smoke, and certified for use in a plenum environment.
- The station cable support system components shall be firmly attached to the existing building structure and installed not more than five feet apart.
- The station cable support system components shall be installed to provide at least three (3) inches of clear vertical space between the cables/optics and the ceiling tiles.
- The station cable support system components shall be spaced to prevent the cables/optics from sagging or buckling.
- No more than eighteen (18) Category 6 cables shall be supported by a J - hook.
- No more than thirty (30) Category 6 cables shall be supported by triangular galvanized metal bracket.
- The station cable support system shall be clearly and neatly labeled per TIA/EIA 606-A, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

4 Raceways

- All dual channel raceway shall be installed with a complete end-to-end channel for future power service installation.
- The raceway shall be stubbed above the false ceiling space and capped so that each section of raceway can be connected to a power service in the future without a requirement to add raceway to visible portions of the system. If no false ceiling space is available, the power channel is to be stubbed up and capped next to the point at which the communication services enter the room.

5 Cable Tray

- The Contractor will be responsible for placement of the cable tray in concert with other trades, allowing sufficient room for the cable installers to gain access to all portions of the tray system. Cable tray location shall be coordinated with open ceiling areas, access panel locations, and feeder conduit positions to provide an accessible cable pathway throughout the facility.
- All metallic trays must be grounded and may be used as a ground conductor. Provide #2 AWG bare copper equipment grounding conductor through entire length of tray; bond to each component. Trays used as an equipment grounding conductor must be clearly marked.
- Trays shall be bonded end-to-end.
- Trays shall enter distribution rooms a minimum or six inches into the room, then utilize a drop out to protect station cables from potential damage from the end of the tray.

- Cable trays shall be placed a minimum of six (6) inches from any overhead light fixture and twelve (12) inches from any electrical ballast. A minimum of eight (8) inches of clearance above the tray shall be maintained at all times. All bends and T-joints in the tray shall be fully accessible from above (within 1 foot). Trays shall be mounted no higher than twelve (12) feet above the finished floor and shall not extend more than eight (8) feet over a fixed ceiling area.
- A separate conduit sleeve (minimum of four inches) must be provided as a pathway through any wall or over any obstruction (such as a rated hallway) from the cable tray into any room having a communications outlet.
- The Contractor shall fire stop around the tray and, after installation of the cables, within the tray using removable pillow-style products following manufacturers' guidelines. Sound deadening material shall be provided and installed after installation of cable.
- In rooms without a drop ceiling (open to the structure), the cable shall be mounted as high as possible to provide the greatest clearance above the finished floor, but within the limits in (e) above.

6 Wire Mesh Cable Tray

- Provide all components of the tray system (tray, supports, splices, fasteners, and accessories) from a single manufacturer.
- Wire mesh cable tray shall be secured to the structural ceiling, building truss system, wall or floor using manufacturer's recommended supports and appropriate hardware as defined by local code or the authority having jurisdiction (AHJ).
- When the pathway is overhead, wire mesh cable tray shall be installed with a minimum clearance of 12" (300 mm) above the tray. Leave 12" (300 mm) in between the tray and ceiling/building truss structure. Multiple tiers of wire mesh cable tray shall be installed with a minimum clearance of 12" (300 mm) in between the trays. When located above an acoustical drop ceiling, wire mesh cable tray shall be installed a minimum of 3" (75 mm) above the drop ceiling tiles.
- When installed under a raised floor, wire mesh cable tray shall be installed with a minimum 3/4" (19 mm) clearance between the top of the tray and the bottom of the floor tiles or floor system stringers, whichever are lower in elevation. Maintain a 3" (75 mm) clearance between trays wherever trays cross over.
- Wire mesh cable tray shall be supported every 6' (1.8 m) of span or less. Support wire mesh cable tray within 2' (0.6 m) of every splice and intersection. Support intersections on all sides. Support wire mesh cable tray on both sides of every change in elevation/direction. The weight of the load on the cable tray must not exceed the stated limits per span in the manufacturer's published load table. Use additional supports where needed.
- Secure wire mesh cable tray to each support with a minimum of one fastener. Follow the manufacturers' recommended assembly, splice and intersection-forming practices.
- Use installation tools and practices recommended by the manufacturer to field fabricate wire mesh cable tray intersections and changes in elevation. Use side-action bolt cutters with an offset head to cut wire mesh cable tray.
- Wire mesh cable tray shall be bonded to the Telecommunications Grounding Busbar (TGB) using an approved ground lug on the wire basket tray and a minimum #6 grounding wire or as recommended by the AHJ. Follow UL Classified splicing methods recommended by the manufacturer, ground the tray per NEC requirements and verify bonds at splices and intersections between individual cable tray sections. Cable pathway should be electrically continuous through bonding and attached to the TGB.
- The quantity of cables within the tray will not exceed a whole number value equal to 50% of the interior area of the tray divided by the cross-sectional area of the

cable. Cable fill will not exceed the depth of the cable tray's side rail [2" (50 mm), 4" (100 mm) or 6" (150 mm)].
- The combined weight of cables within the tray will not exceed stated load capacity in manufacturer's specifications.
- Separate different media type within the tray. Treat each type of media separately when determining cable fill limits.
- When pathways for other utilities or building services are within 2' (0.6 m) of the wire mesh cable tray, cover the tray after cables are installed.

7 Pull Boxes
- Pull boxes shall be installed in easily accessible locations.
- Pull boxes installed as part of a horizontal cabling pathway shall be installed immediately above suspended ceilings, where possible.
- Pull boxes shall not be used for splicing cable.
- Pull boxes shall be placed in conduit runs that exceed 100 feet or which require more than two 90-degree bends. The pull boxes shall be located in straight sections of conduit and must not be used for a right-angle bend. Installation shall allow cable to pass through from one conduit to another in a direct line.
- Pull boxes must have a length at least 12 times the diameter of the largest conduit.

B Grounding and Bonding Systems

1 General
- Installation: The Contractor shall provide grounding and bonding in accordance with the requirements of NFPA 70, IEEE 142, TIA/EIA 568, TIA/EIA 607, state and local codes, the campus standards and to requirements specified herein. Codes shall be complied with as a minimum requirement, with these specifications prevailing when they are more stringent.
- Bonding
  - Metallic conduits, wireways, metal enclosures of busways, cable boxes, equipment housings, cable racks and all non-current carrying metallic parts of the installed telecommunications services shall be grounded with #6 AWG copper wire. The metallic conduit system shall be used for equipment and enclosure grounding but not as a system ground conductor.
  - All metallic conduit stub-ups shall be grounded, and where multiple stub-ups are made within an equipment enclosure, they shall be equipped with grounding bushings and bonded together and to the enclosure and the enclosure ground bus.
  - Each metallic raceway, pipe, duct and other metal object entering the buildings shall be bonded together. The Contractor shall use #6 AWG bare copper conductors.
  - The Contractor shall bond telecommunications equipment and busbars separately.

2 Signal Reference Grounding and Bonding
- Each identified telecommunications space within a building shall have a common signal reference ground. The signal reference ground shall conform to the following:
  - Within the building, all communication spaces shall be separately bonded to each other and connected to the primary building ground in accordance with the provisions of TIA/EIA 607. The communication ground shall not ground any other equipment or be connected to any potential high voltage source. All racks, frames, drain wires, and all installed communication equipment shall only be grounded to this common reference ground with a minimum size #6 AWG copper wire.
  - The Contractor shall provide, as a minimum, a continuous #3/0 AWG green electrical conductor connected to a 1/4" x 4" x 5.25" telecommunications

grounding bus bar (TGB) 6" AFF on the plywood backboard of each IDF (or telecommunication space) to terminate chassis and other equipment grounds.
        - The ground wires from each individual IDF shall be routed directly to the Building Distribution Frame (BDF), terminated and bonded together via a telecommunications main grounding bus bar (TMGB) of minimum 1/4" x 4" x 12" dimensions. This point of single reference for all closets in a building shall in turn be grounded with a minimum #3/0 AWG ground conductor to the main building ground. If a main building ground is unavailable, the ground wire from the BDF shall be grounded to the nearest electrical panel ground bus bar. The building ground for signal reference shall be the building service entrance ground.
    - Riser/Tie Cable Bonding
        - There shall be no bonding between the entry cable and the inside riser or distribution cable.
        - All riser and tie cable shields shall be bonded into a single continuous path end-to-end and grounded on each floor in which pairs leave the sheath. Cable shields shall be grounded to the signal reference ground provided in each telecommunication space.
3 Grounding and Bonding Testing Inspection Procedures
    - As an exception to requirements that may be stated elsewhere in these documents, the Inspector of Record shall be given five (5) working days' notice prior to each test. The Contractor shall provide all test equipment and personnel and shall provide written copies of all test results.
    - Grounding and bonding system conductors and connections shall be inspected for tightness and proper installation.
    - The Contractor shall provide personnel and test equipment for point-to-point resistance tests before connecting equipment. Perform point-to-point tests in each building to determine the resistance between the main grounding system and all BDF/IDF ground bus bars. Investigate and correct point-to-point resistance values that exceed 0.5 ohm. The Contractor shall record resistance measurements at all test point locations.

C Information Outlets
1 General Requirements
    - Station outlets shall be mounted securely at work area locations.
    - Station outlets shall be located so that the cable required to reach the desktop equipment is no more than 10 feet long.
    - Station outlets should not be "daisy-chained."
    - Outlets shall be mounted as follows:
        - Wall phone: 48 inches above the finished floor.
        - Standard voice/data outlet: 15 inches above the finished floor.
        - Wall-mounted video outlet: 78 inches above the finished floor.
        - Counter top: 6 inches above the counter top.
2 Modular Furniture Telecommunications Outlets
    - The Contractor shall provide and install all components and labor necessary to completely install, test, and document voice and data telecommunications outlets at each modular furniture workstation location.
    - Category 6 station cable shall be placed from the BDF, through the riser sleeves, through the cable tray system into the conduit, ceiling or floor poles, etc. into the furniture to be served.
    - The Contractor shall coordinate the telecommunications and electrical installation so that the modular furniture is served from the joint signal/power floor monuments or joint power pole in a consistent manner. The Contractor shall provide and install all fittings, flex conduit, adapter plates, and

telecommunications cable and components necessary to install Category 6 station cable from the consolidation point box, through the ceiling or floor monument or pole, into the furniture raceway, and to the final user outlet location (including jacks, adapters, and faceplates).

- The telecommunications installers shall coordinate with the electrical drawings for the number and location of user voice and data outlets.
- Labels shall be numbered according to a scheme developed in consultation with the owner's representative.

D Grounding and Bonding

1 The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor.

2 The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607 Telecommunications Bonding and Grounding Standard.

3 The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB).

4 The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

5 All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.

6 All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape.

7 All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

8 Wall-Mount Busbars

- Attach busbars to the wall with appropriate hardware according to the manufacturer's installation instructions.
- 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.
- Each lug shall be attached with stainless steel hardware after preparing the bond according to manufacturer recommendations and treating the bonding surface on the busbar with antioxidant to help prevent corrosion at the bond.
- The wall-mount busbar shall be bonded to ground as part of the overall Telecommunications Bonding and Grounding System.

9 Rack Mount Busbars and Ground Bars

- 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.
- Attach rack-mount busbars and ground bars to racks or cabinets according to the manufacturer's installation instructions.
- Bond the rack-mount busbar or ground bar to the room's TMGB or TGB with appropriately sized hardware and conductor.

10 Ground Terminal Block

- Every rack and cabinet shall be bonded to the TMGB or TGB.

- Minimum bonding connection to racks and cabinets shall be made with a rack-mount two-hole ground terminal block sized to fit the conductor and rack and installed according to manufacturer recommendations.
- 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.

11 Pedestal Clamp
- 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 according to the manufacturer's recommendations.
- 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.
- 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.
- Remove insulation from conductors where wires attach to the pedestal clamp.

12 Pipe Clamp
- 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 according to the manufacturer's recommendations.
- 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.
- Remove insulation from conductors where wires attach to the pipe clamp.

13 Equipment Ground Jumper Kit
- Bond equipment to a vertical rack-mount busbar or ground bar using ground jumper according to the manufacturer's recommendations.
- 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.

E Fire Stop System

1 The fire stop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure.

2 Fire stop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

3 All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall use the proper fire stop equipment.

4 Fire stop systems shall be UL Classified to ASTM E814 (UL 1479).

3.3 System Close Out and As-Built Documentation

A Documentation

1 Refer to Section 27 0000 '4.5-A – Close Out Documentation' for requirements.

END OF SECTION

SECTION 27 1000

STRUCTURED CABLING SYSTEM

Part 1 General

1.1 Work Included

A. General

1. Provide all labor, materials, tools and equipment required for the complete installation of work called for on the Construction Drawings and described in the Specifying Documentation.
2. This document describes the requirements for the contractors, products and installation relating to furnishing and installing Telecommunications Cabling systems.
3. The Horizontal Cabling System as described in this document is comprised of cabling, infrastructure, J-hook pathways and termination devices for Data systems.
4. Contractor will provide a bid including all labor, materials, tools and equipment required for the complete installation of work called for on the Construction Drawings and described in this Document. It is the responsibility of the Contractor to provide all material necessary to provide a complete and operable system. If the contractor feels that the system described is incomplete, they must address this in writing to the Owner/Owner's Representative before providing a bid.
5. All questions concerning non-specified product and services will be address to the Owner's Representative before Contactor provides a bid. Owner expects that by accepting the Contractor's bid proposal that the Contractor has provided a competent bid for a complete solution.
6. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types will be provided as an attachment to this document.

1.2 References

A. Regulatory References

1. Contractors will comply with all requirements as specified in Section 27 0000 '1.3. – Regulatory References'.

1.3 Safety and Indemnity

A. Requirements

1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0000 '2.1 – Safety and Indemnity'.

1.4 Contractor Qualifications

A. Requirements

1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0000 '2.2 – Contractor Qualifications'.

1.5 Quality Assurance

A. Requirements

1. Contractors shall comply with all requirements as specified in Section 27 0000 '2.3 – Quality Assurance'.

1.6 Equivalent Products

A. Approved Products

1. All Products described, and Part Numbers given in this Specification are those of Hubbell unless otherwise noted.

B. Pre-Approved Equals:

1. None

C. Other Than Approved Products

1. Contractors wishing to approve a system other than those specified in this document shall do so in accordance with Section 27 000 '3.1 Products'.

1.7 Submittal Documentation

A. Requirements

1. The successful contractor shall provide their submittal package in accordance with the Section '01 20 00 – Submittal Schedule' and Section 27 0000 '3.2 – Submittal Documentation'.

1.8 Acceptance

A. Requirements

1. The contractor shall comply with all requirements as listed in Section 27 0000 '3.3 – Acceptance'.

1.9 Warranty

A. Requirements

1. The contractor shall comply with all requirements as listed in Section 27 0000 '3.4 – Warranty'.

1.10 Technology Clause

A. General Requirements

1. As technology advances, it is understood that improved or enhanced products may supersede existing products in both price and performance and yet be essentially similar. This request for bids seeks to address the rapid advances in technology by allowing functionally similar or identical products that may be introduced in the future, during the term of this bid, to be included under the general umbrella of compatible product lines and are thus specifically included in this bid document.
2. Discontinued or end of life products shall be replaced with an equal product to the original specified product at no additional costs to the owner.

Part 2 Products

2.1 Work Area Subsystem

A. General

1. The Work Area shall consist of the connectivity equipment used to connect the horizontal cabling subsystem and the equipment in the work area. The connectivity equipment shall include the following options:
   - Patch Cords

- Modular Inserts, Jacks and Plugs
- Faceplates

B. Patch Cords

1. Category 6 Data/Voice Outlet Patch Cords
   - All category 6 channel patch cords shall be constructed with a snagless boot, made of molded PVC, colored matched to the color of the patch cord cable.
   - All category 6 channel patch cords shall be constructed with category 6 patch cable, 24 AWG, 7/32 tinned copper stranded patch cable, insulated with polyethylene and paired, jacketed with PVC, ETL Verified for ISO 11801, (UL) NEC type CM or CMR, 75º C, Article 800 CSA Type CMG.
   - All category 6 channel patch cords shall be 100% factory tested to pass return loss (RL) and near-end cross talk (NEXT).
   - All category 6 channel patch cords shall be manufactured using a T568-B plug-wiring format.
     - All patch cords will be delivered to the site and must be signed for by the Owner/Owner's Representative. It will be the responsibility of other to install all Work Area Data Patch Cords.
   - Length:
     - Data/Voice patch cords will be 15 feet long.
   - Color:
     - Data/Voice Black
   - Quantity
     - Data/Voice Contractor will provide 25% of all data outlets shown on the drawings, and contractor to provide one (1) 3ft patch cord for each television location.
   - Hubbell Premise Part #, or approved equal:
     - Data/Voice **HCL6BK15**
     - TV **HCL6BK03**

2. Category 6A Wireless Access Points Outlet Patch Cords
   - All category 6A channel patch cords shall be constructed with a snagless boot, made of molded PVC, colored matched to the color of the patch cord cable.
   - All category 6A channel patch cords shall be constructed with category 6A patch cable, 24 AWG, 7/32 tinned copper stranded patch cable, insulated with polyethylene and paired, jacketed with PVC, ETL Verified for ISO 11801, (UL) NEC type CM or CMR, 75º C, Article 800 CSA Type CMG.
   - All category 6A channel patch cords shall be 100% factory tested to pass return loss (RL) and near-end cross talk (NEXT).
   - All category 6A channel patch cords shall be manufactured using a T568-B plug-wiring format.
     - All patch cords will be delivered to the site and must be signed for by the Owner/Owner's Representative. It will be the responsibility of other to install all Work Area Data Patch Cords.
   - Length:
     - Wi-Fi patch cords will be 3 feet long.
   - Color:
     - Wi-Fi White
   - Quantity
     - Wi-Fi Contractor will provide one (1) patch cable for each Wi-Fi data outlet.
   - Hubbell Premise Part #, or approved equal:
     - Wi-Fi **HCL6AW03**

C. Modular Inserts and Jacks

1. Category 6 Data/Voice Jack & Camera Termination Plugs
   - Jack will meet the Category 6 Standard.
   - Jacks shall be 8 positions un-keyed
   - Each jack shall be an individually constructed unit and shall snap mount in an industry standard keystone opening (.760" x 580")
   - Jacks shall utilize a 2-layer printed circuit board to control NEXT
   - Jack termination shall follow the industry standard 110 IDC.
   - Jacks shall have a designation indicating Category 6 on the nose which can be plainly seen from the front of the faceplate. Bottom of jack shall have date code and an abbreviated catalog number.
   - Jacks shall utilize a paired punch down sequence. Cable pair twists shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.
   - Jacks shall terminate 22-26 AWG stranded or solid conductors.
   - Jacks shall be compatible with single conductor 110 impact termination tools.
   - Jacks shall be compatible with TIA/EIA 606 color code labeling
   - Jacks shall have universal wiring designation.
   - Jacks shall have an attached color-coded wiring instruction label housed between the IDC termination towers.
   - Jacks shall be manufactured in the USA
   - Jacks will be terminated according to theT568B wiring scheme
   - Color:
     - Data/Voice WHITE
     - Camera Factory
   - Quantity: Contractor will provide one jack for every outlet cable shown on the drawings.
   - Hubbell Premise Part #, or approved equal.
     - Data/Voice **HXJ6W**
     - Camera **SP6**

2. Category 6A Wireless Access Point Jack
   - Jack will meet the Category 6A Standard.
   - Jacks shall be 8 positions un-keyed
   - Each jack shall be an individually constructed unit and shall snap mount in an industry standard keystone opening (.760" x 580")
   - Jacks shall utilize a 2-layer printed circuit board to control NEXT
   - Jack termination shall follow the industry standard 110 IDC.
   - Jacks shall have a designation indicating Category 6A on the nose which can be plainly seen from the front of the faceplate. Bottom of jack shall have date code and an abbreviated catalog number.
   - Jacks shall utilize a paired punch down sequence. Cable pair twists shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.
   - Jacks shall terminate 22-26 AWG stranded or solid conductors.
   - Jacks shall be compatible with single conductor 110 impact termination tools.
   - Jacks shall be compatible with TIA/EIA 606 color code labeling
   - Jacks shall have universal wiring designation.
   - Jacks shall have an attached color-coded wiring instruction label housed between the IDC termination towers.
   - Jacks shall be manufactured in the USA
   - Jacks will be terminated according to theT568B wiring scheme
   - Color:
     - Wi-Fi Purple

- Quantity: Contractor will provide one jack for every outlet cable shown on the drawings.
- Hubbell Premise Part #, or approved equal.
  - Wi-Fi **HXJ6W**

D. Wall Mount and Modular Furniture Faceplates

1. Wall Plates
   - Faceplates shall be UL Listed and CSA Certified
   - Faceplates shall be 2.75" W x 4.5" H (69.8 mm x 114.3 mm)
   - Faceplates shall provide for TIA/EIA 606 compliant station labeling
   - Faceplates shall have plastic covers over the mounting screws that can be replaced with a clear plastic window over a printable paper insert
   - Color: WHITE or STAINLESS STEEL.
     - Contractor will field verify and match finish to the existing electrical outlet face plate cover.
   - Quantity: Contractor will provide one single gang faceplate for each outlet shown on the drawings.
   - Hubbell Premise Part #, or approved equal.
     - WHITE
       - **1 Port IFP11W**
       - **2 Port IFP12W**
       - **3 Port IFP13W**
       - **4 Port IFP14W**
       - **6 Port IFP16W**
     - STAINLESS STEEL
       - **1 Port SSFL11**
       - **2 Port SSFL12**
       - **3 Port SSFL13**
       - **4 Port SSFL14**
       - **6 Port SSFL16**
2. Blank Insert
   - Color: Blank Insert to be WHITE –
   - Quantity: Contractor will provide one insert for every unused port in a faceplate.
   - Hubbell Wiring, Part #: **SFBW10**, or approved equal.
3. Wall Phone Plates
   - Faceplate shall be a two-piece design, including a steel base and a stainless-steel cover plate.
   - Faceplates steel base shall incorporate six screw terminals, one 6 position jack and an insulating plastic sleeve.
   - Faceplate shall be equipped with screw studs to be used as the mounts for wall hung telephones.
   - Color: Faceplate to be STAINLESS STEEL
   - Quantity: Contractor will provide one faceplate for each Intercom Handset outlet shown on the drawings.
   - Allen Tel, Part #: **AT630A-6**, or approved equal. Tragic
4. Blank Wall Plates
   - Faceplate shall be constructed from stainless steel.
   - Faceplates shall be UL Listed and CSA Certified
   - Faceplates shall be 2.75" W x 4.5" H (69.8 mm x 114.3 mm) for single gang.
   - Color: Faceplate to be STAINLESS STEEL
   - Quantity: Contractor will provide one faceplate for each unused data/voice/video/intercom outlet shown on the drawings.

- Hubbell Wiring Part #: **S13**, or approved equal.

5. Surface Mount Raceway Insert –
   - Inserts for Hubble PB2, PB3, and PS3 Device Mounting Brackets
   - Insert shall allow for two category 6 jacks to be mounted flush.
   - Insert shall match the color of the Raceway installed.
   - Color: Faceplate to be IVORY
   - Quantity: Contractor will provide one 2port insert for each outlet in the Surface Mount Raceway shown on the drawings.
   - Hubbell Part #: **KP2162 or approved equal**.

2.2 Horizontal Distribution Cabling

1. The horizontal distribution cabling system is the portion of the telecommunications cabling system that extends from the Work Area (WA) telecommunications outlet/connector to the horizontal cross-connect in the Telecommunications Room (TR).
   - Cabling Support System
   - Copper Station Cabling
   - Copper Cross-Connect Cabling

B. Cabling Support System

1. J-Hooks
   - Cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed.
   - Cable supports shall have flared edges to prevent damage while installing cables.
   - Cable support system shall provide fasteners that allow them to be mounted to wall, concrete, joist, tee-bar wire, treaded rod, beams and raised floor supports.
   - Fasteners shall have the ability to either be factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.
   - Fastener to with one non-continuous cable support, factory or jobsite assembled.
   - Color: NA
   - Quantity: Contractor will provide quantities of j-hooks and hanger accessories in the amount necessary to support all horizontal cabling every 4-5 feet.
   - Part #:
     - ERICO CAT425
     - Cooper B-Line BCH12, BCH21, BCH32, BCH64 and accessories.

C. Copper Station Cable

1. Category 6 Data/Voice, Camera, and Intercom Unshielded Twisted Pair (UTP) Cable
   - Cable will meet or exceed the proposed requirements of ANSI/TIA/EIA 568-B.2, 568-B.2 Addendum #1 and ISO/IEC 11801 Category 6 Cable Standard for: NEXT and ELFEXT (Pair-To-Pair and Power Sum), Insertion Loss (Attenuation), Return Loss, and Delay Skew.
   - Cable shall be proven to support Gigabit Ethernet / 1000BASE-T / IEEE 802.3ab, ATM up to 155 Mbps, IEEE 802.3af Power Over Ethernet for VoIP, 100 Mbps Fast Ethernet / 100BASE-T / IEEE 802.3, ANSI.X3.263 FDDI TP-PMD, Ethernet / 10BASE-T / IEEE 802.3, 4 & 16 Mbps Token Ring / IEEE 802.5, T1/E1, xDSL, ISDN, 550 MHz Broadband Video and standards under development such as ATM at 622 Mbps, 1.2 and 2.4 Gbps.
   - The cable shall consist of four unshielded twisted pairs of thermoplastic insulated bare copper enclosed in a thermoplastic jacket.
   - All cable shall conform to the requirements for communications circuits defined by the National Electrical Code (Article 800) and the Canadian Building Code.

Cable listed to NEC Article 800-51(a) will be used for “Plenum” installations. Cable listed to NEC Article 800-51(b) shall be installed in vertical runs penetrating more than one floor.

- Cable shall have been certified with the UL 1666 Vertical Tray Flame Test.
- Cable shall be available in a Plenum, Riser and Indoor/Outdoor rated jackets.
- Contractor will use the indoor/outdoor rated cable for all locations where the cable pathway goes underground and/or run in exterior conduit.
- The listed Category 6 cables in this specification are manufactured by Mohawk/CDT. All other manufactures eligible for Hubbell’s Certified Premise Solution also have been pre-approved.
- Color:
  - Data/Voice BLUE
  - Camera WHITE
  - Intercom YELLOW
- Quantity: See Drawing for quantity and installation details.
- Part#:
  - For Riser Application:
    - Data/Voice Hubbell **C6RREB**
    - Camera Hubbell **C6RREW**
    - Intercom Hubbell **C6RREY**
  - For Plenum Application:
    - Data/Voice Hubbell **C6RPEB**
    - Camera Hubbell **C6RPEW**
    - Intercom Hubbell **C6RPEY**
  - For Indoor/Outdoor Application:
    - Data/Voice, Mohawk PN# **M58722** (all cable jackets will be BLACK)

2. Category 6A Wireless Access Point Unshielded Twisted Pair (UTP) Cable
   - Cable will meet or exceed the proposed requirements of ANSI/TIA/EIA 568-B.2, 568-B.2 Addendum #1 and ISO/IEC 11801 Category 6 Cable Standard for: NEXT and ELFEXT (Pair-To-Pair and Power Sum), Insertion Loss (Attenuation), Return Loss, and Delay Skew.
   - Cable shall be proven to support Gigabit Ethernet / 1000BASE-T / IEEE 802.3ab, ATM up to 155 Mbps, IEEE 802.3af Power Over Ethernet for VoIP, 100 Mbps Fast Ethernet / 100BASE-T / IEEE 802.3, ANSI.X3.263 FDDI TP-PMD, Ethernet / 10BASE-T / IEEE 802.3, 4 & 16 Mbps Token Ring / IEEE 802.5, T1/E1, xDSL, ISDN, 550 MHz Broadband Video and standards under development such as ATM at 622 Mbps, 1.2 and 2.4 Gbps.
   - The cable shall consist of four unshielded twisted pairs of thermoplastic insulated bare copper enclosed in a thermoplastic jacket.
   - All cable shall conform to the requirements for communications circuits defined by the National Electrical Code (Article 800) and the Canadian Building Code. Cable listed to NEC Article 800-51(a) will be used for “Plenum” installations. Cable listed to NEC Article 800-51(b) shall be installed in vertical runs penetrating more than one floor.
   - Cable shall have been certified with the UL 1666 Vertical Tray Flame Test.
   - Cable shall be available in a Plenum, Riser and Indoor/Outdoor rated jackets.
   - Contractor will use the indoor/outdoor rated cable for all locations where the cable pathway goes underground and/or run in exterior conduit.
   - The listed Category 6 cables in this specification are manufactured by Mohawk/CDT. All other manufactures eligible for Hubbell’s Certified Premise Solution also have been pre-approved.
   - Color:
     - Wi-Fi BLUE
   - Quantity: See Drawing for quantity and installation details.

- Part#:
  - For Riser Application:
    - Wi-Fi Hubbell **C6ASRB**
  - For Plenum Application:
    - Wi-Fi Hubbell **C6ASPB**
  - For Indoor/Outdoor Application:
    - Wi-Fi, Mohawk PN# **M58722** (all cable jackets will be BLACK)

D. Horizontal Copper Cross-Connect Cabling

1. Voice Cross-Connect Cabling
   - Cable shall meet and/or exceed the UL Listed Type CMR and the ANSI/ICEA S-80-576 standard.
   - Core Construction
     - Conductors: Solid-copper conductors, 24 AWG.
     - Insulation: Flame retardant semi-rigid PVC.
     - Core Assembly: Cable core will be made up of 100 pair units consisting of four (4) 25 pair sub-units. Each group individually identifiable by color coded unit binders.
   - Jacket: Gray, flame retardant PVC jacket.
   - Color: Voice cable jacket will be GRAY
   - Quantity: See Drawing for quantity and installation details. The number of 25-pair cable between the MDF and the IDF shall be derived by multiplying the number of pairs required for the cross-connect by 1.25 to the nearest 25-pair increment.
   - Part#: Equal to Mohawk Cable:
     - 12 pair = PN# **09-094-02 – Superior Essex**
     - 25 pair = PN# **M58141**
     - 50 pair = PN# **M58522**
     - 100 pair = PN# **M585201**

2.3 Backbone Cabling

A. General

1. The backbone cabling system is the portion of the telecommunications cabling system that extends from the Intermediate Distribution Frame (IDF) to the Main Distribution Frame (MDF).
   - Fiber Optic Backbone Cabling
   - Copper Backbone Cabling

B. Fiber Optic Backbone Cabling –

1. Data System Backbone Cabling
   - Cable shall be UL/cUL OFNR/OFN FTA rated and be Flame Resistant in accordance with the UL 1666.
   - Cable shall an indoor/outdoor rated jacket.
   - Cable shall be constructed utilizing a loose tube design.
   - Cable will be fully water blocked combining overall water blocking tape and a moisture blocking gel for each individual tube.
   - Cable will maintain the following:
     - Crush Resistance (EIA-455-41) = 2000 N/cm
     - Impact Resistance (EIA-455-25) = 2000 Impacts w/1.6 N-m
     - Min Bend Radius:
       - Long Term - No Load = 15x Cable diameter
       - Short Term – Load = 20x Cable diameter
     - Operating Temp. = -40°C to +70°C
     - Storage Temp. = -40°C to +80°C
   - Cable shall be constructed of 50/125µ Laser Optimized rated glass capable of:
     - 1 Gigabit Ethernet Link at 1000m/600m (@850nm/1300nm)

        - 10 Gigabit Ethernet Link at 300m/300m (@850nm/1300nm)
    - The Fiber Optic Cable in this specification is manufactured by Mohawk/CDT. All other manufactures eligible for Hubbell's Certified Premise Solution that meet and/or exceed the below specifications have also been pre-approved.
    - Color: Fiber Optic cable jacket will be BLACK
    - Quantity: See Drawing for quantity and installation details.
    - Hubbell Premise Part #:
        - 12 Strand Multi Mode Fiber **HFCD14012R4BK**

C. Copper System Backbone Cabling
1. Voice & Intercom System Backbone Cabling
    - Cable shall meet or exceed those specified in RUS Bulletin 1753F-208 (REA PE-89)
    - Core Construction
        - Conductors: Solid, annealed copper, 24 AWG unless otherwise noted on design documents.
        - Insulation: Dual insulation consisting of an inner layer of foamed polyolefin skin, colored coded in accordance with industry standards
        - Core Assembly: Cables of 25 pairs and less formed by assembling pairs together in a single group. Cables of more than 25 pairs formed by twisted pairs arranged in groups with each group having a color coded unit binder.
        - Filling Compound: The entire core assembly completely filled with ETPR compound, filling the interstices between the pairs and under the core tape.
        - Core Wrap: Non-hygroscopic dielectric tape applied longitudinally with an overlap.
        - Sheath Construction
        - Aluminum Shield: Corrosion protected plastic coated, corrugated 0.008" aluminum tape.
    - Jacket: Black, linear low-density polyethylene.
    - Color: Voice cable jacket will be BLACK
    - Quantity: See Drawing for quantity and installation details. The number of 25-pair cable between the MDF and the IDF shall be derived by multiplying the number of pairs serving the individual telephone handsets by 1.25 to the nearest 25-pair increment.
    - Part#: Equal to General Cable:
        - 12 pair = PN#**09-094-02 – Superior Essex**
        - 25 pair = PN# **7525758**
        - 50 pair = PN# **7525793**
        - 75 pair = PN# **7525801**
        - 100 pair = PN# **7525819**
        - 200 pair = PN# **7525835**

2.4 Telecommunication Room

A. General Requirements
1. The Telecommunication Room (TR) includes those products that terminate horizontal and backbone cabling subsystems and connect then to the network equipment.
    - Patch Cords
    - Horizontal Cabling Termination Equipment
    - Backbone Cabling Termination Equipment
    - Cabinets, Racks, and Enclosures
    - Cable Support System

B. Patch Cords
1. Category 6 Data/Voice & Camera TR Patch Cords

- TR Copper Patch Cords shall comply with those specified in 2.1 Work Area Subsystem, A. Patch Cords, 1. Category 6 Data Outlet Patch Cords
- All patch cords will be delivered to the site and must be signed for by the Owner/Owner's Representative. It will be the responsibility of other to install all TR Data and Voice Patch Cords.
- Color:
  - Data/Voice BLUE
  - Camera RED
- Quantity: Contractor will provide one patch cord for every data and voice outlet cable shown on the drawings. Contractor will provide the quantity of different length patch cords as follows:
- Part#:
  - Data/Voice Patch Cords
    - 3-Foot **HCL6B03**
  - Camera Patch Cords
    - 3-Foot **HCL6R03**

2. Category 6A Wireless Access Points TR Patch Cords
   - TR Copper Patch Cords shall comply with those specified in 2.1 Work Area Subsystem, A. Patch Cords, 1. Category 6A Data Outlet Patch Cords
   - All patch cords will be delivered to the site and must be signed for by the Owner/Owner's Representative. It will be the responsibility of other to install all TR Data and Voice Patch Cords.
   - Color:
     - Wi-Fi PURPLE
   - Quantity: Contractor will provide one patch cord for every data and voice outlet cable shown on the drawings. Contractor will provide the quantity of different length patch cords as follows:
   - Part#:
     - Wi-Fi Patch Cords
       - 3-Foot **HCL6AP03**

3. Fiber Patch Cords
   - Patch Cords shall be a Duplex LC to LC 50/125µm "Laser Optimize" Graded-Index Multimode Fiber Patch Cord.
   - All patch cords shall be factory polished and 100% optically tested for superior performance.
   - Cables shall have a Mated Pair MM Insertion Loss of less than 0.60 dB (0.25 dB Typical).
   - Cable Retention: > 25 pounds
   - All optical, mechanical and environmental performance shall meet and/or exceed the TIAEIA-568-B.3 specifications.
   - Fiber patch cords will be 1-meter long.
   - Color: NA
   - Quantity: Contractor will provide two fiber patch cords for every New fiber optic backbone cable run shown on the drawings.
   - Part#: **DFRCLCLCF1MM**

C. Horizontal Cable Termination Equipment
   1. Modular Unloaded Patch Panels (Only 48-Port Patch Panels is Acceptable)
      - Panels shall be made of black anodized aluminum in 24-, 48-, and 96- port configurations.
      - Panels shall have modular jacks employing a tri-plane staggered contact array with a flat "hairpin" contact design made of Beryllium copper with a minimum 50-

micro-inch gold plating on contact surfaces over 50-100 micro-inch of nickel compliant with FCC part 68.

- Panels shall be equipped with 110-style termination made of fire retardant UL 94V0 rated thermoplastic and tin lead solder plated IDC.
- Panels shall have optional rear cable support bar for strain relief. Cable support bar shall attach to the rear of the patch panel itself without the use of additional fasteners or screws.
- Panels shall have self-adhesive, clear label holders and white designation labels provided with the panel for each row of 24 ports.
- Panels shall provide wiring identification & color code and maintain an in-line, paired punch down sequence that does not require the splitting of conductors from individual cable pairs.
- Panels shall terminate 22-26 AWG solid conductors, maximum insulated conductor outside diameter 0.050".
- Panels shall be ANSI/TIA/EIA-568-B.1, B.2 and ISO/IEC 11801 category 6 compliant.
- Panels shall be UL LISTED 1863 and CSA certified.
- Panels shall be made by an ISO 9002 Certified Manufacturer.
- Panels installed in a 4-connector channel with a category 6 modular jack, and category 6 patch cords, all from the same manufacturer, and a qualified category 6 cables shall meet or exceed the requirements of Draft 5 of the TIA UTP Systems Task Group PN3727, Category 6 Draft Addendum to the ANSI/TIA/EIA-568-B.2 standard.
- Color: Patch Panel shall be BLACK
- Quantity: See Drawing for quantity and installation details. The number of patch panels to be supplied shall be derived by multiplying the number of data/voice cables being terminated at the individual TR by 1.25 and providing additional panels in the nearest 24 port increment.
- Part#:
  - 24 port Category Patch Panel, **HWS14608C**
  - 48 port Category Patch Panel, **HWS14609C**
    - *Provide one Cable Management Bar, PN# **PCBLMGT**, for each 24 ports.

D. Horizontal Voice & Intercom Cross-Connect 66 Wiring Blocks

1. Wall Mount
   - Blocks shall be available in a 25 pair unit.
   - Blocks shall be wall mounted.
   - Wiring blocks shall be available as kits that include the wiring blocks, the proper number of connecting clips, wire management and label strips.
   - Blocks shall be constructed of a UL94 V0 rated polycarbonate blend.
   - Blocks shall be mounted to a rugged 16 ga steel distribution frame. Frame shall support the 66 blocks and allow for a through for cables to be routed through the rear of the blocks directly to the termination point.
   - Blocks shall be UL VERIFIED for TIA/EIA-568-B compliance.
   - Color: NA
   - Quantity: See Drawing for quantity and installation details.
   - Part#: 6 pair block, PN# **HPW66B16**
   - Part#: 25 pair block, PN# **HPW66B425**
   - Accessories to be provided with each installed 66 Block:
     - Mounting Bracket PN# **HPW89D**

E. Backbone Cable Termination Equipment

1. Fiber Optic Cassette

- ETL Tested per TIA/EIA-568-C.3
- MM Mated Pair Insertion Loss: <0.5dB (0.35dB typical)
- Return Loss: <-35dB
- Operating temperature: 0-70°C
- Materials:
  - Connector ferrule: Zirconia ceramic
  - Connector body/nut: Nickel plated brass/zinc or polymer
- Strain relief boot: Flame retardant (UL-Rated 94-V0) polymer
- Color: Aqua
- Quantity: See Drawing for quantity and installation details.
- Part#: **OCLC50G4CVI**

F. Copper Termination Panels
1. Voice 110 Wiring Blocks
2. Wall Mount
   - Blocks shall be available in a 300-pair unit.
   - Blocks shall be wall mounted.
   - Wiring blocks shall be available as kits that include the wiring blocks, the proper number of 5 pair connecting clips, wire management and label strips.
   - Blocks shall be constructed of a UL94 V0 rated polycarbonate blend.
   - Blocks shall be mounted to a rugged 16 ga steel distribution frame. Frame shall support the 110 blocks and allow for a through for cables to be routed through the rear of the blocks directly to the termination point.
   - Blocks shall be UL VERIFIED for TIA/EIA-568-B compliance.
   - Color: NA
   - Quantity: See Drawing for quantity and installation details. The number of 110 blocks to be supplied shall be derived by multiplying the number of voice/intercom cables being terminated at the individual TR by 1.25 and providing additional panels in the nearest 300 pair block increment.
   - Part#: 300 pair block, PN# **110WMK**
3. OSP Protection Panels
   - 110 connector input and output
   - wall or frame mountable
   - designed with an internal splice chamber and cover over incoming and outgoing connections and protection modules
   - stackable to allow for future service expansion
   - equipped with an internal fuse link
   - external ground connectors accept 6-14 AWG ground wire
   - accommodates industry standard 5 pin protection modules
   - designed to exceed the requirements set forth in Underwriters Laboratory's UL497
   - Color: NA
   - Quantity: One protection panel will be installed per IDF home run to the MDF. Protection panels are not required at the IDF side of the cable run.
4. Part#: Circa Enterprise inc. –
   25 pair block, PN# **1880ECA1-25**
   50 pair block, PN# **1880ECA1-50**
   100 pair block, PN# **1880ECA1-100**

G. Fiber Termination Panels
1. MDF Rack Mount Fiber Panel
   - Panels shall be constructed of cold rolled 16 ga. steel with a black powder paint finish and provide for fully enclosed fiber patching and termination.

- Panels shall have a removable smoked Plexiglas front cover with optional lock kit. The panel shall have a removable top, front and rear covers. The panel adapter tray shall be removable from the front of the panel by sliding the tray forward. Panels shall come with rack mounting brackets that allow it to be mounted with the front cover flush with the front of the rack, or with the front of the panel extended 5.0" in front of the rack.
- Panels shall be 2 rack spaces, accepting 9 adapter panels.
- Adapter panels shall be available with SC multimode adapters. Adapter shall have a zirconia alignment sleeve.
- Panel shall have a splice tray mounting stud incorporated into the base for mounting of mechanical or fusion splice trays. Adapter tray shall have cable management anchor points and come with cable anchors allowing for the maintenance of the incoming cable with the proper minimum bend radius.
- Panels shall have four cable entrance ports on the top and 2 on the bottom, which are covered by knock outs. Panels shall have two jumper ports in the bottom at the front of the panel with plastic dust covers for routing of jumpers.
- Color: Fiber Panel will be BLACK
- Quantity: See Drawing for quantity and installation details.
- Hubbell Premise Part #, or approved equal:
  - 4U Rack Mount Panel **FCR4U15SPL**
  - Insert Panels
    - Blanks **FSPB**

2. IDF Rack Mount Fiber Panel
   - Panels shall be constructed of cold rolled 16-gauge steel with a black powder paint finish.
   - The panel shall have a hinged swing-out fiber drawer. Panels shall come with rack mounting brackets that allow it to be mounted on a 19" or 23" rack. Panel shall occupy no more than one rack space.
   - Panel shall be constructed to accept up to 3 adaptor panels.
   - Panels shall have cable entrance points in the rear, which are covered by knock-outs
   - Color: Fiber Panel will be BLACK
   - Quantity: See Drawing for quantity and installation details.
   - Hubbell Premise Part #, or approved equal:
     - Rack Mount Panel
       - 1U Rack Mount Panel **FCR1U3SPL**
     - Insert Panels
       - Blanks **FSPB**

3. IDF Wall Mount Fiber Panel
   - Panels shall be constructed of cold rolled 16-gauge steel with a black powder paint finish.
   - Panel shall be constructed to accept up to 1 adaptor panels.
   - Color: Fiber Panel will be BLACK
   - Quantity: See Drawing for quantity and installation details.
   - Corning Cabling System Part #, or approved equal:
     - Wall Mount Panel
       - Single Panel Housing **SPH-01P**

H. Cabinets, Racks, and Enclosures
   1. Contractor will provide the following 'MDF/IDF' Cabinets, Racks, Enclosures and components based on the number of cables to that will be terminated:

1. Floor Mount Racks
   - Floor Mount Racks shall be UL Listed and constructed using 60630-T6 extruded aluminum.
   - Rack shall have a black polyurethane finish.
   - Rack base shall be pre-drilled for securing rack to the floor.
   - Rack rails shall be spaced for 19" mounting rail-to-rail and shall be of a U shaped construction with 12/24 pre-tapped holes in the EIA-310-D standard hole pattern providing 48 rack spaces on both the front and rear. Rails shall have a universal side drilling pattern to allow racks to be bolted together or attachment of accessories.
   - Rack shall provide for a grounding point per the TIA/EIA 607-A.
   - Rack shall have a minimum of 45 rack spaces.
   - Rack height shall be 83.50" (7')
   - Rack shall support 1500lbs of equipment.
   - OSHPD Pre-Approved # OPA-0845
   - **Color: BLACK**
   - **Quantity:** See Drawing for quantity and installation details.
   - **Part#: APC-NetShelter**
     Floor Mount 2-Post Open Frame Rack
     AR201
     Contractor to provide (2) per MDF

     Vertical Wire Managers
     AR8715
     Contractor to provide (1) per MDF
     AR8775
     Contractor to provide (1) per MDF

2. Wall-Mounted Cabinets
   - Wall-mounted cabinets shall be manufactured from steel sheet.
   - Each cabinet will have a rear panel that attaches to the wall, a hinged cabinet body that swings open from the rear panel providing easy access to the rear of equipment and a locking front door.
   - The rear panel will provide cable access with pre-punched knockouts, up to 3", for conduit along the top and bottom edges of the panel. There will also be cutouts in the back of the rear panel so that cables can enter the panel through the wall. The rear panel will provide attachment points for accessory equipment mounting brackets and cable tie points within the panel (cabinet).
   - The cabinet body will include a single pair of vertical 19" EIA equipment mounting rails. The mounting rails will be EIA-310-D compliant with the Universal hole pattern. Mounting holes will have #12-24 threads.
   - Mounting rails will be adjustable in depth so that they can be positioned at any point within the cabinet body. The design of all cabinets will allow an additional pair of mounting rails (for a total of two pairs of mounting rails per cabinet) to be added to the cabinet.
   - The wall-mount cabinet shall provide a hinge design that attaches the cabinet body and the rear panel and allow the rear panel to be removed during installation. The hinge design will allow the cabinet body to open at least 90°. The hasp used to secure the rear panel and the cabinet body together will assist in drawing the components together during the locking action.
   - The cabinet body will include vents that are designed to accept fan kits.
   - The front door will be hinged and locking. The front door and rear panel will be keyed alike. The front door will have rounded edges and corners. The cabinet body will allow the front door to be attached so that it will swing open from the right or left. The cabinet manufacture shall provide an option for a solid or a tinted

plexi-glass window front door. The plexi-glass in doors shall be bronze acrylic (not clear) with a UL flammability classification of 94HB or better.

- Finish shall be epoxy-polyester hybrid powder coat (paint).
- The cabinet shall have the option of being delivered fully assembled. All cabinets will include installation hardware (hex lag screws) for wood studs and 50 each #12-24 equipment mounting screws.
- Load bearing capacity for cabinets that wall-mount will be a minimum of 200 pounds per cabinet.
- Cabinets that are wall-mount only will be certified and UL Listed to standard UL 60950 under category NWIN.
- Color: Wall Mount Cabinet will be BLACK
- Quantity: See Drawing for size, quantity and installation details.
- Part#:
  - Wall Mount Cabinet **RE4X**

  - Accessories to be provided with each installed cabinet:
    - Sound Dampening Kit **REKS**
    - Fan Kit **REKF**
    - Fan Filter Kit **REKFF**

I. Telco Backboards

1. Backboards shall be 4’ x 8’ x .75” void free plywood (ACX Plywood with the “A” side turned out).
2. Sheets shall be but to size for the application intended.
3. The plywood shall be painted with two coats of white fire-retardant paint.
   - Flame Stop III paint additive ASTM E-84, NFPA 255, UL 723
   - Add one pint of Flame Stop III and one pint of water to one gallon of latex-based paint.

Part 3 Execution

3.1 Installation

A. Work Area Outlets Installation

1. No more than 12” of cable shall be stored in an outlet box, modular furniture raceway, or insulated walls.
2. Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.
3. The cable jacket shall be maintained to within 12.7mm (½ inch) of the termination point.
4. All UTP cables shall have no more than 12.7mm (½ inch) of pair untwist at the termination point.
5. Data jacks, unless otherwise noted in drawings, shall be located in the top position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the left-most position(s).
6. Voice jacks, unless otherwise noted in drawings, shall occupy the next position(s) below the data on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the position left of the data jack.
7. Video jacks, unless otherwise noted in drawings, shall occupy the bottom position(s) on the faceplate. Video jacks in horizontally oriented faceplates shall occupy the position left of the data/voice jack.
8. All faceplates installed shall be level.
9. All outlets will be labeled according to the approved labeling scheme.

10. Each faceplate shall be machine labeled. The labeling shall be placed on the faceplate so that the individual jack can be clearly identified by its associated label.
11. Cables shall be identified by a self-adhesive label in accordance with the Identification and Labeling section of this specification and ANSI/TIA/EIA-606. The cable label shall be applied to the cable no further than 6" behind termination module, behind the faceplate on a section of cable that can be accessed by removing the cover plate.

B. Horizontal Distribution Cable Installation
1. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.
2. Tie Wraps will not be allowed for supporting, bundling and/or dressing of any station cables on this project.
3. Contractor will provide a three foot "service loop" for all station cables. The service loop will be coiled and secured using Velcro in the accessible ceiling at the conduit stub to the work area outlet box.
4. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in all "common" conduit runs. "Common" Conduit Runs are those that house more than one cable or set of cables that do not specifically feed a Work Station Outlet. Examples of "Common" Conduit Runs are: floor/ceiling penetrations, stub-throughs, distribution conduits, all conduits between J-boxes, etc.
5. Cable raceways shall not be filled greater than the TIA/EIA-569-A maximum fill for the particular raceway type or 40%.
6. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
7. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
8. Pulling tension on 4-pair UTP cables shall not exceed 25-lb for a four-pair UTP cable.
9. The Cable Support System shall be installed in such away that will allow for future cables to be added and to provide sufficient protection of all cable.
10. For all installs where station cables are not installed in a continuous conduit run the following guidelines will apply. The Contractor will be responsible to reinstall all cables and pathways that do not meet with the following at no additional cost to the Owner:
11. J-hooks shall be installed to support all station cables every 4ft to 5ft.
12. All pathways shall be run at right angles. No diagonal pathways will be allowed unless otherwise noted on the drawings.
13. Horizontal cables shall be bundled in groups of no more than 25 cables per Cooper B-Line's BCH21 J-hook, no more than 40 cables per Cooper B-Line's BCH32 J-hook, and no more than 64 cables per Cooper B-Line's BCH64 J-hook.
14. At no point shall cable(s) rest on acoustic ceiling grids, acoustic panels, or lighting fixtures.
15. All cables will be installed so that there is a minimum of 3" of clearance above all ceiling grid and tiles.
16. All cables will be installed so that there is a minimum of 12" of clearance above all florescent lighting.
17. All cables will be installed so that there is a minimum of 6" of clearance from all fire alarm and electrical system conduits.
18. Cables shall not be attached to the ceiling grid or lighting fixture wires. The contractor will provide their own carriers wires to support their horizontal cabling.
19. All cables shall be installed above fire-sprinkler systems and plumbing system fixtures and devises. Cables shall not be attached to or supported by these fixtures and/or their ancillary equipment or hardware.
20. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

21. Contractor is responsible for sealing around all cables that penetrate fire rated barriers.
22. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

C. Horizontal Cross-Connect Installation
1. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-A standard, manufacturer's recommendations and best industry practices.
2. The cable jacket shall be maintained to within 12.7mm (½ inch) of the termination point.
3. All UTP cables shall have no more than 12.7mm (½ inch) of pair untwist at the termination point.
4. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
5. All cables shall be neatly bundled and dressed continuously from the entrance point of the Telecommunications Room to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame. Contractor will use Velcro strip to bundle cables together. The use of Tie –Wraps is not permitted.
6. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

D. Backbone Cable Installation
1. Backbone cables shall be installed separately from horizontal distribution cables.
2. Where possible the backbone and horizontal cables shall be installed in separate conduits.
3. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
4. Pulling tension on Backbone cables shall not exceed the manufacture’s limitations.
5. The minimum bend radius for all Backbone cables is 16 times the cable diameter or the manufactures specification, whichever is greater.
6. All OSP cables may not penetrate more than 50ft into the buildings before be terminated or splices to cable with a fire resistant jacket, unless the jacket is indoor/outdoor rated.
7. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
8. A pull cord (nylon; 1/8" minimum) shall be installed with all empty OSP and Entrance Facility conduit.
9. All backbone cables shall be securely fastened to the sidewall of the TR on each floor.
10. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
11. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
12. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

E. Backbone Cross-Connect Installation
1. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-A document, manufacturer's recommendations and best industry practices.

2. Bend radius of the cable in the termination area shall not exceed 16 times the outside diameter of the cable.
3. All cables shall be neatly bundled and dressed continuously from the entrance point of the Telecommunications Room to their respective panels or blocks.
4. Contractor will provide a minimum of a 3 foot “service loop” for each backbone cable before terminating to allow future rearrangement. Cables will be coiled and secured above the ceiling where possible or to the Telco Backboard where entrance point is from the floor.
5. Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18” from the finished floor.
6. Contractor shall provide a machine label 1ft. to 2ft. from the entrance point of the TR and 6in. to 12in. from the termination point on each backbone cable. Cable shall be easily identified and fully legible without removing the bundle support ties.

F. Cabinets, Racks, Enclosures and Ladder Rack Installation
1. Wall Mount Racks/Cabinets shall be securely attached to the Telco Backboard using minimum 3/8” hardware or as required by local codes.
2. Floor Mount Racks/Cabinets shall be securely attached to the concrete floor using minimum 3/8” drop-in anchor hardware or as required by local codes.
3. All Floor Mount Racks/Cabinets will be either; secured on one side to the wall or attached to the closest wall with ladder rack.
4. All Racks/Cabinets shall be braced to meet Zone 4 seismic requirements.
5. Contractor will maintain a minimum of 36 inches of clearance from the front of the all rack/cabinets and all other obstructions.
6. Floor Mount Racks/Cabinets shall be installed to allow for a minimum of 36” from rear and all other obstructions.
7. All racks shall be grounded to the telecommunications ground bus bar.
8. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.
9. The plywood bottom edge shall be mounted vertically no less than 12” above the finished floor.
10. Contractor will provide all cutouts for the Electrical Contractors expansion rings and electric receptacles as shown on the drawings.
11. Ladder Rack must be securely attached to walls, backboards, and racks/cabinets to comply with all Zone 4 seismic requirements.
12. Ladder rack shall be installed so that there is a minimum of 8” of unobstructed clearance above rack.
13. Ladder Rack shall be installed so that there is a minimum of 12” of clearance from all: florescent lighting, electrical conduits/circuits, and fire alarm conduits/devices.

3.2 Identification and Labeling

A. General Requirements
1. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor.
2. The approved system will comply with the TIA/EIA -606-A Class 2 designations and include at a minimum, identifiers for all major components of the system: telecommunication rooms, grounding bus bars, racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure.
3. All label printing will be machine generated or hand-held printers using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination

point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

4. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

3.3 Testing and Acceptance

A. General

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-A Addendum 5, TSB-67 and TSB-95. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
2. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the Manufacturer's Warranty guidelines and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.
3. Contractor will notify the Owner/Owner's Representative 72 hours before commencement of testing.
4. Upon receipt of the test documentation, the Customer reserves the right to have the contractor perform a 10% witnessed "spot testing" of the cabling system to validate test results provided in the test document, at no additional cost. If a significant amount of cables are marginal and/or fail during the "spot test" Contractor will retest the entire cable plant at no additional cost.

B. Copper Cable Testing

1. Twisted Pair Cable
   - All twisted-pair copper cable links (including backbone cables) shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below.
   - Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
   - Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA-568-A Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
2. Category 6 Performance
   - Follow the Standards requirements established in:
     - ANSI/TIA/EIA-568-A -TSB-67
     - Wire Map
     - Length
     - Attenuation
     - NEXT (Near end crosstalk)
     - • ANSI/TIA/EIA-568-A -TSB-95
     - Return Loss

- ELFEXT Loss
- Propagation Delay
- Delay skew
- • ANSI/TIA/EIA-568-A, Amendment 5.
- PSNEXT (Power sum near-end crosstalk loss)
- PSELFEXT (Power sum equal level far-end crosstalk loss)

- A Level III or better test unit is required to verify category 6 performances and must be updated to include the requirements of TSB-95 and Amendment 5. Testers will be equal to Fluke Network's DXT CableAnalyzer™ Series.
- All testers shall have been recalibrated with 6 months of use on this project. Contractor will be asked to provide proof of recalibration.
- Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard, and the result shown as pass/fail. The approved Level Three tester shall provide a printed document for each test that is also available in a downloadable file using an application from the test equipment manufacturer. The printed test results shall include a print out of all tests performed, and the individual test results for each cable.

C. Fiber Optic Cable Testing

1. 50/125µ Backbone Fiber
   - Each fiber strand shall be tested for attenuation with an Optical Power Meter and light source and with an Optical Time Domain Reflectometer (OTDR) for actual length and splice/connector loss. Cable length shall be verified using sheath markings. The guidelines and procedures established for Tier 1 testing in TIA/TSB-140 shall apply.
   - All fiber optic cables shall be tested from the site's MDF to each fiber terminals located in the IDF. The results of OTDR testing to define the length of each riser cable shall be documented. The Contractor shall conduct a power meter (loss) test of each fiber optic station and riser cable at both wavelengths, 850/1300nm for MM and 1310/1550nm for SM, A to B, B to A, and OSPL (OSPL is defined as La + Lb). No individual station or riser fiber link segment (including connectors) shall measure more than 2.0 dB loss. Tests shall be conducted using ANSI/EIA/TIA/EIA-526-14A, Method B. Test results evaluation for the panel to panel (backbone) shall be based on the values set forth in ANSI/TIA/EIA-568-B.1.The Contractor shall provide an electronic printout for each strand tested with the Power Meter and the OTDR.
   - Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between the Owner and the Contractor prior to the start of the test.
   - All installed cables must meet or exceed the defined standards for performance. The Contractor shall take all steps necessary to repair or replace any optic not meeting the standard.
   - Fiber optic riser and station cable test results shall be provided in electronic format to the Owner.

3.4 System Closeout and As-built Documentation

A. General Requirements

1. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Owner's Representative/Engineer for approval. One (1) to be a hardcopy and two (2) to be electronic copies. Documentation shall include the items detailed in the sub-sections below.

2. Documentation shall be submitted within ten (10) working days of the completion of each testing phase. This is inclusive of all test results and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 calendar days of the completion of each testing phase. At the request of the Owner's Representative/Engineer, the telecommunications contractor shall provide copies of the original test results.
3. The Owner's Representative/Engineer will request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.
4. Test Results documentation shall be provided in two media, as listed above, one (1) hardcopy and one (1) on disk within three weeks after the completion of the project. The documentation shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an bi-annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
5. Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package.
6. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.
7. The As-Built drawings are to include cable routes, outlet locations and the approved labeling identifiers. Their sequential number as defined elsewhere in this document shall identify outlet locations. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (DWG, AutoCAD 2008) formats on which as-built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.
8. Contractor will provide one laminated 11"x17" drawing at each IDF that includes the building layout for that IDF, along with the outlet locations and all of the approved labeling.

END OF SECTION

SECTION 27 2000

NETWORK ELECTRONICS – OWNER PROVIDED & OWNER INSTALLED

Part 1 General

1.1 Statement of Work

A General

1 Provide coordination with district staff for scheduling of this system.

2 271000 contractors shall be complete with work including all testing and labeling prior to owner work start.

3 The district requires minimum of 10 days to review test documents prior to network start up.

Part 2 Products

2.1 General

A Network Electronics

1 The Network system will be owner supplied (parts and smarts).

2 All network equipment and programming required for this system will be owner supplied.

Part 3 Execution

3.1 General

A Installation

1 It is the contractor's responsibility to inform the Owner and/or the Owner's Representative of any and all conflict's, between the project documents and the onsite conditions.

END OF SECTION

SECTION 27 2300

UNINTERRUPTIBLE POWER SUPPLY - OWNER PROVIDED & OWNER INSTALLED

Part 1 General

1.1 Statement of Work

A. General

1. This document describes the requirements for the contractors, products and installation relating to furnishing and installing an Uninterruptible Power Supply System. The Uninterruptible Power Supply system, hereafter referred to as the UPS, shall provide high-quality AC power to the telecommunications systems.
2. This specification describes the UPS, a modular uninterruptible power supply system for workstation, server, network telecom and other sensitive electronic equipment applications. It defines the electrical and mechanical characteristics and requirements for a continuous-duty single-phase, solid-state, uninterruptible power supply system.
3. Contractor will provide a bid including all labor, materials, tools and equipment required for the complete installation of work called for on the Construction Drawings and described in this Document. It is the responsibility of the Contractor to provide all material necessary to provide a complete and operable system. If the contractor feels that the system described is incomplete, they must address this in writing to the Owner/Owner's Representative before providing a bid.
4. All questions concerning non-specified product and services will be address to the Owner's Representative before Contactor provides a bid. Owner expects that by accepting the Contractor's bid proposal that the Contractor has provided a competent bid for a complete solution.
5. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of UPSs, typical installation details, and outlet types will be provided as an attachment to this document.

1.2 References

A. Regulatory References

1. Contractors will comply with all requirements as specified in Section 27 0000 '1.3 – Regulatory References'.

1.3 Safety and Indemnity

A. Requirements

1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0000 '2.1 – Safety and Indemnity'.

1.4 Contractor Qualifications

A. Requirements

1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0000 '2.2 – Contractor Qualifications'.

1.5 Quality Assurance

A. Requirements

1. Contractors shall comply with all requirements as specified in Section 27 0000 ‘2.3 – Quality Assurance’.

1.6 Equivalent Products

A. Products

1. All products described, and part numbers given in this specification are those of Eaton unless otherwise noted.

B. Pre-Approved Equals

1. None at this time.

C. Other Than Specified

1. Contractors wishing to approve a system other than those specified in this document shall do so in accordance with Section 27 000 ‘3.1 Equivalent Products’.

1.7 Submittal Documentation

A. Requirements

1. The successful contractor shall provide their submittal package in accordance with the Section ‘01 20 00 – Submittal Schedule’ and Section 27 0000 ‘3.2 – Submittal Documentation’.

1.8 Acceptance

A. Requirements

1. The contractor shall comply with all requirements as listed in Section 27 0000 ‘3.3 – Acceptance’.

1.9 Warranty

A. Requirements

1. The contractor shall comply with all requirements as listed in Section 27 0000 ‘3.4 – Warranty’.

Part 2 Products

2.1 Uninterruptible Power Supply Systems (UPS)

A. Server Room UPS

1. General
   - Topology: Line Interactive
   - Configuration: Rack Mounted
   - Rating: 3kVA (3000 VA), 2,700W
   - UPS Bypass: Yes, included
   - Diagnostics: Full system self-test at power up
   - Dimensions: 3.4in H x 17.2in W x 22.6in D (1U)
   - Weight: 55 lbs.
   - Manufacturer’s Warranty: Lifetime
   - Rail Kit included: 4-Post rail kit and tower pedestals
   - Remote Emergency Power Off: Rear deck emergency stop connectors
2. Electrical Input
   - Connection: C19 to L6-20P
   - Input Cord: Included

- Input Voltage Range: 47-70 Hz (50Hz system), 56.5-70 Hz (60 Hz system), 40 Hz in low-sensitivity mode.
- Nominal Voltage: 230V default (200/208/220/230/240V/250V)

3. Electrical Output
   - Nominal Voltage: 230V default (200/208/220/230/240/250V)
   - Output receptacles
     - Six (6) C13
     - One (1) C19
   - Power Factor: 0.9
   - Transfer time: 0ms
   - Circuit Breaker: Three (3) for L6-20R; six (6) for 5-20R
4. Battery
   - Lithium
   - Maximum number of EBM: up to 5 extended battery modules, add up to 12 with supercharger module
   - Hot-Swappable extended battery modules, no internal batteries in UPS module
   - Start on Battery: Cold-start enabled, first cold start is always forbidden
5. Communications
   - User Interface
     - Graphical display, UPS status in a single view
   - LEDs: Four (4) status-indicating LEDs
   - Communication Ports: RS-232 (RJ-45) ports, USB port as standard (HID), 6 Foot RS-232 cables included
   - Communications Card Slot: Network Card included
   - Power Management Software: Included
6. Environmental
   - RoHS Compliance: Yes
   - IEEE ANSI C62.41 CatB2
7. The **MDF UPS** shall be equal to **N1C** model #: **N1C.L3000G (3KVA, 208/220/230/240V)**
   - Contractor to include the **N1C** model #: **N1C SNMP Card**.
   - Contractor will provide one (1) UPS units for the MDF's.
   - Contractor to include the **APC** model #: **AP9626**.
   - Contractor will provide one (1) step down transformer units for the MDF's.
   - Contractor to include the **IEC320 C20 to NEMA L6-30** model #: **PFC2012L63012**.
   - Contractor to include the **APC** model #: **AP7920B**.
   - Contractor will provide one (1) Rack Mount PDU per Rack/Cabinet Installed in the MDF's

Part 3 Execution

3.1 Installation

A. Inspection

1. The following inspections and test procedures shall be performed by factory trained field service personnel during the UPS start-up.
   - Visual Inspection
     - Inspect equipment for signs of shipping or installation damage.
     - Verify installation per drawings
     - Inspect cabinets for foreign objects
     - Verify neutral and ground connectors are properly sized and configured
   - Mechanical Inspection
     - Check all power modules are correctly fitted

        - Check all batter modules are correctly fitted
        - Check all terminals screws, nuts and/or spade lugs for tightness
    - Electrical Inspection
        - Confirm input voltage and phase rotation is correct
        - Verify bypass voltage jumper is correct for voltages being used

B. Unit Start Up and Site Testing
    1. The manufactures field service personnel shall provide site testing if requested. Site testing shall consist of a complete test of the UPS system and the associated accessories supplied by the manufacturer. A partial batter discharge test shall be provided as part of the standard start-up procedure. The test results shall be documented, signed and dated for future reference.

C. Manufacturer's Field Service
    1. Service Personnel
        - The UPS manufacturer shall directly employ a nationwide service organization, consisting of factory trained Customer Engineers dedicated to the start-up, maintenance, and repair of UPS and power equipment. The organization shall consist of factory-trained Customer Engineers working out of District Offices in most major cities. An automated procedure shall be in place to ensure that the manufacturer is dedicating the appropriate technical support resources to match escalating customer needs.
        - The manufacturer shall provide a fully automated national dispatch center to coordinate field service personnel schedules. One toll-free number shall reach a qualified support person 24 hours/day, 7 days/week, and 365 days/year. If emergency service is required, call back response time from a local Customer Engineer shall be 20 minutes or less.
    2. Replacement Parts Stocking
        - Parts shall be available through an extensive network to ensure around- the-clock parts availability throughout the country.
        - Local Customer Engineers shall stock replacement spare parts with back up available from District Service offices and the manufacturing location.
        - Customer Support Parts Coordinators shall be on-call 24 hours a day, 7 days a week, 365 days a year for immediate parts availability.
    3. UPS Maintenance Training
        - Maintenance training courses for customer employees shall be available by the UPS manufacturer. This training is in addition to the basic operator training conducted as a part of the system start-up.
        - The training course shall cover UPS theory, location of subassemblies, safety, battery considerations and UPS operational procedures. The course shall include AC to DC conversion and DC to AC inversion techniques as well as control and metering, Troubleshooting and fault isolation using alarm information and internal self-diagnostics shall be stressed.

3.2 System Close Out and As-Built Documentation

A. Testing
    1. Factory Testing
        - Before shipment, the manufacture shall fully and completely test the system to assure compliance with the specification. These tests shall include operational discharge and recharge tests on the internal battery to guarantee rated performance.
    2. General
        - All hardware shall be 100% tested for defects in installation and to verify system performance under installed conditions. Any defect in the system installation

shall be repaired or replaced in order to ensure 100% usage, at no cost to the Owner.

- The system shall be tested in accordance with this document, the manufacturer's warranty guidelines and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.
- Upon receipt of the test documentation, the customer reserves the right to have the contractor perform a witnessed 'spot testing' of the system to validate test results provided in the test document, at no additional cost.

B. Documentation
   1. Refer to Section 27 0000 '3.5 – Close Out Documentation' for requirements.

END OF SECTION

SECTION 27 3000

TELEPHONE SYSTEM – OWNER PROVIDED & OWNER INSTALLED

Part 1 General

1.1 Statement of Work

A General

1 Provide coordination with district staff for scheduling of this system.

2 271000 contractors shall be complete with work including all testing and labeling prior to owner work start.

3 The district requires minimum of 10 days to review test documents prior to telephone start up.

Part 2 Products

2.1 General

A Telephone System

1 The telephone system will be owner supplied (parts and smarts).

2 All telephone equipment and programming required for this system will be owner supplied.

Part 3 Execution

3.1 General

A Installation

1 It is the contractor's responsibility to inform the Owner and/or the Owner's Representative of any and all conflict's, between the project documents and the onsite conditions.

END OF SECTION

SECTION 27 5100

PAGING SYSTEMS – ADDING TO EXISTING INTERCOM SYSTEM

Part 1 General

1.1 Related Work in Other Sections

A General

1 All 120VAC power conductors and conduits associated with power circuits to all equipment locations shall be furnished and installed by Division 26 contractor.

2 All raceway systems including but not limited to conduit, j-boxes, outlet boxes, floor boxes, & surface mounted raceway shall be furnished and installed by Division 26 contractor.

1.2 Statement of Work

A General

1 Provide all labor, materials, tools and equipment required for the complete installation of work called for on the Construction Drawings and described in the Specifying Documentation.

2 This document describes the products and execution requirements relating to furnishing and installing Paging systems. Paging System Electronics and installation requirements are covered under this document.

3 The intent of these Specifications is to provide a complete Paging System and it is the responsibility of the bidding Contractor to provide a complete solution. It is also the responsibility of the Contractor to provide all material necessary to provide a complete system even if the material is not described specifically in the following documentation. All questions concerning non-specified product and services will be address to the Owner's Representative before the Contactor provides a bid. Owner expects that by accepting the Contractor's bid proposal that they [the Contractor] have provided a competent bid for a complete solution.

4 Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of devices, typical installation details, and mounting details will be provided as an attachment to this document. The successful vendor shall meet or exceed all requirements for the cable system described in this document.

1.3 Regulatory References

A Requirements

1 The contractor shall comply with all regulations listed in Section 27 0000 – '1.3 – Regulatory References'.

1.4 Safety and Indemnity

A Requirements

1 Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0000 '2.1 – A. Safety & Indemnity'.

1.5 Contractor Qualifications

A Requirements

1 Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0000 '2.2 – Contractor Qualification'.

1.6 Quality Assurance

A Requirements

1 Contractor shall comply with all requirements as specified in Section 27 0000 '2.3 Quality Assurance'.

1.7 Products

A Equivalent Products

1 All products approved in this specification are those of:

- Valcom Class Connect

B Pre-Approved Equals

1 None at this time.

2 The following Systems are designated as NOT EQUAL, and will not be accepted for review as a substitute

- Telecor
- Teradon

C Other Than Specified

1 Contractors wishing to approve a system other than those specified in this document shall do so in accordance with Section 27 0000 "3.1 Equivalent Products".

1.8 Submittal Documentation

A Requirements

1 The successful contractor shall provide their submittal package in accordance with the Section 01 20 00 1.06 Submittal Schedule, and Section 27 0000 '3.2 – Submittal Documentation'.

1.9 Acceptance

A Requirements

1 Contractor shall comply with all requirements as specified in Section 27 0000 '3.3 – Acceptance'.

1.10 Warranty

A Requirements

1 Contractor shall comply with all requirements as specified in Section 27 0000 '3.4 – Acceptance & Warranties'.

1.11 Close-Out Documentation

A Requirements

1 Contractor shall comply with all requirements as specified in Section 27 0000 '3.5 – Close-Out Documentation'.

Part 2 Products

2.1 General

A System Description

1 The following products specifically list the acceptable equipment types and items for this project. Where quantities are not noted, they may be obtained from the project drawings. In the event of a discrepancy between the specifications and the project drawings, the greater quantity or better quality shall be furnished.

2 This section includes a fully functional school internal communications and system incorporating safety, including but not limited to the following features:

- Complete control of all functions of the system from a web based user interface.
- Direct dialed, hands-free, two-way communication from all administrative telephones to any location equipped with a talkback speaker.
- Automatic gain control on intercom speech to assure constant talkback speech level.
- Microprocessor based system capable of handling up to 360 points. A point is defined as a call-in switch or a speaker output.
- System shall be modular in design and capable of expanding in increments of 48 points allowing for budget flexibility and expandability.
- System shall interface with any telephone system, thus allowing the school(s) to upgrade or replace the telephone system without suffering a requirement to replace, or lose any feature of, their internal communications (intercom) system. Any system that limits system features based upon any selected telephone system, and/or is proprietary to one or only a few telephone systems shall not be acceptable.
- Automatically sound an alert to over any loudspeaker connected for two-way communication to alert the classroom teacher that this two-way call has been established. This is intended to prevent unauthorized monitoring. This tone must repeat every fifteen (15) seconds.
- Distribution of emergency announcement(s) from any authorized telephone to all areas furnished with a loudspeaker. Emergency announcements from any administrative telephone, staff telephone, classroom telephone. The system shall be capable of provide all-call, group call, multiple group call, or dial-on-the-fly page groups.
- Classroom speakers shall be software assignable to any or all of the seventy-two (72) paging groups.
- Provide unlimited time tone schedules/unlimited events with the ability to automatically administer eight (8) or more schedules at any given time. Each scheduled event shall be capable of utilizing any one of nine (9) user defined internal tones/auxiliary sources. Automatically administered schedules shall be capable of simultaneous operation. Schedule administration, modification and creation functions must be available through password protected web access. Systems that do not provide this function will not be accepted.
- Provide 1, 2, 3, or 4 digits numbering plan, thus allowing the classroom speaker and the classroom telephone to be the same architectural number.
- Provide facilities for up to seven (7) call-in priority levels. Each classroom call button shall be assignable to any one or two of these priority levels. The call button priority levels shall have the capacity to change state on the time of day basis. The priority levels shall be as follows:
  - Normal
  - Security
  - Normal/Emergency
  - Urgent/Emergency
  - Overhead Ring
  - Emergency Only
  - Ignore
- Call button priority levels shall determine call queue placement. Emergency calls will be answered first; urgent calls second and normal calls last.

- System shall be capable of placing intercoms call on hold in order to perform other administrative functions.
- Any classroom/area loudspeaker must have the flexibility to be programmed as a testing room. A testing room shall be excluded from receiving general announcements, class change tones, group announcements and program material. The testing room must receive emergency tones and announcements. A dial code must be provided that will access these testing rooms at the same time, allowing for an announcement to the testing rooms for applications such as standardized testing. The testing rooms may be reactivated to normal operation at any time by the administration staff as needed. Testing rooms shall automatically be reset to normal operation before start of class the next day.
- Programmable features shall be stored in non-volatile memory and shall not be lost due to power failures.
- Classroom initiated intercom calls must be able to be assigned to ring at specific administrative ports. These administrative ports shall have the flexibility to be forwarded to other administrative ports should a call go unanswered or should the assigned administrative port be busy.
- Facilities to annunciate incoming intercom calls at multiple administrative phones simultaneously. Calls may be answered from any of the administrative telephones by simply lifting handset, dialing the room number or pressing a button on telephone. Once answered, the call will automatically be cancelled for other administrative phones.
- System functionality must include the capability to manually distribute up to 5 (five) alert emergency tones via pushbuttons, contact closure, or dial up tones from any administrative telephone. These tones shall be customizable with respect to cadence, type and duration. Dial up tones must only be accessible by authorized users.
- The system must provide a minimum of 4 (four) ports to be connected to the telephone system from the intercom system. These 4 (four) intercom lines shall provide built-in Enhanced Caller Line Identification which will visually announce the name of the teacher or location, the architectural classroom number, and the status of the call-in level; thus allowing interfacing to any telephone system. Systems that require integration to a specific telephone system or systems in order to offer this feature, or any system feature, shall not be acceptable.
- The system shall have the ability to control all system relays. Relays shall be DTMF controlled, automatically cycle at a programmed time of day, follow time schedule events, follow time group events, follow security calls, and follow emergency and ADA calls. All relays must be software programmable with the flexibility to change as required.
- The system shall provide at least three simultaneously operating, non-restrictive program distribution channels. The audio program material shall be controlled and distributed with administration PC software allowing simple and easy changes. Systems that require manual operated switch-banks or cumbersome DTMF telephone codes for distribution shall not be acceptable.
- The Communication System shall feature the capability to operate a system of cameras such that visual and audible communication may be seamlessly synchronized. The resulting system of cameras and intercom (visual intercom) shall feature a capacity of at least 192 camera locations and 4 administrative monitors. The system shall provide functionality such that each monitor can display a full motion visual broadcast of the area corresponding to any active intercom path. The camera system shall feature a PC based setup utility and shall use standard UTP infrastructure. Systems that do not offer the capability to seamlessly integrate with a camera system as described above shall not be acceptable.
- The system shall have the ability to store wav. files directly onto the CPU and shall not be lost due to power outage.

    - The wav files shall be activated via the Administration Software, Telephone and/or Telephone system, and/or pushbuttons.
    - The wav files shall be programmable as to what level of priority they can be broadcast. They shall be programmable as to override any class change tones, normal all call, music, and intercom in the event of an emergency.
    - The wav files shall also have the ability to be broadcast into any one or all of the 72 audio groups as well to any zone within the system.
    - The wav files shall be have the ability to be broadcast via a schedule for any day of the week or time of the day. They shall also have the ability to be broadcast for any duration of time and repeat number of plays with the ability to select how long the duration is between each repeated broadcast.
    - The wav files shall be able to be broadcast via a pushbutton. When this pushbutton is activated it shall be programmable to select which wav file is broadcast, the priority level, where it is broadcast, and how many times it shall play.
    - The wav files shall also have the ability to be a part of the class change tones within the system. These files shall be able to replace any tone within the class change schedules as to offer the flexibility of customizable tones and or phrases in this class change mode.
    - The wav files shall be programmable as to replace the hands-free alert tone, repeated alert tone, or the all call alert tones.
- Provide pre-alert tone to classroom for intercom calls and general announcements.
- Ability to program and control the built-in master clock with unlimited events and unlimited time schedules with multiple time groups.
- Ability to control wireless or wired clocks (various correction methods).
- Ability to produce user defined tone signals for time tones or emergency tones.
- Ability to select the tone on an all-call basis from any, or selected, administrative telephones.
- Provide an RS-232 port, which will give ability to monitor operations and functions of the systems.
- Provide off-site programming and diagnostics of the system. It shall also be capable of determining basic circuit faults.
- The system shall be capable of simultaneous conversations between administrative ports.
- The system shall have a Windows® based PC administration programming tool which allows the administrative personnel to easily manage Audio Sources, Class Change schedules, paging groups, time updates, holiday schedules and day/night mode operation from their desktop PC. It shall also have the ability to activate on board .wav files on a schedule and/or immediately in the event of an emergency at the highest priority override level. Systems that require propriety consoles, special LCD displays or solely utilize DTMF for changes to perform these functions shall not be acceptable.
- System shall be capable of utilizing 45 (forty-five) ohm speakers for classroom type speakers.
- System shall be capable of utilizing existing operational 25-volt type speakers
- System shall use 45 (forty-five) ohm or 25-volt speakers for intercom talkback zones. System shall also be connected to Valcom self-amplified one-way speakers and horns with built-in volume controls. An unlimited quantity of Valcom one-way speakers and horns may be connected to each zone.
- System speakers shall be capable of utilizing standard CAT 3 (three), 5 (five) or 6 (six) telephone/data wiring for installation, thus allowing for only one type of wiring infrastructure within the school. The speakers and call buttons shall be capable of utilizing spare pairs in the telephone wire connected to the classroom, allowing for lower installation cost. Systems that waste infrastructure by requiring separate heavy gauge infrastructure wire shall not be acceptable.

- Provide 8 (eight) unrestricted audio paths for communication between administrative phones, program material, time tone distribution, and paging.
- Provide 6 (six) software programmable pushbutton inputs that can be used to activate tones, emergency tones, time tones, schedules, set system time, force a holiday schedule, door entry, etc.
- Provide 8 (eight) software programmable output contact closures which can be activated manually to turn on cameras, unlock doors, emergency lockdown, etc., or automatically via Master Time Control Center.
- Provide voice-synthesized call-in, which allows the administrative telephones to hear the incoming intercom call's room number over the handset.
- Provide call confirmation tone at speaker when an intercom call is placed. This verifies that the call has been placed in queue. If the call is upgraded to an emergency, a second confirmation tone shall be activated.
- Automatically announce the architectural room number over any one, group, or all speakers if an emergency call-in goes unanswered. Systems that do not announce emergency call-ins shall not be acceptable.
- Provide Emergency Override on Board Voice Messaging via the following methods:
  - Any authorized PC on the schools Lan/Wan Network
  - Any authorized telephone
  - Any pushbutton
- The Existing Intercom System is **Valcom ClassConnection** Model **V-PR72**.

B Paging and Program distribution

1 Incorporate district-wide announcements, either live or recorded through a direct connection to the WAN and telephone system.

2 Any authorized administrator shall be able to call from outside the school into any classroom, zone or entire campus directly via the School District supplied telephone network. This shall allow remote monitoring and two-way communication from outside the school building as well as paging into the system. This feature shall allow the user access to all functions via a user defined PIN code. Compliance with NEMA standard SB-40 for emergency communications in K-12 schools.

3 Authorized system users shall be able to record a minimum of ten (10) automated messages with emergency instruction and replay them. Automated message strings shall be either automatically distributed as part of the dial string, manually played from a single button access on the phone or through the master clock as a timed event.

4 The system shall allow users to exclude their classroom from paging and tones in the event of testing or other activities that should not be interrupted. This exclusion will not affect emergency paging. This exclusion must have the ability to 'reset' at midnight.

5 The system shall synchronize its system time to the network time server or a web-based time server.

C Master Clock System

1 The approved Master Clock System shall have the following features:
- TCP/IP Internet connection
- Frequency tuning circuit to allow for time correction with changes in temperature.
- Field enabled Daylight Savings Time
- Can act as an interface between existing systems and Valcom Wireless Systems
- Microprocessor based
- Can transmit up to 2,000 meters in open space
- LED Display for a clear, accurate read-out.
- Self-Testing mode allows the user to test the real-time clock, output relay, LED segments, and inputs.
- Simple interactive menu system.
- Analog and digital wireless clocks can be mixed on the same system.

- LED's for indication of transmission or receipt of Valcom digital signal (from the V-DCPI Digital Clock Protocol Interface)
- Transmits wireless signal every minute
  - The V-WMC shall be capable of transmitting data to the Valcom wireless analog clocks and the Valcom wireless digital clocks.
  - The VWMC shall be capable of receiving a signal from an atomic clock web site via the Internet.
  - The VWMC will be capable of receiving signals from all Valcom Master Clocks via Valcom digital, as well as 59 minute correction, 58 minute correction, National Time and Rauland, and Dukane.
  - The V-WMC shall have the capability of transferring a wired system into a wireless system.
  - The V-WMC shall have a programmable auxiliary relay and shall be programmed anywhere from 1—99 seconds. Upon utilization of the relay, the V-WMC will be capable of interfacing with a once a day closure or interfacing with intercom systems.
  - The V-WMC shall be capable of acting as a repeater while receiving a signal wired or wirelessly from the main transmitter. The time base shall be temperature controlled allowing calibration of the time base during temperature changes.
  - The V-WMC will have two (2) switches for operation of the menu system.
  - The V-WMC shall be capable of interfacing with the Valcom analog clocks via the V-VCU and the Valcom digital clocks via two (2) wire digital communication.
  - The V-WMC shall utilize 915–928 MHz frequency–hopping technology.
  - The V-WMC shall be FCC compliant, part 15 Section 15,247.
  - Loaded, half wave antenna
  - Input sensitivity: -103 dB
  - Power output: 30 dB (1 watt)
  - Programmable relay output
  - 915-928 MHz frequency-hopping technology
  - 85 - 265 VAC input voltage making it accessible for American
- The approved Master Clock shall be the **Valcom** model #: **V-WMCA**.

2 Quantity: Provide one (1) for each Class Connection Master System. Should the campus be larger than a 2,000-meter radius, building construction type, or site configuration restricts communication between clocks, provide additional transceivers as required. Repeater equipped clocks will also be accepted.

3 Location: The master clock will be in the MDF.

2.2 Devices

A Intercom Handset

1 None, Handsets are connected to the Telephone Switch.

B Cut-In Ceiling Speakers *(Contractor Provided Contractor Installed)*

1 The approved cut-in ceiling speakers shall have the following features:
- The ceiling flush mounted 8" talkback speaker, shall consist of a 45-ohm speaker and round grille
- The speaker assembly, housing and hardware shall be electrically and acoustically matched for a frequency response of 80 Hz to 12kHz.
- The speaker element shall be cone type with 5 oz. ceramic magnet. Diameter of speaker cone shall be 8.0". Voice coil diameter shall be .75".
- Voice coil impedance shall be 45 ohms. Speakers utilizing an 8-ohm impedance voice will not be acceptable.
- The grille shall be constructed of steel, finished in semi-gloss white enamel.
- The maximum dimensions shall be 13" diam. X 3" dp.

- Shipping weight shall be approximately 3.75 lbs.

2 Quantity: See drawing for quantities and locations.

3 The approved cut-in ceiling speaker shall be **Valcom** model #: **V-1060A**.
- Contractor shall provide a support bridge for all suspended ceiling mounted cameras and a Backbox for all hard lid ceiling mounts.
  - Backbox V-9915M-5
  - Support Bridge V-9914M-5

C Flush Mounted Vandal Resistant Horn *(Contractor Provided Contractor Installed)*

1 The approved flush mounted horn shall have the following features:
- The paging horn shall be a high efficiency re-entrant type weather-proof horn. It shall be equipped with a universal mounting bracket.
- The frequency response of the horn shall be 300 Hz to 11 kHz The horn shall have a continuous power rating of 3 watts.
- Dispersion shall be 120 degrees horizontal and 90 degrees vertical.
- The housing shall be constructed of filled polypropylene and be available in gray, white of beige.
- All hardware shall be stainless steel.
- The universal bracket shall be constructed of 16 awg CRS and finished with a weather resistant black E-Coat.
- Dimensions of the horn shall be 6.8" (17.3 cm) H x 8.3" (21.1 cm) W x 3.3" (8.4 cm) D.
- The weight shall be 2.75 lbs. (1.25 kg).
- Quantity: See drawings for quantities and locations.

2 The approved Horn shall be **Valcom** model #: **V-1090**.

3 The approved vandal resistant mounting box shall be **Valcom** model #: **V-9805**.

D 12” Round Wireless Clocks

1 The approved wireless clocks shall have the following features:
- The clock will be capable of receiving a signal from multiple clocks.
- The clock shall receive and transmit with 915–928 MHz frequency–hopping technology.
- The clock is to be capable of transmitting the time simultaneously without interfering with each other.
- The clocks shall include automatic calibration, as well as a diagnostic function that allows the user to view the quality of the signal, the last time the clock received a correction signal, a gearbox test and a comprehensive analysis of the entire clock.
- The clock shall have a maximum correction time of five (5) minutes.
- It shall be designed to be used with the Valcom VWMC, which can be regulated via Valcom wireless communication protocol. Upon receipt of the wireless signal, the clock will immediately self–correct.
- The clock shall have a semi–flush smooth surface ABS case.
- The dial is to be made of durable polystyrene material.
- The crystal is to be shatterproof, side molded polycarbonate.
- Glass and visible molding marks are unacceptable.
- The clock shall have black hour and minute hands as well as a red secondhand.
- The clock shall be FCC compliant, part 15 Section 15,247.

2 Quantity: See drawings for quantity and location.

3 The approved wireless clock shall be **Valcom** model #: **V-AW12**.
- Contractor shall provide the following as required:
  - Universal Mounting Bracket **V-UMB**
  - Wire Guards **V-WGA12**

E Uninterruptible Power Supply

1 See section 27 2300 for UPS specifications and approved manufactures.

F Equipment Racks

1 The contractor shall use the supplied 2-post racks in the MDF to house the intercom head end and card cages.

- The cables to/from the source equipment must be terminated on 66-M150 telephone type punch blocks and NEVER on 110 computer type punch blocks. The 66-M150 punch blocks must be snapped onto 89B brackets.
- The “house” cables for the speakers and any feeder cables must also be terminated on 66- M150 cables, NEVER on 110 type blocks.

G Wire & Cables – *(Yellow Cat 6 cable provided in separate contract)*

1 The approved Ceiling Speaker Cable shall be:

- 18awg stranded (7x26awg) ASTM bare copper
- 2 conductor twisted pair cable with PVC insulation and a Gray PVC jacket.
- The approved Speaker Cable shall be equal to West Penn, PN# 224.
- The approved low frequency Speaker Cable shall be:
- 12awg stranded (19x25awg) ASTM bare copper
- 2 conductor twisted pair cable with PVC insulation and a Gray PVC jacket.
- The approved Game Speaker Cable shall be equal to West Penn, PN# 227.
- The approved Microphone Cable shall be:
- 20awg stranded (7x28awg) ASTM tinned copper
- 2 conductor twisted pair cable with PVC insulation and a Gray PVC jacket.
- Cable shall have an overall 100% aluminum polyester foil shield and a 22awg tinned copper drain wire.
- The approved Microphone Cable shall be equal to West Penn, PN# 292.
- The approved inter-rack cabling shall be:
- 20awg stranded (7x28awg) ASTM tinned copper
- 2 conductor twisted pair cable with PVC insulation and a Gray PVC jacket.
- Cable shall have an overall 100% aluminum polyester foil shield and a 22awg tinned copper drain wire.
- The approved cable shall be equal to West Penn, PN# 452
- Connectors: 3.5mm Stereo Male to 3.5mm Stereo Male
- Fully molded connectors provide strain relief
- Braided shield prevents unwanted EMI/RFI interference
- Nickel-plated connectors
- The approved cable shall be equal to Cables To Go, PN# 40412
- Connectors: (2) RCA Male Plug to (2) RCA Male Plug
- Bonded construction design for neat, easy connection of audio signals
- Oxygen-free copper conductors deliver high-quality audio
- 100% foil and OFC shield protects against noise and interference
- Twisted pair construction of audio conductors fight noise and hum.
- Corrosion-resistant, precision 24K gold-plated connectors ensure long-lasting quality
- Ultra-flexible jacket for easy installation
- The approved cable shall be equal to Cables To Go, PN# 13032
- Connectors: 3.5mm Stereo Male to 2x RCA Stereo Male
- Fully molded connectors provide strain relief
- Foil shielded to prevent unwanted EMI/RFI interference
- Gold-Plated connectors
- The approved cable shall be equal to Cables To Go, PN# 40613

H Electrical Power Equipment

1 The approved Power Strip shall have:

- Shall be a one-rack-space unit in a magnetic shielding steel enclosure.

- Shall operate from 120 volts AC and have a 9-foot, grounded, 3-wire #14-line cord.
- There shall be 8 grounded AC receptacles on the back panel, with 6 switched and 2 always on.
- Overall dimensions shall be 1.75" H x 19" W x 10.5" D.
- Weight shall be 11 pounds.
- Shall have a load rating of 15 amps at 120 volts, a self-test circuit with visual indicator, and provide EMI/RFI filtering, inrush current elimination and catastrophic over/under-voltage shutdown.
- It shall meet Federal Grade A, Class 1, Mode 1 guidelines for powerline surge suppressors and withstand at least 1000 occurrences of surge pulse voltages up to 6000 volts.
- Thermal circuit breaker overload protection
- Self-test circuit with visual indicator
- 10-year warranty
- Made in U.S.A.
- The approved Power Sequencer shall be equal to the SurgeX, Model# SX1115.

I Installation Components

1 Device Outlets:

- Mic and Line:
  - Input: 3-pin female XLR-type, RCA (phono) type and 1/4" TRS jacks where shown on Drawings.
  - Microphone receptacles shall be Switchcraft J3FS or equal by Neutrik
  - Insulate RCA and TRS jacks from plate, do not ground pin 1 on XLRs.
  - Output: 3-pin male XLR-type, RCA (phono) type, and 1/4" TRS as specified above.

2 Terminal Blocks:

- Loudspeaker and DC Control Lines:
  - Terminal blocks providing any of these sets of features:
  - Screw-clamp-type terminals with wire guards, designed for max. 8 AWG wires.
  - Min. 9/16 in. terminal centers with barriers, 8-32 x 5/16 binder head screws, and closed bottom.
  - Variable length modular system designed for wire sizes AWG No. 22 to No. l0, with dual head screws and barrier, retaining track, and end stops no greater than 20 blocks apart.
- Acceptable Products:
  - Electrovert 16 EDS.
  - TRW Cinch Connectors 542 series.
  - AMP Special Industries FLEXI-BLOCK 8 Series Terminal BlockSystem.

3 Connectors:

- Microphone and Line Connectors (Panel Mount):
  - Balanced Input Receptacles: female gender "XLR"-type receptacles.
- Acceptable Products:
  - Switchcraft C3F or D3F.
  - Equivalent by Neutrik

4 Balanced Output Receptacles: Male gender "XLR"-type receptacles.

- Acceptable Products:
  - Switchcraft C3M or D3M.
  - Equivalent by Neutrik

5 Microphone and Line Connectors (Cable Mount):

- Balanced Input Connectors: female gender “XLR”-type connectors.
  - Acceptable Products:
    - Switchcraft A3F.
    - Neutrik NC3FX.
- Balanced Output Connectors: male gender “XLR” type connectors.

- Acceptable Products:
  - Switchcraft A3M.
  - Neutrik NC3MX.

Part 3 Execution

3.1 Installation

A General

1 Furnish components, racks, wire, cabinetry, connectors, materials, parts, equipment, labor, etc. necessary for the complete installation of the systems in full accordance with the recommendations of the equipment manufacturers and the requirements of the drawings and specifications.

2 Installation shall follow standard broadcast wiring and installation practice, and shall meet or exceed industry standards for such work.

3 Wire not installed in equipment racks, not portable, unrated ceiling space, or not installed in conduit shall be fire rated and meet all applicable codes.

4 All signal equipment control cables shall be stranded wire, appropriately shielded, of gauge and number of conductors required by the manufacturer for proper operation of the system or equipment item furnished.

5 All cables including control, network, low-voltage power, video and audio which are required to be on floor will be properly covered and secured so that they are protected by strain and safe of trip hazards.

6 Wire and cable for all other devices shall be supplied in accordance with the recommendations of the device manufacturer and the National Electrical Code.

7 Equipment shall be held firmly in place with proper types of mounting hardware. All equipment affixed to the building structure must be self-supporting with a safety factor of at least three. All equipment shall be installed so as to provide reasonable safety to the operator. Supply adequate ventilation for all enclosed equipment items which produce heat.

8 Furnish the system to facilitate expansion and servicing using modular, solid-state components. All equipment shall be designed and rated for continuous operation and shall be UL listed, or manufactured to UL standards.

9 Shields of audio cables shall be grounded at one end only, at the inputs of the various equipment items in the system.

10 Observe proper circuit polarity and loudspeaker wiring polarity. No cables shall be wired with a polarity reversal between connectors with respect to either end. Special care shall be taken when wiring microphone cables, to insure that constant polarity is maintained.

11 Terminate all unused inputs and outputs with proper precision shielded resistors.

12 Route cables and wiring within equipment racks and cabinetry according to function, separating wires of different signal levels (video, microphone, line level, amplifier output, AC, control, etc.) by as much physical distance as possible. Neatly arrange and bundle all cables loosely with hook and loop cable ties. Cables and wires shall be continuous lengths without splices.

13 All system wire, except spare wire, after being cut and stripped, shall have the wire strands twisted back to their original lay and be terminated by approved soldered or mechanical means. No unterminated wire ends will be accepted. Heat shrink type tubing shall be used to insulate and dress the ends of all wire and cables. Include a separate tube for the ground or drain wire.

14 All cables in conduits shall be insulated from each other and from the conduit the entire length and shall not be spliced. All cables and wires are to be continuous lengths without splices.

15 All solder joints and terminations shall be made with resin-core silver solder. Temperature regulated soldering irons rated at least 60 watts shall be used for all soldering work. No soldering guns or temperature unregulated irons shall be used on the job site.

16 Mechanical connections shall be made using approved connectors of the correct size and type for the connection. Wire nuts will not be accepted.
17 Each mechanical connector shall be attached using the proper size controlled-duty-cycle ratcheting crimp tool which has been approved by the manufacturer of the connectors.
18 Conventional non-ratcheting type crimping tools are unacceptable, and shall not be used on the job site.
19 Label all wires in racks and console as to destination and purpose. Clearly and permanently label all jacks, controls, and connections with permanent engraved laminated plastic labels or by engraving and filling mounting plates, unless otherwise noted. Attach laminated plastic labels with contact cement, being careful to clean off excess or visible cement. Embossed or printed label tape, and press-on or lift-off lettering systems will not be accepted. All labeling shall be completed prior to final system inspection.
20 The contractor shall provide necessary transient protection on the AC power feed, all copper station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.
21 Wiring within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.
22 Provide physical isolation from speaker-microphone, telephone, line-level wiring, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12 inch minimum separation between conductors to speaker-microphones, telephone wiring and adjacent parallel power. Provide physical separation as recommended by equipment manufacturer for other system conductors.
23 Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.
24 Weatherproofing: Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

3.2 Programming

A General

1 Contractor shall provide all necessary programming to provide a complete operating paging system.
2 Contractor shall include in their bid one (1) two (2) hour planning meeting with the owner and their Representatives to outline all specific programming issues, as well as, but limited to:
- Contractor will be informed of any specific requirements for use of the system.
- Contractor will provide overview of system capabilities.
- Contractor will address all concerns of the Owner and their Representatives.

3 Impedance and Level Matching: Carefully match input and output impedance's and signal levels at signal interfaces. Provide matching networks where required.
4 Control circuit wiring: Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacture to provide control functions as indicated or specified.

3.3 Grounding

A General

1 Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.
2 Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross

talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

3 Provide all necessary transient protection on the AC power feed and on all copper station lines leaving or entering the building. Note in system drawings, the type and location of these protection devices as well as all wiring information.

3.4 Testing

A General

1 The completed systems shall be physically inspected by the Owner's representative to assure that all equipment is installed in a neat and professional manner, and in accordance with these Specifications.

2 The final system testing and commissioning shall be performed after all installation and initial testing has been completed by the Installer, but prior to any use of the systems.

3 The Contractor, prior to requesting systems testing and demonstration to the Owner's representative, shall ensure that all systems are in first-class working condition and free of short circuits, ground loops, parasitic oscillations, excessive hum and noise, RF interference, or instability of any form.

4 The Contractor shall be responsible for properly performing all setup and alignment of systems, and all assembly and setup of portable equipment.

5 The Installer shall be responsible for properly performing the equalization of the sound system. After equalization and test the sound system shall meet or exceed the following specifications:

6 System shall be free of short circuits, ground loops, parasitic oscillation, excessive system noise, hum, RF interference, and instability of any form.

7 Maximum SPL with band-limited pink noise input to the system shall be 99dB before audible distortion occurs.

8 Acoustic response of the system shall be plus or minus 1.5dB along a line which is flat from 80Hz to 4000Hz and which rolls off at 1dB per octave to 16kHz.

3.5 Field Quality Control

A General

1 The Final Acceptance Testing shall be provided to the Owner or the Owners designated representative only. Final acceptance testing to any other trade or service provider for the project will not comply with the requirements of this section.

2 The contractor will provide a Final Acceptance Test record document signed by both the contractor and the Owner or designated Owner’s Representative establishing the “In Warranty” date. The warranty period will not commence until the Final Acceptance Test is completed. This document MUST list either the extension number, port number, or some other means so the owner will be able to look at the location of a speaker and cross reference it’s number/port on this list as to be able to make programming bell/zone type changes.

3 Be prepared to verify the performance of any portion of the installation by demonstration, listening and viewing test, and instrumented measurements. Make additional adjustments within the scope of work and which are deemed necessary by the Owner because of the acceptance test.

3.6 System Commissioning

A Commissioning

1 In the presence of the Owner’s Representative the Contractor shall perform the attached functions listed below:

- Check calculated Sound Pressure Levels (spl) readings at seating

- Inspection of equipment racks for neatness and proper termination
- Inspection of all terminations
- Inspection of all W/P connections
- Inspection of all inputs and output devices
- Verify bandwidth of sound system
- Verify polarity of speaker system and connectors
- Check wire types at all locations
- Verify connector types
- Check Impedance of speaker lines
- Verify frequency response of speaker system with RTA
- Verify coverage of speaker system

2 Contractor must provide man lift to speaker location
3 Contactor must provide access to all termination points
4 Check cooling system in equipment rack
5 Check general operation of control surface
6 Check programming of control surface for routing and proper function
7 Check power sequencing
8 All testing documentation will be supplied as a part of the Contractors As-built Documentation.
9 Contractor will include in their bid price six (6) hours for onsite commissioning. Contractor will provide the installation technician who was responsible for this project to be present at the system commissioning to tune, fix, repair, replace all system components that do not operate within the tolerance as set forth in this specification, the project documents, and industry standards.

B Acceptance
1 The final acceptance of the system by the Owner will be based upon the report of the Owner representative following inspection, testing, and commissioning. A list of items in need of completion or correction shall be generated by the owner, which must be corrected by the Installer before final acceptance will be granted.

3.7 Training
A General
1 Contractor shall provide no less than three (3) two (2) hour training sessions.
2 The first training session will be a “Train the Trainer”. The owner will appoint their representative to be provided extensive training so that he/she will be able to provide additional support once the project has been completed.
3 The additional training session will be provided as a general overview of the system operation for large groups or several smaller groups as designated by the owner. Usually these additional training events will coincide with a school function when the sound system will be used.
4 Provide sign in sheets for all training events. Deliver to architect in the close out documents.
5 System Training: Submit the following information describing the training programs and system trainers in accordance with the specifications.
6 Include with the submittal a preliminary staff development training program in outline form for review and approval by the owner’s representative.
7 Include with the submittal a current copy of the trainer’s certification from the manufacturer that certifies and identifies the trainer(s) who are eligible to provide training and support for the project.
8 Include with the submittal a current copy of trainer’s need’s assessment form which will be reviewed with the owner’s designated representative for the system’s preliminary system programming and configuration.

9 Include with the submittal copies of all documentation used to identify for the owner those participants attending and completing the training programs.

3.8 Warranty

A General

1 Contractor will provide a minimum of a 1-year Workmanship Warranty that includes Parts and Labor.

2 All equipment provided under this specification shall be warranted to be free from defects in materials and workmanship for a period of 12 months from the notice of completion.

3 The Contractor shall maintain regular service facilities and provide a qualified technician familiar with the work specified for this project. Contractor will respond to all notice of malfunction from the Owner within 24 hours of receiving trouble call. As part of this warranty, the Contractor shall provide, at no expense to the Owner, all material, devices, equipment, and personnel necessary and resolve malfunction and/or to provide alternate facilities, services, or equipment for the duration of repairs to any defective work as described in this section.

4 All repairs and service under warranty shall be at the jobsite unless in violation of manufacturer's warranty, wherein contractor shall provide substitute equipment for the duration of repairs. Transportation of substitute or test equipment and personnel to and from the jobsite shall be at no expense to the owner.

5 All repair and service work under warranty work, except emergency repairs can be performed during regular working hours of regular working days. Emergency repairs shall be made when a system or component malfunctions during use, and shall be performed on an immediate basis. All work shall be performed by personnel in the employ of contractor, having specific experience in the work of this specification and shall not be subcontracted or assigned to another company for service, unless Owner has approved such assignment in writing, in which event contractor shall nevertheless be responsible to the Owner for such work.

3.9 Occupancy Adjustments/Cleaning and Protection

A General

1 The contractor shall provide Occupancy Adjustments through a response scenario amenable to both the owner and the contractor that will be established for the first year of service.

2 Prior to final acceptance, the contractor shall vacuum and clean all system components and protect them from damage and deterioration. All blank spaces in equipment cabinets will be covered with blank panels. Top and side panels, and all cabinet doors will be installed. All general areas within and around all equipment rack/cabinets in the facility will be swept, vacuumed, and cleaned up. No cabinets will be left unlocked and all cabinet keys will be turned over to the owner or designated owner’s representative.

3.10 System Closeout and As-Built Documentation

A General

1 Contractor will comply with all requirements list in Section 27 0000 ‘1.8 – System Closeout and As-Built Documentation’.

END OF SECTION

Section 27 5200

Assistive Listening Systems - Owner Provided & Owner Installed

Part 1 General

1.1 Statement of Work

A. General

1. Provide all labor, materials, tools and equipment required for the complete installation of work called for on the Construction Drawings and described in the Specifying Documentation.
2. The intent of these Specifications is to provide a complete Assistive Listening System and it is the responsibility of the bidding Contractor to provide a complete solution.
3. It is the responsibility of the Contractor to provide all material necessary to provide a complete system even if the material is not described specifically in the following documentation.
   - All questions concerning non specified product and services will be address to the Owner's Representative before the Contactor provides a bid. Owner expects that by accepting the Contractor's bid proposal that they [the Contractor] have provided a competent bid for a complete solution.
4. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of devices, typical installation details, and mounting details will be provided as an attachment to this document. The successful vendor shall meet or exceed all requirements for the cable system described in this document.

1.2 Related Work in Other Sections

A. General

1. All 120VAC power conductors and conduits associated with power circuits to all equipment locations shall be furnished and installed by Division 26 contractor.
2. All raceway systems including but not limited to conduit, j-boxes, outlet boxes, floor boxes, & surface mounted raceway shall be furnished and installed by Division 26 and 27 0528 contractors.

1.3 References

A. Regulatory References

1. Contractors will comply with all requirements as specified in Section 27 0000 '1.3 – Regulatory References'.

1.4 Safety and Indemnity

A. Requirements

1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0000 '2.1 – Safety and Indemnity'.

1.5 Contractor Qualifications

A. Requirements

1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0000 '2.2 – Contractor Qualifications'.

1.6 Quality Assurance

A. Requirements

1. Contractors shall comply with all requirements as specified in Section 27 0000 '2.3 – Quality Assurance'.

1.7 Equivalent Products

A. Products

1. All Product provided in this Specification are those of Listen Technologies.

B. Pre-Approved Equals:

1. Sennheiser

C. Other Products

1. Contractors wishing to approve a system other than those specified in this document shall do so in accordance with Section 27 0000 "3.1 Products".

1.8 Submittal Documentation

A. Requirements

1. The successful contractor shall provide their submittal package in accordance with the Section '01 20 00 – Submittal Schedule' and Section 27 0000 '3.2 – Submittal Documentation'.

1.9 Acceptance

A. Requirements

1. The contractor shall comply with all requirements as listed in Section 27 0000 '3.3 – Acceptance'.

1.10 Warranty

A. Requirements

1. The contractor shall comply with all requirements as listed in Section 27 0000 '3.4 – Warranty'.

Part 2 Compliance

2.1 CBC Access Compliance

A. SECTION *11B*- 216.10 – ASSITIVE LISTENING SYSTEMS

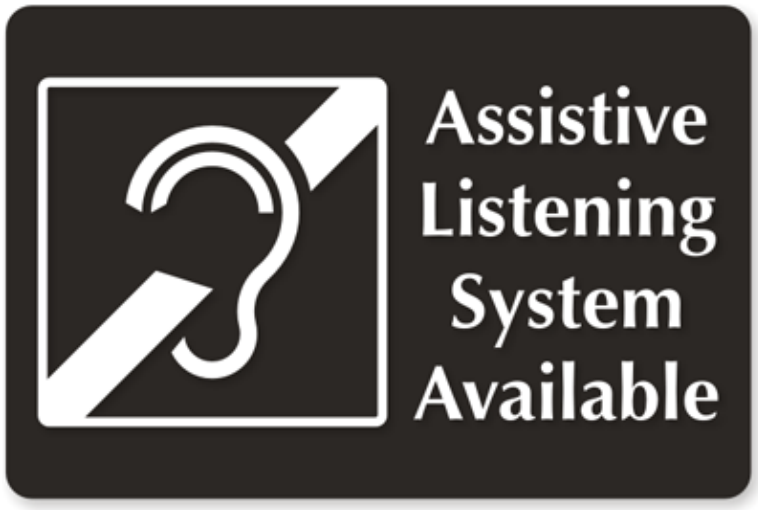
1. Each assembly area required by Section 11b-219 to provide assistive listening systems shall provide signs informing patrons of the availability of the assistive listening system. The sign shall include wording that states "Assistive-Listening System Available" and shall be posted in a prominent place at or near the assembly area entrance. Assistive listening signs shall comply with Section 11B-703.5 and shall include the International Symbol of Access for Hearing Loss complying with Section 11B-703.7.2.4.
2. **EXCEPTION:** Where ticket offices or windows are provided signs shall not be required at each assembly area provided that signs are displayed at each ticket office or window informing patrons of the availability of assistive listening systems.

B. SECTION *11B*-219 – ASSISTIVE LISTENING SYSTEMS

1. Section 11B-219.1 GENERAL - Assistive listening systems shall be provided in accordance with Section 11B-219 and shall comply with Section 11B-706.

2. *Section 11B-219.2 REQUIRED SYSTEMS – An assistive listening system shall be provided in assembly areas, including conference and meeting rooms.*
3. ***EXCEPTION:*** *This section does not apply to systems used exclusively for paging, background music, or a combination of these two uses.*
4. *Section 11B-219.3 RECEIVERS – The minimum number of receivers to be provided shall be equal to 4 percent (4%) of the total number of seats, but in no case less than two. Twenty-five percent (25%) minimum of receivers provided, but no fewer than two, shall be hearing-aid compatible in accordance with Section 11B-706.3*
   - EXCEPTIONS:
5. 1. Where a building contains more than one assembly area and the assembly areas required to provide assistive listening systems are under one management, the total number of required receivers shall be permitted to be calculated according to the total number of seats in the assembly areas in the building provided that all receivers are usable with all systems.
6. *2. Where all seats in an assembly area are served by an induction loop assistive listening system, the minimum number of receivers required by Section 11B-219.3 to be hearing aid compatible shall not be required to be provided.*
7. *Section 11B-219.4 – LOCATION – If the assistive-listening system provided is limited to specific areas or seats, then such areas or seats shall be within a 50-foot (15,240 mm) viewing distance of the stage or playing area and shall have a complete view of the stage or playing area.*
8. *Section 11B-219.5 PERMANENT AND PORTABLE SYSTEMS – Permanently installed assistive-listening systems are required in areas if (1) they accommodate at least 50 persons or if they have audio-amplification systems, and (2) they have fixed seating. If portable assistive listening systems are used for conference or meeting rooms, the system may serve more than one room. An adequate number of electrical outlets or other supplementary wiring necessary to support a portable assistive listening system shall be provided.*

C. SECTION *11B*-703.7.2.4 ASSISTIVE LISTENING SYSTEMS – Assistive listening systems shall be identified by the International Symbol of Access for Hearing Loss complying with Figure *11B-703.7.2.4.*
   1. Coordinate the location of ALS system signage with Architect drawings and documentation.



D. SECTION *11B*-706 ASSISTIVE LISTENING SYSTEM
   1. Section *11B*-706.1 GENERAL – Assistive listening systems required in assembly areas, *conference and meeting rooms* shall comply with *Section 11B*-706.

2. Section *11B*-706.2 RECEIVER JACKS – Receivers required for use with an assistive listening system shall include a 1/4”inch (3.2 mm) standard mono jack.
3. Section *11B*-706.3 RECEIVER HEARING AID COMPATIBILITY – Receivers required to be hearing-aid compatible shall interface with telecoils in hearing aids through the provision of neckloops.
4. Section *11B*-706.4 SOUND PRESSURE LEVEL – Assistive listening systems shall be capable of provided a sound pressure level of 110 dB minimum and 118 dB maxmum with a dynamic range on the volume control of 50 dB.
5. Section *11B*-706.5 SIGNAL-TO-NOISE RATIO – The signal-to-noise ratio for internally generated noise in assistive listening systems shall be 18 dB minimum.

6. Section *11B*-706.6 PEAK CLIPPLING LEVEL – Peak clipping shall not exceed 18 dB of clipping relative to the peaks of speech.

Part 3 Products

3.1 System Description

A. Assistive Listening System

1. Furnish and install an FM wireless assistive listening system for use by the hearing-impaired. The assistive listening system (ALS) shall be capable of broadcasting on 57 channels and be frequency agile. The ALS system shall have 80dB SNR or greater, end-to-end. Receivers shall be frequency agile and frequency set with a "seek" button. The receiver will incorporate a stereo headset jack that allows the user to plug in either a mono or stereo headset and listen to audio normally. The portable receivers and transmitters shall incorporate automatic battery charging circuitry for recharging of Ni-MH batteries. Listen Technologies Corporation products are specified
2. The following sections specifically list the acceptable equipment types and items for this project. Where quantities are not noted, they may be obtained from the project drawings. In the event of a discrepancy between the specifications and the project drawings, the greater quantity or better quality shall be furnished.

3.2 Stationary/Permanent Installation

A. System Components

1. For the system shall include the following components:
   - Transmitter
   - Receiver
   - Antenna
   - Ear Speaker
   - Neck Loop

B. Transmitter

1. The approved transmitter shall have the following features:
   - Audio
     - Audio Input 1
     - Rear panel: one (1) female XLR and 1/4-inch combo connector, balanced, 0 / -55dBu (line/mic) normal input level adjustable -30/ +21 dBu (line/mic) maximum input level, impedance 20k / 1k ohm (line/mic), phantom power +12VDC
     - Distortion: <2% total harmonic distortion (THD) ta 80% deviation
     - Signal to noise ratio: 62 dB
     - Contour: cuts and boots frequencies above 5kHz
     - Frequency Response: 50Hz – 15kHz
     - Audio Input 2: Rear panel, two (2) phono connectors, unbalanced, -10 / +10 dBu nominal input level adjustable, +30 dBu maximum, impedance 100k ohm

        - Audio Output: Input 1 and input 2, mixed output (rear panel), two (2) phono connectors, unbalanced, -10 dBu nominal output level, +15 dBu maximum, impedance 10 ohm
        - Audio Processing: Compression can be turned on/off. Slope internally adjustable from 1:1 to 4:1. Default 2:1
        - Headphone Output: Front panel, one (1) 3.5 mm (0.14 in.) stereo connector, unbalanced, adjustable output level, +3 dBu maximum, impedance 10 ohm
    - Controls
        - Internal Adjustments: Compression ratio for audio processor
        - User Controls: Front Panel: Power, Test Tone on/off, channel up/down, Input Levels, Mix Level, Contour, Monitor volume control Rear Panel: Input 1 Level, (Line, Mic, Mic-Phantom Power), Input 2 level (-10 / +10 dBu), RF power level (low, mid, high)
        - Programming: Process on/off, channel lock
    - Indicators
        - Audio Input Status LEDs: Indicates Input 1, Input 2, and Mix audio levels; 10 segment LED's (8 green, 2 red)
        - LCD: Channel Designation, lock status, RF power level (front panel)
        - RF Power: Indicated on the LCD (low, mid, high)
        - Processing: Indicated by a green LED when on (front panel)
        - Test Tone: Red LED illuminates when test tone is enabled
    - RF
        - Frequency Accuracy: ± .005% stability 32 to 122º (0 to 50ºC)
        - Number of Channels: 3 wide band
        - Frequency Range: (A) 72.100, (E) 72.900, (H) 75.900
        - Antenna Connector: BNC
        - Transmitter Stability: 50 PPM
        - Output Power: 80,000 uV at 3 m
        - Transmission Range: Up to 1,500 ft. (457.20 m)
        - Antenna Type: Various antennas available
    - Power
        - Power Supply Output: 12 VDC, 1.3 A, 15.6 W
        - Power Supply: In line power supply, Listen part number LA-207 (Line cord is determined by the each Country's AC power standards)
        - Power Supply Input: 100-240 VAC, 50-60 Hz, 0.4 A
        - Power Supply Connector: 0.02 in (5.0 mm) OD, 0.01 in. (2.5 mm) ID, barrel type
        - Compliance: UL, CE, GS, TÜV, RoHS
    - Physical
        - Height: 1.75 in. (4.5 cm)
        - Width: 8.50 in. (21.5 cm)
        - Color: Dark Grey with white silk screening
        - Unit Weight with Power Supply: 4.5 lbs. (2.0 kg)
        - Depth: 9.13 in. (23 cm)
        - Weight: 2.6 lbs. (1.2 kg)
        - Rack Mounting: One (1) rack space height, 1/2 rack space wide. One (1) or two (2) transmitters can be mounted in one rack space, optional rack mount (LA-326)
    - Compliance
        - FCC Part 15, Part 90
    - The approved Transmitter shall be equal to **Listen Technologies** model #: **LT-803-072-01**
        - Contractor will include one (1) rack mount kit equal to **Listen Technologies** model #: **LA-326** per two (2) transmitters.

C. Receiver
    1. The approved receiver shall the following features:

- Audio
  - System Distortion: <2% total harmonic distortion (THD) at 80% deviation
  - Output/s: Two (2) 3.5 mm (0.14 in.) connectors, unbalanced, 0 dBu nominal output level, 16 mW maximum, impedance 32 ohm
  - Frequency Response: 50 Hz - 15 kHz (±3 dB)
  - System Signal to Noise Ratio: SQ enabled 80 dB, SQ disabled 60 dB
- Controls
  - Set-up Controls: Press and hold up/down volume buttons for 5 seconds to enter channel adjust, use up/down to select channel
  - User Controls: Power, up/down volume, Listen button for end user channel selection
  - Programming: Via software and USB port
- Indicators
  - Display: Channel designation, battery level, unit number, charging status
  - LEDs: Flashes when batteries are low or to indicate charging, solid when fully charged
- RF
  - Sensitivity: .6uV typical, 1 uV maximum for 12 dB sinad
  - Frequency Range: 72.025 - 75.950 MHz
  - Number of Channels: 17 wide band, 40 narrow band
  - Antenna Type: Uses ear phone/neck loop lanyard and short ear phone cable or standard earphone cable
  - Frequency Accuracy: ± .005% stability 32 to 122 ºF (0 to 50 ºC)
  - Squelch: Programmable in 20 steps, automatic on loss of RF signal
- Power
  - Power Supply: Micro USB connector, 5 V, 500 mA
  - Battery Life: 8 Hours of continuous use
  - Battery Type: Lithium Ion 3.7 Vdc, 1200 mAh
  - Battery Charging Time: Fully charged in 2.5 Hours
- Physical
  - Dimensions with Belt Clip: 3.75 x 2.0 x 0.80 in.
  - Dimensions (H x W x D): 3.75 x 2.0 x 0.64 in.
  - Color: Black
  - Unit Weight 1.60 oz.
  - Unit Weight with Batteries: 2.40 oz.
- Compliance
  - FCC Part 15, Part 90
- The approved Receiver shall be equal to **Listen Technologies** model #: **LR-5200-072**

D. Antenna

1. The approved antenna shall have the following features:
   - Physical
     - Mounting: Wall mount, dual and single electrical box, ceiling electrical box, horizontal surface mount (such as on top of a rack), ceiling/inverse mounting, flexible mounting in-wall or in ceiling and mast or conduit mount.
     - Dipole Vertical Length: 72 MHz - 80 in. 216 MHz - 27 in.
     - Mounting Bracket
       - Dimensions (W x D x H): 4.5 in x 7.0 in x 2.5 in
       - Grounding Base Dimensions (W x D x H): 8.0 in x 8.0 in x 2.0 in
       - Mounting Plate Dimensions (W x D x H): 4.48 in x 4.55 in
     - Mounting: Includes self-tapping sheet metal screws, drywall anchors, and all hardware required to mount to electrical boxes. Does not provide hardware required to mount to a mast.
     - Weight 4.4 lbs. (2.0 kg)
   - Interconnections

        - Connector(s)s: BNC
    - RF
        - Antenna Type: Monopole and Dipole
        - Number of Channels: 72 MHz - 57 (17 wide band, 40 narrow band)
        - Frequency Range: 72 MHz - 72.025 MHz - 75.975 MHz
        - Unity Gain: 0 dB
    - The approved Antenna shall be equal to **Listen Technologies** model #: **LA-122**

E. Ear Speaker
1. The approved ear speaker shall have the following features:
    - Audio
        - Frequency Response: 20 Hz - 20 kHz
        - Impedance: 32 ohm +/- 15% @ 1 kHz
        - Rated Power Input: 50 mW
        - Max Power Input: 100 mW
        - Input Sensitivity: 115 dB +/- 4dB @ 1 kHz, 1 mW
    - Compliance
        - Standards: RoHS
    - Interconnections
        - Connector: male 3.5mm (TRS)
    - Physical
        - Color: Dark Gray
        - Cable Length: 13 in., extension cable is 28 in.
        - Unit Weight: 0.40 oz.
    - The approved Ear Speaker shall be equal to **Listen Technologies** model #: **LA-401**
        - Contractor shall provide one (1) ear speaker for each receiver provided.

F. Neck Loop
1. The approved neck loop shall have the following features:
    - Audio
        - Frequency Response: 20 Hz - 20 kHz
        - Impedance: 12 ohm +/- 15% @ 1 kHz
        - Max Power Input: 2 W
        - Rated Power Input: 75 mW
        - Headset Input Sensitivity: 110 dB +/- 4dB @ 1 kHz, 1 mW
        - Magnetic Field Strength: 100 mA/m 6 inches above loop at 85µW 1kHz input (IEC 60118-4)
    - Loop
        - Loop Cable Length: 33 inches
    - Compliance
        - Safety: RoHS
        - Standards: IEC 60118-4
    - Interconnections
        - Connector: 3.5mm stereo
    - Physical
        - Cable Length: 22 in. (55 cm)
        - Color: Dark Grey
        - Dimensions (H x W x D) 1.44 in. x 1.10 in. x 0.59 in.
        - Weight: 1.65 oz.
    - The approved Neck loop shall be equal to **Listen Technologies** model #: **LA-166**

G. Charging Station
1. The approved Charging Station shall have the following features:
    - Power
        - Power Supply Input :100-240VAC, 50-60 Hz

        - Power Supply Output: 5.0 VDC, 8 A, 40 W
        - Cord: 72 in Input Power Cord, 45 in Output Cord
        - Power Supply Connector: .22 in. OD x .09 in. ID, barrel type
    - Physical
        - Color: Black
        - Unit Capacity: 12 Units
        - Unit Weight: 5.0 lbs.
        - Dimensions (H x W x D): 1.75 in. x 14 in. x 7.5 in.
    - Compliance
        - Standards: UL, CE, RoHS
    - The approved Charging Station shall be equal to **Listen Technologies** model #: **LA-381**
        - Contractor will provide one (1) charging station for every 12 receivers allowing all receivers to be charged simultaneously.

H. Coax Cable
1. The approved coaxial cable shall be equal to **Listen Technologies** model #: **LA-390**.

Part 4 Execution

4.1 Installation

A. General
1. Furnish components, materials, parts, equipment, labor, etc. necessary for the complete installation of the systems in full accordance with the recommendations of the equipment manufacturers and the requirements of the drawings and specifications.

4.2 Programming

A. General
1. Contractor shall provide all necessary programming to provide a complete operating system.

4.3 Testing

A. General
1. The completed systems shall be physically inspected by the Owner's representative to assure that all equipment is installed in a neat and professional manner, and in accordance with these Specifications.
2. The final system testing and commissioning shall be performed after all installation and initial testing has been completed by the Installer, but prior to any use of the systems.
3. The Contractor, prior to requesting systems testing and demonstration to the Owner's representative, shall ensure that all systems are in first-class working condition and free of short circuits, ground loops, parasitic oscillations, excessive hum and noise, RF interference, or instability of any form.

4.4 Training

A. General
1. Contractor shall provide no less than one (1) two (2) hour training session.
    - The training session will be a “Train the Trainer”. The owner will appoint their representative to be provided extensive training so that he/she will be able to provide additional support once the project has been completed.
    - Provide sign in sheets for all training events. Deliver to architect in the close out documents.

4.5 Warranty

A. General

1. Contractor will provide a minimum of a 1-year Workmanship Warranty that includes Parts and Labor.
2. All equipment provided under this specification shall be warranted to be free from defects in materials and workmanship for a period of 12 months from the notice of completion.

4.6 System Documentation

1. Contractor will comply with all requirements listed in Section 27 0000 '3.5 – System Closeout and As-Built Documentation'.

END OF SECTION

SECTION 28 1600

BURGLAR ALARM SYSTEM – SEPARATE CONTRACT WITH SONITROL

Part 1 General

1.1 Work Included

1.2 Related Work in Other Sections

A General

1 All 120VAC power conductors and conduits associated with power circuits to all equipment locations shall be furnished and installed by Division 260000 contractor.

2 All raceway systems including but not limited to conduit, j-boxes, outlet boxes, floor boxes, surface mounted raceway, grounding & bonding, communication backboards shall be furnished and installed by Division 260000 contractor.

1.3 Statement of Work

A General

1 Provide all labor, materials, tools and equipment required for the complete installation of work called for on the Construction Drawings and described in the Specifying Documentation.

2 Provide all cabling required to supply a complete and operable system at the locations shown on the drawings and to the “future” locations. See drawing for locations.

3 Product specifications, general design considerations, and installation guidelines are provided in this document. The drawings indicate the locations of the devices. If the bid documents are in conflict, this specification shall take precedence. The successful vendor shall meet or exceed all requirements for the fire alarm system described in this document.

4 The system shall be monitored off-site by the security monitoring station via the network. No additional telephone lines shall be required to accommodate this feature.

5 The Contractor shall include in their bid documentation the cost of a yearly maintenance contract to maintain this system and a separate proposal on the cost of the second year of the maintenance contract.

6 Supply and install all grounding, bonding, and fireproofing required by the local authorities and by code. All cables installed through fire rated walls shall be fire-proofed.

B System Requirements

1 The work described by this part includes the furnishings of all materials, equipment, supplies, and labor and the performing of all operations necessary for the installation of a complete operating system. The monitoring shall be Supervised Networked Internet Monitoring.

2 The conduit, outlets, terminal cabinets, etc., which form a part of the rough-in work shall be furnished and installed complete by the division 26 contractor if required. The balance of the system, including the furnishing and installation of cable, furnishing and installation of equipment, making all connections, etc., shall be installed by the Alarm Contractor, and the entire responsibility of the system, its operation, function, testing and maintenance for one year after final acceptance of the project by the owner, shall be the responsibility of the Alarm Contractor.

3 The Alarm Contractor shall furnish and install all equipment, cables, devices, which are necessary for the proper integration of the system so that the system shall perform the function listed herein in compliance with all the specified requirements.

4 The specified equipment for the alarm systems is that of the GE Alliance Systems or Equal. All mechanical, electrical and general information set forth on the respective data sheets for each specified item shall be considered as part of these specifications and binding herein. Any proposed equal item offered shall be substantiated fully to prove equality and must be pre-approved prior to bid. Alternate systems shall not be bid without pre-approval. The Owner reserves the right to require a complete sample of any proposed equal item and may, if necessary, request a sample tested by an independent testing laboratory to prove equality. The decision of Owner regarding equality of proposed equal items will be final.

5 The Alarm Contractor shall furnish a letter which certifies that the equipment has been installed according to factory intended practices and that the system is operating satisfactorily. The Alarm Contractor shall also furnish a written unconditional guarantee, guaranteeing all parts and labor for a period of one year after final acceptance of the project by the owner.

1.4 Regulatory References

A Requirements

1 Contractor will comply with all references listed in Section 27 0000 '1.3 – Regulatory References'.

1.5 Safety and Indemnity

A Requirements

1 Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0000 '2.1 – Safety & Indemnity'.

1.6 Contractor Qualifications

A Requirements

1 Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0000 '2.2 – Contractor Qualifications'.

1.7 Quality Assurance

A Requirements

1 Contractor shall comply with all requirements as specified in Section 27 0000 '2.3 C – Quality Assurance'.

1.8 Products

A Specified Equals

1 All Products described, and Part Numbers given in this Specification are those of GE, Belden unless otherwise noted herein or on the project drawings.

B Pre-Approved Equals:

1 Bosch
2 DSC
3 Honeywell

C Other Than Approved Products

1 Contractors wishing to approve a system other than those specified in this document must comply with all requirements listed in Section 27 0000 '3.1 – Products'.

1.9 Submittal Documentation

A Requirements

1 The successful contractor shall provide their submittal package in accordance with the Section 01 20 00 1.06 Submittal Schedule, and Section 27 0000 '3.2 – Submittal Documentation'.

1.10 Acceptance

A Requirements

1 Contractor shall comply with all requirements as specified in Section 27 0000 '3.3 – Acceptance'.

1.11 Warranties

A Requirements

1 Contractor shall comply with all requirements as specified in Section 27 0000 '3.4 Acceptance & Warranties'.

Part 2 System

2.1 System Description

A Basic Function

1 The first basic intent of the alarm system is to detect unauthorized entry into the building and identify, immediately, the specific zone of entry to a 24-hour central Station that provides supervised internet monitoring and/or to the District's on site security staff.
2 Zones of entry to be monitored will be all outside doors unless specified otherwise.
3 Selected corridors have passive detector coverage to supplement the door entry protection.
4 All doors and windows on the outside of the building shall be equipped with door sensors and window break-glass detectors.
5 The second basic intent is to minimize response to false alarm. Alarm pads placed in protected buildings shall have appropriate time delays to avoid false activations.
6 The third basic intent is to provide a flexible, expandable system, which is fully electronically supervised.
7 The system shall have the capability of connection for audible alarm and/or internet monitoring.

2.2 Control Design

A General

1 The system presented is based on a GE Alliance # AL4617 Alarm control panel.

2.3 System Function

A General

1 The activation of any alarm initiating device in the system shall cause the alarm panel to go into alarm mode.
2 The alarm shall then be digitally transmitted to the alarm pad. It shall annunciate, by zone on the alpha-numeric display and transmit all signals to the central monitoring station.

3 The system shall include required network interfaces to monitor over the internet.
4 The system shall be completely programmable either locally from a keypad or remotely through the central monitoring station.

2.4 System Description

A Input/Output Capacity

1 This system shall be capable of monitoring a minimum of 256 individual zones and controlling up to 255 fully programmable relays.

B User/Authorization Level Capacity

1 The system shall have a minimum of 200 Personal Identification Numbers (PIN) codes with each code having its own custom authority level.

C Zone Configuration

1 Each zone shall function in any of the following configurations: Night, Day, Exit, Fire, Supervisory, Emergency, Panic, Auxiliary 1, Auxiliary 2, Fire Verification, Cross Zone, Priority, Key switch Arming.

D Communication

1 The system shall be capable of supporting DSL multiplex communication with digital dialer backup, existing data networks, satellite communication, fiber optic networks, local area networks, wide area networks, cellular communication, and retail data networks.

Part 3 Products

3.1 Control Panel

A Features

1 Integrated intrusion alarm and access control system
2 Up to 16 remote arming stations (key pad or reader)
3 Built-in dialer for monitoring and remote management
4 Up to 256 zone inputs and 64 doors
5 Up to 255 outputs
6 Up to 15 additional remote panels
7 Logs 2,000 alarm and access events

3.2 Electronic Components

A General

1 All electronic components of the system shall be of the solid-state type, mounted on printed circuit boards conforming to UL 294, 609, 365, 1610 & 1635 standards.

B Relays

1 Relays and similar switching devices shall be solid-state type or electromechanical.

C Test Modes

1 The system shall include a provision that permits testing from any alphanumeric keypad. The test shall include standby battery, alarm bell or siren, and communication to the central station.
2 The system shall include a provision for an automatic, daily, weekly, thirty day, or up to sixty day test of the communication link from the panel site to the central station.
3 The system shall include a provision for displaying the condition of the internal system power and wiring. Internal monitors shall include the bell circuit, AC power,

battery voltage level, charging voltage, panel box tamper, phone trouble line 1, phone trouble line 2, and transmit trouble.

D Power Supplies
1 Power supplies for the Detection devices shall operate from 120 VAC, Supplied at the respective protected areas.
2 Standby batteries shall be supplied to power the system in the event of a utility power failure. Batteries shall be sized to provide 105% capacity for eight hours. Standby batteries shall be sealed lead-acid.
3 Power supplies shall be Solid State.
4 Controls shall be designed to maintain full battery charge when alternating current is available.
5 Batteries shall be recharged to 85% capacity within 24 hours from battery use.
6 The system shall be automatically transferred to battery power upon loss of alternating current power and return to alternating current power upon restoration.
7 Intrusion alarms shall not be initiated during switch over; a signal shall be initiated upon failure of battery and/or alternating current power.

E Control Panel Components
1 System Control Panel
- GE Model # AL-4617
2 Transformer
- GE Model # AL-1690
3 Metal Enclosure
- GE Model # AL-1680
4 Serial PC communications port
- GE Model # AL-1801
5 TCP/IP network interface module
- GE Model # AL-1806
6 8-zone expansion module
- GE Model # AL-1206
7 4-relay expansion module
- GE Model # AL-1810
8 8-relay expansion module
- GE Model # AL-1813

F Alarm Pad
1 Master Key Pad
- Alarm pads shall be semi-flush, outlet box mounted, push button Arm, Monitor and Clear commands.
- 4-line LCD display
- GE Model # AL-1111

G Remote Key Pad
1 Alarm pads shall be semi-flush, outlet box mounted, push button Arm, Monitor and Clear commands.
2 2-line LCD display
3 GE Model # AL-1103

H Door Contacts
1 Press Fit
2 Flush, concealed type

3 Suitable for wood or steel doors and sash
4 Wide break distance
5 Magnetic, reed type switch rated, 1,000,000 cycles (minimum)
6 GE Model # 1075 series.

I Passive Motion Detectors
1 Passive infrared detector shall be designed to minimize false alarms and to fully sense protected areas.
2 Wall box mounted
3 Flush, concealed type for use in a standard single gang outlet box
4 360deg ceiling and wall mount coverage of 15'
5 Wide angle range of 30'
6 Single spot range of 40'
7 GE Model # 6255FM

J Glass break Detector
1 Glass break detector shall be designed to operate when glass has been broken or removed to gain entry into the building.
- 3x3 technology
- Microprocessor Based
- Automatic adjustment
- Detects all types of glass
- ceiling or wall mounted
- GE Model # Solution 2200

K Wire
1 All wiring shall be of the type and size recommended by the equipment supplier, and as approved by the authority having jurisdiction. Wire color-coding shall remain the same throughout the system.
2 From each door switch and, pair of door switches, or glass break station
- 1 pair # 22 gauge
- vinyl insulated
- PVC jacketed
- Belden # AW27137

3 To each alarm pad
- one 4 conductor # 18 gauge
- PVC insulated and jacketed
- Belden # AW38137

4 To each motion detector
- 4 conductor # 18 gauge
- polyethylene insulated
- PVC jacketed
- loop connected
- Belden # AW38137

5 No wiring other than that directly associated with the alarm system functions (NO 110 VAC), shall be permitted in alarm conduits. All wiring shall be tested for opens, shorts or grounds prior to the connection of any devices. All alarm system junction boxes shall be clearly marked for easy identification. Wire nut splices shall no be permitted.

Part 4 Execution

4.1 End of Line Devices

A General

1 Each detection device to be individually annunciated using n/o contacts with full E.O.L supervision.

4.2 Testing

A General

1 Upon completion of the installation, the Contractor shall test each and every detection, initiating, and control device for proper operation.

2 A monitoring report shall be submitted to the owner, or his representative, indicating proper operation, compliance, date of testing and the Contractor's signature.

3 On completion of the acceptance tests, the Owner or his representative shall be instructed in the operation and testing of the system. A minimum of two hours training shall be provided.

4.3 System Closeout and As-Built Documentation

A Requirements

1 The contractor will comply with all requirements listed in Section 27 0000 '1.8 – System Closeout and As-Built Documentation'.

4.4 Manufacturer's Responsibility

A General

1 It is mandatory, under this section of the specification, that the factory authorized representative, install and connect, supervise the installation and connection, or at the minimum, inspect and test the entire system after completion. A letter from the factory authorized representative certifying that this inspection and testing has been done and that the complete system is in full and proper operation and in compliance with this specification and the manufacturer's recommendations, shall be submitted before the project will be accepted.

4.5 Central Station

A General

1 The intrusion alarm equipment manufacturer's factory authorized representative shall have available a 24-hour, 7 day per week central station service to receive and respond to alarms from the intrusion alarm system

4.6 Service

A General

1 The intrusion alarm equipment manufacturer's factory authorized representative shall have a 24-hour (maximum) response capability to service calls.

END OF SECTION

SECTION 28 2300
SURVEILLANCE CAMERA SYSTEM - OWNER PROVIDED & OWNER INSTALLED

Part 1 General

1.1 Statement of Work

A General

1 Provide coordination with the District staff for scheduling of this system.

2 27 1000 contractors shall be complete with work including all testing and labeling prior to owner work start.

3 The District requires a minimum of 10 days to review test documents prior to system start up.

Part 2 Products

2.1 General

A Surveillance Camera System

1 The Surveillance Camera System shall be owner supplied (parts and smarts).

2 All system equipment and programming for this system will be owner supplied.

Part 3 Execution

3.1 General

A Installation

1 It is the contractor's responsibility to inform the Owner and/or the Owner's Representative of any and all conflict's, between the project documents and the onsite conditions.

END OF SECTION

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

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. Fire-alarm Remote Power Supply.
2. System smoke detectors.
3. Heat detectors.
4. Notification appliances.
5. Addressable interface device.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

A. Noncoded, UL-certified and FMG-placarded addressable voice evacuation system, with multiplexed signal transmission, dedicated to fire-alarm service only.

1.5 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic

forces specified and the unit will be fully operational after the seismic event."

1.6 ACTION SUBMITTALS

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

B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," deliver copies to authorities having jurisdiction and include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.

1.10 PROJECT CONDITIONS

A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Architect and Owner no fewer than two days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Owner's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Verified automatic alarm operation of smoke detectors.
5. Automatic sprinkler system water flow.
6. Fire-extinguishing system operation.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.

2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

2.3 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

    a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
    b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
    c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

2.4 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector: Actuated by a fixed temperature of 194 deg F.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.5 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

B. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

1. Rated Light Output:

    a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.

5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

C. Voice/Tone Notification Appliances:

1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
2. High-Range Units: Rated 2 to 15 W.
3. Low-Range Units: Rated 1 to 2 W.
4. Mounting: Flush, or surface mounted and bidirectional.
5. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.6 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

2.7 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the gong or other device requiring protection.

1. Factory fabricated and furnished by manufacturer of device.
2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

C. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.
2. Connect new equipment to existing monitoring equipment at the supervising station.
3. Expand, modify, and supplement existing equipment as necessary to extend existing monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

D. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
5. HVAC: Locate detectors not closer than 5 feet (1.5 m) from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.

E. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

F. Remote Power Supply Unit: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

G. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.

H. Remote Power Supply Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

3.2 CONNECTIONS

A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Supervisory connections at valve supervisory switches.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to remote annunciator.

3.5 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by Architect and authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test visible appliances for the public operating mode according to manufacturer's written instructions.
5. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283111

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes:
   1. Protecting existing trees, shrubs, groundcovers, plants, and grass to remain.
   2. Removing existing trees, shrubs, groundcovers, plants, and grass.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Removing above- and below-grade site improvements.
   6. Disconnecting, capping or sealing, and removing site utilities.
   7. Temporary erosion and sedimentation control measures.

B. Related Sections:
   1. Division 1 Section for temporary utilities, temporary construction and support facilities , and temporary protection facilities.
   2. Section 02 41 16 “Building Demolition” for demolition of buildings, structures, and site improvements.
   3. Section 02 41 19 “Selective Demolition” for partial demolition of buildings or structures undergoing alterations.
   4. Section 31 20 00 “Earthwork” for soil materials, excavating, backfilling, and site grading.

1.3 DEFINITIONS

A. 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 nonsoil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Photographs sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Section 31 20 00 "Earthwork."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within fenced area.
2. Do not permit vehicles, equipment, or foot traffic within fenced area.
3. Maintain fenced area free of weeds and trash.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
2. Replace trees that cannot be repaired and restored to full-growth status, as determined by Architect.

3.4 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities identified for removal.

1. Arrange with utility companies to shut off indicated utilities.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than 5 working days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect’s written permission.

3. Any utilities damaged, removed, or undercut by construction operations shall be repaired or replaced at contractor's expense.

C. Excavate for and remove underground utilities identified for removal.

1. Backfill excavations in accordance with requirements of Section 31 20 00 "Earthwork".

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. 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.
3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18-inches below exposed subgrade.
4. Use only hand methods for grubbing within tree protection zone.
5. Chip removed tree branches and dispose of off-site.
6. Perform according to the recommendations of the Geotechnical Investigation.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated, or as directed by the Geotechnical Engineer. Place and compact fill material in accordance with requirements in Section 02200 "Earthwork".

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials, or as required to remove all vegetation and organic laden topsoil, as determined in the field by the Geotechnical Engineer

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within tree protection zones.
3. Dispose of excess topsoil as specified for waste material disposal.
    a. Stripped topsoil material may be used in landscaped areas if approved in writing by Landscape Architect.

3.7 SITE IMPROVEMENTS

A. Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Concrete and Asphalt Paving: Cleanly saw-cut vertically and in straight lines, perimeter of area to be removed, then break up and remove portion indicated.

a. At concrete paving, use existing joints to define area of removal, unless indicated otherwise.

2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.8 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner’s property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 31 10 00

SECTION 31 20 00

EARTHWORK

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:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
3. Excavating and backfilling for buildings and structures.
4. Drainage course (capillary break material) for slabs-on-grade for buildings.
5. Excavating and backfilling for buried mechanical and electrical utilities and pits for buried utility structures.

B. Related Sections include:

1. Section 01 56 39 “Tree Protection and Trimming” for limitations on earthwork within tree protection zones.
2. Section 03 30 05 “Underslab Vapor Barrier” for sheet membrane vapor barrier below building slabs-on-grade.
3. Section 31 10 00 “Site Clearing” for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
4. Section 31 23 26 “Controlled-Low-Strength Material” for controlled-low-strength material, for use as an alternative to compacted soil fill material.
5. Section 31 23 33 “Utility Trenching and Backfill” for excavating and backfilling of trenches for below-grade utility lines.
6. Section 32 12 16 “Asphalt Paving” for underlying base course material below asphalt paving.
7. Section 32 13 13 “Site Concrete” for underlying base course material below concrete paving.
8. Section 33 46 13 “Subdrainage” for below-grade perforated drain lines and associated drainage course backfill for below-grade walls.

1.3 REFERENCES

A. ASTM International:

1. ASTM D 448: Standard Classification for Sizes of Aggregate for Road and Bridge Construction.

2. ASTM D 1556: Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D 1557: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3).
4. ASTM D 1586: Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils.
5. ASTM D 2167: Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
6. ASTM D 2487: Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
7. ASTM D 2937: Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.
8. ASTM D 6938: Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

B. California Code of Regulations:
1. Title 8 – Industrial Relations (Cal/OSHA Standards).

1.4 UNIT PRICES

A. Work of this Section is affected by unit prices for earth-moving specified in Division 1 section for unit prices.

B. Quantity allowances for earth-moving are included in Division 1 section for allowances.

C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.
1. **24** inches outside of concrete forms other than at footings.
2. **12** inches outside of concrete forms at footings.
3. **6** inches outside of minimum required dimensions of concrete cast against grade.
4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
5. **6** inches beneath bottom of concrete slabs-on-grade.
6. **6** inches beneath pipe in trenches, and the greater of **24** inches wider than pipe or **42** inches wide.

1.5 DEFINITIONS

A. Backfill: Soil material or controlled-low-strength material used to fill an excavation.

B. Base Course: Aggregate layer placed between the subgrade and surface pavement in a paving system.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Drainage Course: Course of washed granular material supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Owner's geotechnical testing agency. Authorized additional excavation and replacement material will be paid for according to Contract provisions for **changes in the Work**.

2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Owner's geotechnical testing agency. Unauthorized excavation, as well as remedial work directed by geotechnical testing agency, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that 3/4 cubic yard or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subgrade: Uppermost surface of an excavation, or top surface of a fill or backfill immediately below base course, drainage course, or topsoil materials.

J. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.6 PREINSTALLATION MEETING

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

1. Review methods and procedures related to earth-moving, including, but not limited to, the following:

a. Personnel and equipment needed to make progress and avoid delays.

b. Coordination of Work with utility locator service.

c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.

d. Extent of trenching by hand or with air spade.

e. Field quality control.

1.7 ACTION SUBMITTALS

A. Soil Samples: As required by Owner's geotechnical testing agency for sampling and testing of proposed offsite borrow soil material.

1. Deliver a representative sample of each type of imported borrow material to Owner's geotechnical testing agency's laboratory at least ***7*** working days prior to delivery to site, for evaluation and testing.

1.8 INFORMATIONAL SUBMITTALS

A. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth-moving begins.

1.9 QUALITY ASSURANCE

A. Geotechnical Testing and Inspection: Owner will employ and pay for a qualified independent geotechnical testing and inspection agency to perform soils testing and inspection services during earthwork operations. All imported borrow materials must be approved by Owner's geotechnical testing agency.

1.10 FIELD CONDITIONS

A. Project Soils Information: Data in subsurface investigation report referenced below was used for basis of design, and is available to Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. Opinions expressed in subsurface investigation report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer.

1. "Geotechnical Engineering Investigation Bessie Owens Intermediate School Modernization Bakersfield, California" dated November 26, 2018, by BSK Associates, Project No. G18-268-11B

B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

1. Should uncharted, or incorrectly charted piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation, if required. Repair damaged utilities to satisfaction of utility owner.
2. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Architect, and then only after acceptable temporary utility services have been provided.
    a. Provide minimum 5 working days notice to Architect, and receive written notice to proceed before interrupting any utility.
3. Demolish and completely remove from site existing underground utilities identified for removal. Coordinate with utility companies for shutoff of services if lines are active.

C. Use of explosives is not permitted.

D. Protection of Persons and Property:

1. Barricade open excavations and post with warning lights as per requirements of authorities having jurisdiction.
    a. Conform with all applicable occupational safety regulations.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
3. Excavation within dripline of trees to remain to be performed by hand. Protect root systems from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap. **Refer to Division 1 Section for tree- and plant-protection for additional requirements.**

E. Dust Control: Conduct earthwork operations so as to prevent windblown dust and dirt from interfering with Owner's and adjacent property owners' normal operations.
1. The contractor shall prevent a dust nuisance from originating from the site of work as a result of his operations during the effective period of this contract. Preventative measures shall be taken by the contractor to mitigate the impact of dust and PM10 emissions according to the San Joaquin Valley Air Pollution Control District Regulation VIII (8).

F. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

G. Do not commence earth-moving operations until temporary erosion- and sedimentation-control measures, specified in Division 1, are in place.

H. Do not commence earth-moving operations until plant-protection measures specified in Division 1 Section for tree- and plant-protection are in place.

I. Tree- and Plant Protection Zones:
1. The following practices are prohibited within tree- and plant-protection zones:
    a. Storage of construction materials, debris, or excavated material.
    b. Parking vehicles or equipment.
    c. Foot traffic.
    d. Erection of sheds or structures.
    e. Impoundment of water.
    f. Excavation or other digging unless otherwise indicated.
    g. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
2. Do not direct vehicle or equipment exhaust towards tree- and plant-protection zones.

3. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Import fill materials: Must be free from organic materials or deleterious substances. Imported fill soils must be non-hazardous and from a single consistent soil type in accordance with the following criteria, or as directed by Geotechnical Engineer:

a.	Plasticity Index:	< 12
b.	Expansion Index:	< 20 (Very Low Expansion Potential)
c.	Maximum Particle Size:	3 inches
d.	Percent Passing #4 Sieve:	65 – 100
e.	Percent Passing #200 Sieve:	20 – 45
f.	Low Corrosion Potential:	Soluble Sulfates < 1,500 ppm
		Soluble Chlorides < 150 ppm
		Minimum Resistivity > 3,000 ohm-cm

C. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock and gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter, or as directed by Geotechnical Engineer.

D. Sand Bedding Material: ASTM C 33; fine aggregate, natural, or manufactured sand.

E. Drainage Course (Capillary Break): Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.2 MISCELLANEOUS MATERIALS

A. Controlled-Low-Strength Material: Refer to Section 31 23 26 “Controlled-Low-Strength Material.”

1. Portland Cement: ASTM C 150, Type I or II.
2. Aggregate: ASTM C 33; 3/8-inch maximum size.
3. Water: ASTM C 94; potable.
4. Air-Entraining Admixture: ASTM C 260.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage caused by rain or water.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary ditches.

3.3 EXCAVATION, GENERAL

A. Do not use explosives.

B. Unclassified Excavation: Excavation is unclassified and includes excavation to required subgrade elevations regardless of the character of materials and subsurface conditions encountered.

1. If excavated materials intended for fill or backfill include unsatisfactory soil materials and rock, replace with satisfactory material approved by Owner's geotechnical testing agency.
2. Refer to Section 31 10 00 "Site Clearing" for removal of surface pavements and below-grade improvements.

C. Classified Excavation: Omitted

D. Stability of Excavations:

1. Comply with all applicable codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations. Maintaining stability of excavations is sole responsibility of Contractor.
    a. Support all trench and other excavations in accordance with California Code of Regulations, Title 8 – Industrial Relations (Cal/OSHA Standards), Chapter 4 – Division of Industrial Safety, Subchapter 4 – Construction Safety Orders.

3.4 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions on approved plans within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: at the proposed structures, the exposed ground surface should be overexcavated to 3 feet below the existing grade or 1 foot below the footing, whichever is greater, or as directed by Geotechnical Engineer. Over excavation should extend a minimum of five feet outside exterior footing lines. Yielding areas should be observed by the geotechnical consultant and removed and recompacted if necessary.

a. After overexcavation, the bottom of the exposed soil should be scarified 8 inches, moisturized to optimum moisture content, and compacted to 90 percent of ASTM D1557, or as directed by Geotechnical Engineer.

b. Following the required stripping and overexcavation, the exposed ground surface must be inspected by the Geotechnical Engineer to evaluate if loose or soft zones are present that will require over excavation.

2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Cut and protect roots according to requirements in Division 1 Section for tree protection.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.6 EXCAVATIONS FOR UTILITY TRENCHES

A. Refer to Section 31 23 33 “Utility Trenching and Backfill” for excavation requirements for utility trenches.

3.7 SUBGRADE INSPECTION

A. Notify Architect and Owner’s geotechnical testing agency when excavations have reached required subgrade.

B. If Owner’s geotechnical testing agency determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed by geotechnical testing agency.

C. At areas to receive fill and/or concrete slabs on grade, scarify and recompact upper portion of exposed subgrade soil as specified in “Placement and Compaction” Article.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner’s geotechnical testing agency, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Owner’s geotechnical engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Owner’s geotechnical testing agency.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust and saturation from rain.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
2. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill. Comply with all applicable state and local requirements for offsite disposal of soil and other waste materials.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, and as specified in “Placement and Compaction” Article, but not before completing the following:

1. Construction below finished grade, including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Removal of concrete formwork.
3. Removal of trash and debris from excavations.
4. Removal of temporary shoring and bracing, and sheeting.
5. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Use satisfactory soil material for backfill, except where occurring under structures or exterior concrete paving, use engineered fill material and/or non-expansive fill material as specified in “Fill” Article.

1. Where project conditions prevent the use of properly compacted soil material as backfill, obtain approval of Project Inspector and Owner’s geotechnical testing agency to use controlled-low-strength material in lieu of soil.

C. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Refer to Section 31 23 33 “Utility Trenching and Backfill” for backfill requirements for utility trenches.

3.12 FILL

A. Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fill materials.

B. Scarify upper 12 inches of exposed soil at subgrade areas to receive fill. Recompact scarified soil as specified in “Placement and Compaction” Article.

1. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical in 5 horizontal as directed by Owner’s geotechnical testing agency, so fill material will bond with existing material.

C. Place and compact fill material in layers to required elevations as specified in “Placement and Compaction” Article. Fill material to be as follows:

1. Under footings and foundations, building slabs-on-grade, and adjacent exterior slabs, use non-expansive fill within the top 12-inch zone below bottom of slab or as directed by Geotechnical Engineer. Capillary break material occurring in upper portion of this zone is considered non-expansive fill.
    a. Place non-expansive fill to extend 5 feet beyond perimeter edges of building slabs, or adjacent exterior slabs, where occur.
    b. Below 12-inch non-expansive fill layer, use engineered fill.
    c. Where project conditions prevent the use of compacted soil material as backfill, obtain approval of Project Inspector and Architect to use controlled-low-strength material in lieu of soil.
2. Under exterior concrete paving not occurring adjacent to structures, and exterior concrete steps and ramps, use non-expansive fill within the top 9-inch zone below bottom of slab or as directed by Geotechnical Engineer. Base course material occurring in upper portion of this zone is considered non-expansive fill.
    a. Place non-expansive fill to extend 2 feet beyond perimeter edges of exterior slabs.
    b. Below 9-inch non-expansive fill layer, use engineered fill.
    c. Where project conditions prevent the use of compacted soil material as backfill, obtain approval of Project Inspector and Architect to use controlled-low-strength material in lieu of soil.
3. Under asphalt paved areas, use satisfactory soil material.
4. Under grass and planted areas, use satisfactory soil material.

D. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 PLACEMENT AND COMPACTION

A. Place backfill and fill soil materials in layers not more than the following thicknesses in loose depth:

1. Below Structures and Pavements: Not more than 8 inches for material compacted by heavy compaction equipment, and not more than 4 inches for material compacted by hand-operated tampers.
2. Below Turf and Planted Areas and Other Unpaved Areas: Not more than 8 inches.

B. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

C. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

1. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

D. Soil Moisture Control: Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to levels indicated.

1. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds moisture content levels specified.

E. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Scarify and recompact upper portion of subgrades to receive fill material as follows:
    a. Under Structures: Recompact 24 inches below existing ground or 12 inches below footing to a minimum of 90 percent relative compaction, at optimum moisture content.
    b. Under Exterior Paved Areas: Recompact top 12 inches to a minimum of 95 percent relative compaction, at optimum moisture content.
2. Under structures, compact each layer of fill as follows:
    a. Non-Expansive Fill: Compact each layer to a minimum of 90 percent relative compaction at optimum moisture content.
    b. Engineered Fill: Compact each layer to a minimum of 90 percent relative compaction at optimum moisture content.
3. Under exterior concrete paving, ramps, and steps, and asphalt paving, compact each layer of fill as follows:
    a. Non-Expansive Fill: Compact each layer to a minimum of 90 percent relative compaction at optimum moisture content., except, compact upper 12 inches at 95 percent relative compaction at optimum moisture content.
    b. Engineered Fill Compact each layer to a minimum of 90 percent relative compaction at optimum moisture content., except, compact upper 12 inches at 95 percent relative compaction at optimum moisture content.

4. Under turf and planted areas, compact each layer of fill to a minimum of 90 percent relative compaction at Compact each layer to a minimum of 90 percent relative compaction at optimum moisture content., except, compact upper 12 inches at 95 percent relative compaction at optimum moisture content, except, compact upper 18 inches at 85 percent relative compaction at optimum moisture content..

F. Correct improperly compacted areas or lifts as directed by Architect and Owner's geotechnical testing agency if soil density tests indicate inadequate compaction.

3.14 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1 inch.

C. Grading Inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

D. Adjustment of Existing In-Ground Utility Boxes: Where existing in-ground utility boxes occur in areas in which finish grade is being adjusted, reset top of utility box to conform with new finish grade.

3.15 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Install subdrainage pipe and drainage course backfill material as specified in Section 33 46 13 "Subdrainage."

3.16 PAVEMENT BASE COURSES

A. Place base courses under paved areas on prepared subgrade, in indicated thicknesses, and as specified in Section 32 12 16 "Asphalt Paving" and Section 32 13 13 "Site Concrete."

3.17 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade in indicated thickness as follows:

1. Place drainage course 6 inches or less in compacted thickness in a single layer.
2. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
3. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent relative compaction according to ASTM D 1557.

C. Refer to Section 03 30 05 “Underslab Vapor Barrier” for placement of sheet membrane vapor barrier over drainage course.

3.18 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing and observation.
1. Notify Owner’s testing agency at least 2 working days prior to date when observation and testing services are needed.

B. Allow geotechnical testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by geotechnical testing agency.

D. Geotechnical testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, 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 one test for every 2000 sq ft or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench length, at a frequency of no less than 18 inches vertically, but no fewer than two tests.

E. When geotechnical 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 material to depth required; recompact and retest until specified compaction is obtained.
1. Additional testing and inspection required by failure to meet specified requirements will be at Contractor’s expense.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Owner's geotechnical testing agency; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of off Owner's property.

END OF SECTION 31 20 00

SECTION 312333

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, testing, and installation for pipeline trench excavation, backfilling, and compacting.

1.02 SUBMITTALS

A. Submit method(s) of compaction including removal sequence of shoring where used.

1.03 TESTING FOR COMPACTION

A. The Owner will test for compaction as described below.

B. Determine the density of soil in place nuclear methods, ASTM D6938. Compaction tests will be performed for each lift or layer.

C. Determine laboratory moisture-density relations of soils by ASTM D1557. The compaction test results for maximum dry density and optimum water content shall be adjusted in accordance with ASTM D4718. This will be required for determination of percent relative compaction and moisture variation from optimum.

D. Determine the relative density of cohesionless soils by ASTM D4253 and D4254.

E. Sample backfill materials per ASTM D75.

F. "Relative compaction" is the ratio, expressed as a percentage, of the in-place dry density to the laboratory maximum dry density.

G. Compaction shall be deemed to comply with the specifications when no more than three tests falls below the specified relative compaction. The Contractor shall pay the costs for any retesting or additional testing of work not conforming to the specifications.

H. Where compaction tests indicate a failure to meet the specified compaction, the Owner will take additional tests every 50 feet in each direction until the extent of the failing area is identified. Rework the entire failed area until the specified compaction has been achieved.

1.04 PAVEMENT ZONE

The pavement zone includes the asphalt concrete and aggregate base pavement section placed over the trench backfill.

1.05 TRENCH ZONE

The trench zone includes the portion of the trench from the top of the pipe zone to the bottom of the street zone in paved areas or to the existing surface in unpaved areas. If the resulting trench zone is less than 24 inches thick, the street zone shall extend to the top of the pipe zone and there shall be no separate trench zone.

1.06 PIPE ZONE

The pipe zone shall include the full width of trench from the bottom of the pipe or conduit to a horizontal level above the top of the pipe, as specified below. Where multiple pipes or conduits are placed in the same trench, the pipe zone shall extend from the bottom of the lowest pipe to a horizontal level above the top of the highest or topmost pipe. Thickness of pipe zone above the highest top of pipe shall be as follows unless otherwise shown in the drawings or otherwise described in the specifications for the particular type of pipe installed.

Pipe Diameter	**Thickness of Pipe Zone Above Top of Pipe**
6 inches or smaller	6 inches
8 inches and larger	10 inches

1.07 PIPE BASE OR BEDDING

The pipe base or bedding shall be defined as a layer of material immediately below the bottom of the pipe or conduit and extending over the full trench width in which the pipe is bedded. Thickness of pipe base shall be as follows unless otherwise shown in the drawings or otherwise described in the specifications for the particular type of pipe installed.

Pipe Diameter	**Thickness of Pipe Base**
Smaller than 4 inches	3 inches
4 inches through 16 inches	4 inches
18 inches and larger	6 inches

PART 2 - MATERIALS

2.01 GRANULAR MATERIAL FOR BACKFILL--STREET AND TRENCH ZONES

Granular material or granular soil for backfill used above the pipe zone shall be lean bank-run or pit-run gravel, or native soil. The maximum particle size shall be 2 inches. A maximum of 10% shall pass a No. 200 sieve.

2.02 NATIVE EARTH BACKFILL--STREET AND TRENCH ZONES

A. Native earth backfill used above the pipe zone shall be excavated fine-grained materials free from roots, debris, rocks larger than 3 inches, asbestos, organic matter, clods, clay balls, broken pavement, and other deleterious materials. Less than 50% shall pass a No. 200 sieve. At least 40% shall pass a No. 4 sieve. The coarser materials shall be well distributed throughout the finer material.

B. Backfill materials that are obtained from trench excavated materials to the extent such material is available shall be either screened directly into the trench or screened during the trenching operation. If screened during trenching, the material shall be maintained free of unscreened material during the handling and backfilling process. Hand selecting of rocks from earth as it is placed into the trench will not be permitted in lieu of the specified screening. Backfill shall be moisture conditioned to within approximately 2% of the optimum moisture content prior to being placed in trench.

2.03 IMPORTED SAND--PIPE ZONE AND PIPE BASE

A. Imported sand used in the pipe zone or for the pipe base shall have the following gradation:

Sieve Size	**Percent Passing By Weight**
3/8 inch	100
No. 4	75 to 100
No. 30	12 to 50
No. 100	5 to 20
No. 200	0 to 10

B. Imported sand shall have a saturated resistivity greater than 1,000 ohm-cm per ASTM G187, a neutral pH, and chlorides less than 100 ppm.

2.04 UNDERGROUND DETECTABLE METALLIC PIPE WARNING TAPE

Provide permanent, bright-colored, continuous-printed tape consisting of an aluminum or steel foil sheathed in a plastic laminate, not less than 2 inches wide by 3 mils thick. Provide tape with printing which most accurately indicates type of buried service. Color shall be blue.

PART 3 - EXECUTION

3.01 SLOPING, SHEETING, SHORING, AND BRACING OF TRENCHES

Trenches shall have sloping, sheeting, shoring, and bracing conforming with 29CFR1926, Subpart P--Excavations, CAL/OSHA requirements.

3.02 TRENCH EXCAVATION

Excavate the trench to the lines and grades shown in the drawings with allowance for pipe thickness, sheeting and shoring if used, and for pipe base or special bedding. If the trench is excavated below the required grade, refill any part of the trench excavated below the grade at no additional cost to the Owner imported sand. Place the refilling material over the full width of trench in compacted layers not exceeding 6 inches deep to the established grade with allowance for the pipe base or special bedding.

3.03 TRENCH EXCAVATION IN BACKFILL AND EMBANKMENT AREAS

A. Construct and compact the embankment to an elevation of 1-foot minimum over the top of the largest pipe or conduit to be installed.

B. Excavate trench in the compacted backfill or embankment.

3.04 LOCATION OF EXCAVATED MATERIAL

A. During trench excavation, place the excavated material only within the working area. Do not obstruct any roadways or streets. Do not place trench spoil over pipe, buried utilities, manholes, or vaults. Conform to federal, state, and local codes governing the safe loading of trenches with excavated material.

B. Remove and store excavated topsoil separately. Replace topsoil in the top 24 inches where trenching is in turf.

C. **Replace turf damaged or destroyed by trench excavation and temporary storage of spoil.**

D. Remove and properly dispose of any excess soil from the project site.

3.05 DEWATERING

Provide and maintain means and devices to remove and dispose of water entering the trench excavation during the time the trench is being prepared for the pipe laying, during the laying of the pipe, and until the backfill at the pipe zone has been completed. These provisions shall apply during both working and nonworking hours, including lunchtime, evenings, weekends, and holidays. Dispose of the water in a manner to prevent damage to adjacent property and in accordance with regulatory agency requirements. Do not drain trench water through the pipeline under construction.

3.06 INSTALLING BURIED PIPING

A. Grade the bottom of the trench to the line and grade to which the pipe is to be laid, with allowance for pipe thickness. Remove hard spots that would prevent a uniform thickness of bedding. Place the specified thickness of pipe base material over the full width of trench. Grade the top of the pipe base ahead of the pipe laying to provide firm, continuous, uniform support along the full length of pipe, and compact to the relative

compaction specified herein. Before laying each section of the pipe, check the grade and correct any irregularities.

B. Excavate bell holes at each joint to permit proper assembly and inspection of the entire joint. Fill the area excavated for the joints with the bedding material specified or indicated in the drawings for use in the pipe zone.

C. Inspect each pipe and fitting before lowering the buried pipe or fitting into the trench. Inspect the interior and exterior protective coatings. Patch damaged areas in the field with material recommended by the protective coating manufacturer. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after installation.

D. Handle pipe in such a manner as to avoid damage to the pipe. Do not drop or dump pipe into trenches under any circumstances.

E. After pipe has been bedded, place pipe zone material simultaneously on both sides of the pipe, in maximum 6-inch lifts, keeping the level of backfill the same on each side. If no pipe zone material is specified or indicated, use imported sand. Carefully place the material around the pipe so that the pipe barrel is completely supported and no voids or uncompacted areas are left beneath the pipe. Use particular care in placing material on the underside of the pipe to prevent lateral movement during subsequent backfilling.

F. Compact each lift to the relative compaction specified herein.

G. Push the backfill material carefully onto the backfill previously placed in the pipe zone. Do not permit free-fall of the material until at least 2 feet of cover is provided over the top of the pipe. Do not drop sharp, heavy pieces of material directly onto the pipe or the tamped material around the pipe. Do not operate heavy equipment or a sheepsfoot wheel mounted on a backhoe over the pipe until at least 3 feet or one-half of the internal diameter, whichever is greater, of backfill has been placed and compacted over the pipe.

H. When the pipe laying is not in progress, including the noon hours, close the open ends of pipe. Do not allow trench water, animals, or foreign material to enter the pipe.

I. Keep the trench dry until the pipe laying and jointing are completed.

3.07 BACKFILL COMPACTION

A. Unless otherwise shown in the drawings or otherwise described in the specifications for the particular type of pipe installed, relative compaction in pipe trenches shall be as follows:

1. Pipe Zone: 90% relative compaction.

2. Trench Zone: 90% relative compaction.

3. Top 12-inches of Trench Zone Beneath Paving: 95% relative compaction.

B. Compact trench backfill to the specified relative compaction. Compact by using mechanical compaction or hand tamping. Do not use high-impact hammer-type equipment except where the pipe manufacturer warrants in writing that such use will not damage the pipe.

C. Compact material placed within 12 inches of the outer surface of the pipe by hand tamping only.

D. Do not use any axle-driven or tractor-drawn compaction equipment within 5 feet of building walls, foundations, and other structures.

3.08 MATERIAL REPLACEMENT

Remove and replace any trenching and backfilling material that does not meet the specifications, at the Contractor's expense.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

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:
   1. Hot-mix asphalt paving.
   2. Aggregate base course for asphalt paving.
   3. Patching of asphalt paving.
   4. Asphalt surface treatments.
      a. Slurry seal.
      b. Fog seal.
   5. Asphalt curbs.
   6. Asphalt speed bumps.
   7. Redwood header boards.

B. Related Sections include:
   1. Section 02 41 19 “Selective Demolition” for sawcutting and removal of existing asphalt paving.
   2. Section 31 20 00 “Earthwork” for preparation of subgrade below asphalt paving base course.
   3. Section 31 23 33 “Utility Trenching and Backfill” for trenching and backfill for below-grade utility lines below asphalt paving.
   4. Section 32 13 13 ”Site Concrete” for concrete paving and base course.
   5. Section 32 17 13 “Wheelstops” for precast concrete wheelstops.
   6. Section 32 17 23 “Pavement Markings” for paint striping and marking on asphalt paving.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO M 29: Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
   2. AASHTO M 301: Standard Specification for Joint Sealants, Hot-Poured, for Concrete and Asphalt Pavements.

3. AASHTO T 168: Standard Method for Test for Sampling Bituminous Paving Mixtures.

B. ASTM International:

1. ASTM D 692: Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.
2. ASTM D 979: Standard Practice for Sampling Bituminous Paving Mixtures.
3. ASTM D 1073: Standard Specification for Fine Aggregate for Asphalt Paving Mixtures.
4. ASTM D 1188: Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.
5. ASTM D 1557: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3).
6. ASTM D 2041: Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
7. ASTM D 2726: Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Asphalt Mixtures.
8. ASTM D 2950: Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.
9. ASTM D 3549: Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
10. ASTM D 6690: Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

C. International Organization for Standardization (ISO):

1. ISO 14021: Environmental Labels and Declarations – Self-Declared Environmental Claims (Type II Environmental Labeling).

D. Leadership in Energy & Environmental Design (LEED) Version 4 (v4), United States Green Building Council:

1. LEED v4 BD+C: New Construction and Major Renovations.
2. LEED v4 BD+C: Core and Shell Development.
3. LEED v4 BD+C: Schools.
4. LEED v4 BD+C: Retail.
5. LEED v4 BD+C: Data Centers.
6. LEED v4 BD+C: Warehouses and Distribution Centers.
7. LEED v4 BD+C: Hospitality.
8. LEED v4 BD+C: Healthcare.
9. LEED v4 BD+C: Homes and Multifamily Lowrise.
10. LEED v4 BD+C: Multifamily Midrise.

E. State of California Department of Transportation (Caltrans):

1. 2010 Standard Specifications.

F. Environmental Protection Agency (EPA).

G. Redwood Inspection Service (RIS).

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site, to review pertinent issues related to asphalt paving.
   1. Review methods and procedures related to asphalt paving including, but not limited to, the following:
      a. Proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
      b. Review requirements for protection paving work, including restrictions of traffic during installation period and for remainder of construction period.
   2. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Include technical data and tested physical and performance properties.
   2. Job-Mix Designs: For each job mix proposed for the Work.

B. LEED v4 Submittals:
   1. MR Credit: Building Product Disclosure and Optimization – Sourcing of Raw Materials:
      a. Product data or manufacturer's certificate indicating percentages by weight of postconsumer recycled content.
         i) Materials having postconsumer recycled content:
            a) Asphalt paving material (aggregate).
            b) Base course.
         ii) Include vendor invoices stating costs of products having recycled content.
      b. Documentation of locally sourced materials and products, as specified in "LEED v4 Requirements" Article.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and testing agency.

B. Material Certificates: For each paving material, signed by manufacturer, and certifying that each material complies with specified requirements.

C. Material Test Reports: For each paving material, by a qualified testing agency.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing hot-mix asphalt paving materials, and with a record of successful in-service performance, as well as sufficient production capacity to produce required quantities.

B. Provide asphalt paving according to materials, workmanship, and other applicable requirements of the Caltrans Standard Specifications.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate care, or if the following conditions are not met:

1. Tack Coats: Minimum surface temperature of 50 deg F (10 deg C).
2. Slurry Coat: Minimum surface temperature of 50 deg F (10 deg C) at time of placement.
3. Asphalt Base Lifts: Minimum surface temperature of 45 deg F (7 deg C) and rising at time of placement
4. Asphalt Surface Course: Minimum surface temperature of 50 deg F (10 deg C) at time of placement.

PART 2 - PRODUCTS

2.1 LEED v4 REQUIREMENTS

A. Recycled Content: Provide products with recycled content as defined in ISO 14021 as indicated below:

1. Asphalt Paving: 15 percent postconsumer recycled content.
2. Base Course: 100 percent postconsumer recycled content.

B. Locally Sourced Materials and Products: Provide asphalt paving aggregate and base course materials that have been extracted, manufactured, and purchased within 100 miles of Project site.

2.2 PERFORMANCE REQUIREMENTS

A. Produce and install asphalt paving in accordance with applicable requirements of the State of California Department of Transportation (Caltrans), 2010 Standard Specifications, referred to herein as Caltrans Standard Specifications.

2.3 BASE COURSE AGGREGATE

A. Base Course Aggregate: Sound, angular crushed stone, gravel, or combination thereof conforming with requirements of Caltrans Standard Specifications Section 26 for Class 2 Aggregate Base.

1. Recycled Content: As specified in “LEED v4 Requirements” Article.

2.4 AGGREGATES FOR ASPHALT PAVING

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, or crushed gravel.

C. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, or combination thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

2.5 ASPHALT MATERIALS

A. Asphalt Binder: Conform to requirements of Caltrans Standard Specifications Section 92 for Performance Graded Asphalt Binders, PG 64-10.

B. Tack Coat: Emulsified asphalt conforming with requirements of Caltrans Standard Specifications Section 94; Grade: SS-1, SS-1h, CSS-1, or CSS-1h.

C. Fog Seal: Emulsified asphalt conforming with requirements of Caltrans Standard Specifications Section 37; Grade: Medium Fine; Asphaltic emulsion Grade SS-1.

D. Water: Potable.

2.6 ACCESSORY MATERIALS

A. Joint Sealant: ASTM D 6690 or AASHTO M 301, hot-applied, single-component, polymer-modified bituminous sealant.

B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as “restricted use” for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

C. Wood Header Boards and Stakes:

1. Species: Redwood.
2. Grade: Construction Heart, as per applicable rules of the RIS for grading and inspection.

2.7 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes designed according to Caltrans Standard Specifications Section 39 requirements for Type A asphalt concrete.

1. Provide mixes with a history of satisfactory performance in geographic area where Project is located.
2. Provide mixes complying with the following requirements for maximum aggregate sizes:
    a. Base Lift(s): 3/4-inch maximum size, medium graded.
    b. Surface Lift(s): 1/2-inch maximum size, medium graded.

B. Emulsified-Asphalt Slurry: Slurry mix consisting of emulsified asphalt, fine aggregate, and mineral fillers in conformance with Caltrans Specification Section 37.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

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

3.2 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade. Excavate as follows, unless indicated otherwise:

1. At utility trenches, excavate continuous patch along path of trench.
2. At areas to be patched, excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement.

B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal/sq yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Patching: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch, and, while still hot, compact flush with adjacent surface.

3.3 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.4 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.

B. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive base course and paving, and is free of mud, frost, snow, or ice.

C. Header Boards and Stakes: Set header boards true to lines and grades, and as indicated on Drawings.

D. Place and compact aggregate base course to thicknesses required for each section. Comply with requirements of Caltrans Standard Specification Section 26.

1. Placement Layers:
    a. Place base course 6 inches or less in compacted thickness in a single layer.
    b. Place base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
2. Shape base course to required elevations and grades.
3. Compact aggregate base course at optimum moisture content to 95 percent relative compaction according to ASTM D 1557.
4. Proof-roll prepared base course surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected are ready to receive paving.

E. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted aggregate base before applying paving materials. Exercise care to ensure herbicide is not applied to areas not receiving paving.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

F. Tack Coat: Apply uniformly to horizontal surfaces of existing pavement and vertical surfaces of abutting curbs, gutters, construction joints, and existing pavements at a rate of 0.05 to 0.15 gal/sq yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 PLACING HOT-MIX ASPHALT

A. General: Place asphalt concrete paving in conformance with requirements of Caltrans Standard Specifications Section 39.

B. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that

prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

C. Place hot-mix asphalt paving in maximum lift thicknesses of 3 inches.

D. Spread mix at minimum temperature of 250 deg F (121 deg C), or as otherwise required to maintain required minimum temperatures for breakdown rolling and compaction.

E. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.

F. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

G. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base lift before placing asphalt surface lift.

H. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

I. Conforms between new and existing paving shall form smooth, pond-free transition.

3.6 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct joints as described in Caltrans Specifications Section 39.
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints a density within 2 percent of specified course density.

3.7 COMPACTION

A. General: Compact hot-mix asphalt concrete paving in conformance with requirements of Caltrans Standard Specifications Section 39.

B. Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

C. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

1. Complete initial rolling and breakdown compaction before mix temperature cools to minimum level specified in Caltrans Standard Specifications.

D. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough per requirements of Caltrans Specifications Section 39.

1. Complete intermediate and finish compaction before mix temperature cools to minimum levels specified in Caltrans Standard Specifications.

E. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

F. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

G. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

H. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

I. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Lower Lifts: Plus or minus 1/4 inch.
2. Top (surface) Lift: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Lifts: 1/4 inch.
2. Surface Lift: 1/8 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

C. Speed Bumps: Compact and form asphalt to produce the contour indicated and within a tolerance of plus or minus 1/8 inch of height indicated above pavement surface.

3.9 ASPHALT CURBS

A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at a minimum temperature of 250 deg F (121 deg C).

1. Asphalt Mix: Same as pavement surface-course mix.

B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.10 ASPHALT SPEED BUMPS

A. Construct hot-mix asphalt speed bumps over compacted pavement surfaces. Apply a tack coat unless pavement surface is still tacky and free from dust. Spread mix at a minimum temperature of 250 deg F.

1. Tack Coat Application: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal/sq yd.
2. Asphalt Mix: Same as pavement surface-course mix.

B. Place and compact hot-mix asphalt to cross section indicated, buy machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.11 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal coat in accordance with Caltrans Standard Specification Section 37 to all asphalt concrete paved surfaces.

B. Slurry Seal: Apply slurry coat in a uniform thickness and in accordance with Caltrans Standard Specification Section 37 at existing asphalt paved surfaces indicated.

1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.12 FIELD QUALITY CONTROL

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

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.
2. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. Asphalt Speed Bumps: Finished height of asphalt speed bumps above pavement will be measured for compliance with tolerances.

E. In-Place Density: Testing Agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
    a. One core sample will be taken for every 1000 sq yds or less of installed pavement, with no fewer than three cores taken.
    b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

F. Drainage: After completion of paving work, all asphalt concrete paving shall be flooded with water, and any resulting ponds shall be ringed with chalk. Such areas shall be repaired as required to eliminate ponding by removing and replacing asphalt concrete to correct grades and slopes.

G. Replace and compact hot-mix asphalt where core tests were taken.

H. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 WASTE HANDLING

A. Handle asphalt paving waste according to approved waste management plan required by Division 1 Section for construction waste management and disposal.

B. Do not allow excavated materials to accumulate on-site.

END OF SECTION 32 12 16

SECTION 32 13 13

SITE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following site concrete items:
   1. Concrete paving.
      a. Decorative Treatments:
         i) Integral-color pigment.
         ii) Pigmented dry-shake hardener.
         iii) Stained concrete.
         iv) Exposed aggregate.
         v) Stamped concrete.
         vi) Sandblasted concrete.
   2. Concrete curbs and gutters.
   3. Concrete ramps and steps.
      a. Cast-in safety tread nosings at concrete steps.
   4. Cast-in-place concrete for exposed vertical surfaces.
      a. Decorative Treatments.
         i) Integral color pigment.
         ii) Form liner treatment.
   5. Concrete equipment pads.
   6. Concrete footings for site elements.
   7. Reinforcing for site concrete.
   8. Formwork for site concrete.
   9. Aggregate base course under concrete paving.
   10. Finish treatments for site concrete.
   11. Cast-in skateboard deterrents.

B. Related Sections include:
   1. Section 02 41 19 “Selective Demolition” for sawcutting and removal of existing concrete paving.
   2. Section 03 31 00 “Cast-in-Place Concrete” for structural concrete for general building applications.

3. Section 31 20 00 “Earthwork” for grading and subgrade preparation for site concrete paving.
4. Section 31 23 26 “Controlled-Low-Strength Material” for low-strength cementitious material for use as backfill material in lieu of earth material.
5. Section 32 17 13 “Wheelstops” for precast concrete wheelstops.
6. Section 32 12 16 “Asphalt Paving” for asphalt paving and base course.
7. Section 32 17 23 “Pavement Markings” for painted striping and markings on paved surfaces and curbs.
8. Section 32 17 26 “Tactile Warning Surfaces” for prefabricated tactile warning surface panels cast into freshly poured site concrete paving substrates.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO M 182: Specification for Burlap Cloth Made From Jute or Kenaf.

B. American Concrete Institute (ACI):
1. ACI 117: Specifications for Tolerances Concrete Construction and Materials.
2. ACI 301: Specification for Structural Concrete.
3. ACI 306.1: Specification for Cold Weather Concreting.

C. ASTM International (American Society for Testing and Materials):
1. ASTM A 185: Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
2. ASTM A 615: Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
3. ASTM C 31: Practice for Making and Curing Concrete Test Specimens in the Field.
4. ASTM C 33: Specification for Concrete Aggregates.
5. ASTM C 39: Test Method for Compressive Strength of Cylindrical Concrete Specimens.
6. ASTM C 94: Specification for Ready-Mixed Concrete.
7. ASTM C 143: Test Method for Slump of Hydraulic Cement Concrete.
8. ASTM C 150: Specification for Portland Cement.
9. ASTM C 171: Specification for Sheet Materials for Curing Concrete.
10. ASTM C 172: Practice for Sampling Freshly Mixed Concrete.
11. ASTM C 231: Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
12. ASTM C 260: Specification for Air-Entraining Admixtures for Concrete.
13. ASTM C 309: Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
14. ASTM C 494: Specification for Chemical Admixtures for Concrete.

15. ASTM C 881: Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
16. ASTM C 920: Specification for Elastomeric Joint Sealants.
17. ASTM C 979: Specification for Pigments in Integrally Colored Concrete.
18. ASTM C 1017: Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
19. ASTM C 1028: Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
20. ASTM C 1059: Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
21. ASTM C 1064: Test Method for Temperature of Freshly Mixed Portland Cement Concrete.
22. ASTM C 1116: Specification for Fiber-Reinforced Concrete and Shotcrete.
23. ASTM C 1193: Guide for Use of Joint Sealants.
24. ASTM C 1315: Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
25. ASTM D 1557: Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft^3)
26. ASTM D 1751: Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

D. State of California Department of Transportation (Caltrans):
   1. Standard Specifications.

E. Concrete Reinforcing Steel Institute (CRSI):
   1. Manual of Standard Practice.

F. California Building Code (CBC):
   1. 2016 CBC Chapter 11B (Title 24, Part 2).

G. United States Department of Justice:
   1. 2010 ADA Standards for Accessible Design.

1.4 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

C. Decorative Concrete: Concrete with one of the following decorative treatments:
   1. Integral-color pigment.
   2. Pigmented dry-shake hardener.

3. Concrete stain.
4. Exposed aggregate.
5. Stamped concrete.

1.5 COORDINATION

A. Coordinate placement and finishing of site concrete with installation of tactile warning surface cast-in-place panels as specified in Section 32 17 26 “Tactile Warning Surfaces.”

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to site concrete, including, but not limited to, the following:
a. Concrete mixture design.
b. Quality control of concrete materials and site concrete construction practices.
c. Cold- and hot-weather concreting procedures.
d. Concrete finishes and finishing.
e. Joints and joint-filler strips.
f. Curing procedures.
g. Concrete protection.
2. Require representatives of each entity directly concerned with site 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. Site concrete Installer.
e. Decorative concrete system manufacturer’s representative.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Concrete Mix Designs: For each site concrete mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments. All mix designs shall be identified by a mix design identification number, and selected by a registered Civil Engineer with experience in concrete mix design. Mix design report shall be sealed and signed by qualified professional engineer responsible for its preparation.

C. Formwork Shop Drawings: Show formwork construction including form liner joints, rustications, construction and control joints, reveals, edge conditions, form joint sealant details, form tie locations and patterns, inserts and embedments, and other items that affect visual appearance of cast-in-place site concrete.

D. Samples for Initial Selection: Submit manufacturer's full range of available colors for selection by Architect, for items requiring color selection.

1. Minimum Number of Colors for Selection:

a. Integral Color Pigment: ***[24]***.

i) Submit manufacturer's full range of colors, regardless of amount of pigment required proportionally to concrete mix.

b. Pigmented Mineral Dry-Shake Hardener: ***[24]***.

c. Concrete Stain: ***[8]***.

d. Sealant: ***[45]***.

E. Samples for Verification:

1. Sample of form liner.

2. Sample of exposed aggregate mix, 5 lbs.

3. Sample of each concrete integral color pigment, on concrete material, 4 inches by 4 inches.

4. Sample of each concrete dry-shake hardener color, on concrete material, 4 inches by 4 inches.

5. Sample of each concrete stain color, on concrete material, 4 inches by 4 inches.

F. LEED v4 Submittals:

1. MR Credit: Building Product Disclosure and Optimization - Environmental Product Declarations:

a. Environmental Product Declaration (EPD), as specified in "LEED v4 Requirements" Article.

2. MR Credit: Building Product Disclosure and Optimization – Sourcing of Raw Materials:

a. Product data or manufacturer's certificate indicating percentages by weight of postconsumer and preconsumer recycled content.

i) Products having recycled content:

-Site concrete.

-Steel reinforcing for site concrete.

-Base course aggregate.

ii) Include vendor invoices stating costs of products having recycled content.

b. Documentation of locally sourced materials and products, as specified in "LEED v4 Requirements" Article.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer.

B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

1. Aggregates.

C. Material Certificates: From manufacturers, certifying that each of the following materials complies with requirements:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

D. Concrete Batch Plant Tickets: Load identification tickets for each load of concrete delivered to site. Batch ticket shall bear the following information:

1. Design mix number.
2. Signature or initials of concrete plant representative.
3. Time of batching.
4. Weight of cement, aggregates, water and admixtures in each batch with maximum aggregate size.
5. Total volume of concrete in each batch.
6. Notation indicating equipment was checked for contamination prior to batching.

E. Minutes of preinstallation conference.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative concrete paving systems.

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

C. ACI Publications: Comply with the following:

1. ACI 301, “Specification for Structural Concrete,” unless modified by requirements in Contract Documents.
2. “Finishing Concrete Slabs with Color and Texture.”

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

E. ACI Publications: Comply with ACI 301 unless otherwise indicated.

F. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for typical joints, surface finishes, textures, tolerances, and standard of workmanship.

1. Build mockups of the following:
    a. Full-thickness sections of concrete paving to demonstrate each type of joint, surface finish, texture, and color.
        i) Where pouring concrete adjacent to existing concrete, add carbon black to concrete mixture in amount as required to match tint of existing concrete.
    b. Each type of cast-in-place vertical concrete surface finish and color.
        i) Include patching of form tie holes.
        ii) For each form liner texture, include one horizontal and one vertical form liner joint.
2. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
3. Notify Architect 5 working days in advance of dates and times when mockups will be constructed.
4. Obtain Architect's approval of mockups before starting construction.
    a. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved in writing by Architect.
5. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store aggregate for exposed applications off the ground and protected from contamination and moisture.

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

C. Store form liners in accordance with manufacturer's written instructions, and to prevent deterioration from moisture, heat, cold, direct sunlight, and other detrimental effects.

1.11 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain decorative concrete products and each type of class of cementitious material of the same brand from same manufacturer's plant, and obtain each aggregate from a single source.

2.2 CALGREEN REQUIREMENTS

A. General: Conform with all applicable requirements of the California Green Building Standards Code (CALGreen).

B. Concrete Curing Compounds and Sealers: Provide concrete curing compounds and sealers that comply with VOC limits in Table 1 of the California Air Resources Board (ARB) Architectural Coatings Suggested Control Measure, unless more stringent local limits apply.

2.3 LEED v4 REQUIREMENTS

A. Environmental Product Declaration: Provide site concrete with Environmental Product Declaration (EPD) which conforms to ISO 14025, ISO 14040, ISO 14044, and EN 15804 or ISO 21930, and has at least a cradle to grave scope.
   1. EPD Type: ***[Industry-wide (generic)] [Product-specific Type III]***.

B. Recycled Content: Provide products with recycled content as defined in ISO 14021 as indicated below:
   1. Site Concrete: Sum of postconsumer recycled content plus one-half of preconsumer recycled content as measured by percentage of weight of product is not less than ***[35]*** percent of overall weight of product.
      a. Recycled aggregate must meet the following requirements:
         i) Use of recycled fine aggregates is not allowed.
         ii) Use of recycled coarse aggregates from salt contaminated concrete pavements is not allowed.
         iii) Recycled aggregate must be thoroughly cleaned and washed prior to use.
         iv) Recycled aggregate must contain no deleterious materials.
         v) Recycled aggregate must meet requirements of California Building Code and ASTM C 33.
         vi) Amount of recycled aggregate shall be limited to no more than 50 percent of total dry aggregate mass.
      b. Fly ash shall be supplied by an experienced producer, and comply with ASTM C 618, Class F or N, and ASTM C 311.
   2. Base Course: 100 percent postconsumer recycled content.
      a. Recycled aggregate must meet the following requirements:
         i) Use of recycled fine aggregates is not allowed.

ii) Use of recycled coarse aggregates from salt contaminated concrete pavements is not allowed.

iii) Recycled aggregate must be thoroughly cleaned and washed prior to use.

iv) Recycled aggregate must contain no deleterious materials.

v) Recycled aggregate must meet requirements of California Building Code and ASTM C 33.

vi) Amount of recycled aggregate shall be limited to no more than 50 percent of total dry aggregate mass.

3. Steel Reinforcement:

a. Postconsumer: 89 percent.

b. Preconsumer: 8 percent.

C. Locally Sourced Materials and Products: Provide site concrete aggregate and base course materials that have been extracted, manufactured, and purchased within 100 miles of Project site.

2.4 PERFORMANCE REQUIREMENTS

A. Design and fabricate concrete formwork in accordance with ACI 347..

1. Formwork shall be capable of withstanding all loads imposed during construction, including weight of equipment, uncured concrete, and other pressures and loads occurring prior to curing of concrete.

2.5 BASE COURSE

A. Base Course Aggregate: Sound, angular crushed stone, crushed gravel, or crushed slag, stone, or slag screenings. Comply with Caltrans Standard Specification, Section 26 for Class 2 base, 3/4 inch maximum aggregate size and minimum R value of 78.

1. Recycled Content of Base Course Aggregate: As specified in “LEED v4 Requirements” Article.

2.6 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, true, smooth exposed concrete surfaces. Furnish in largest practical sizes to minimize number of joints.

1. Use flexible or curved forms for curves with a radius of 100 feet or less. Do not use notched or bent forms.

B. Form Joint Tape: Compressible, foam tape; pressure sensitive; AAMA 800, “Specification 810.1, Expanded Cellular Glazing Tape”; minimum 1/4 inch thick.

C. Form Joint Sealant: Elastomeric sealant complying with ASTM C 920, Type M or Type S, Grade NS, that adheres to form joint substrates.

D. Chamfer Strips: Metal, rigid plastic, rubber strips, or dressed wood, 3/4 inch by 3/4 inch, unless indicated otherwise; in longest practicable lengths.

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

1. Furnish units that leave no metal closer than 1-1/2 inches to the plane of exposed concrete surface.
2. Furnish ties with tapered tie cone spreaders that, when removed, will leave holes 1 inch in diameter in concrete surface.
3. Wire ties are not acceptable.

F. Form Liner: Units of face design, texture, arrangement, and configuration indicated, and suitable for reuse. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent surface treatments of concrete. Provide solid backing and form supports to ensure stability of form liners.

1. Product: ***[Scott System; #132, 3/4 inch Fluted Fin]***.
2. Profile: ***[Simulated brick] [Simulated stone] [Fluted] [Fractured rib] [Sandblast] [Stucco]***.
3. Depth: ***[1 inch]***.

G. 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.

2.7 STEEL REINFORCEMENT

A. Plain-Steel Welded-Wire Reinforcement: ASTM A 185, fabricated from galvanized-steel wire into flat sheets.

B. Reinforcing Bars: ASTM A 615, Grade 60; deformed.

C. Joint Dowel Bars: ASTM A 615, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.

1. Dowel Sleeve: Rigid polypropylene sleeve, 5/8-inch diameter by 9 inches long, with reusable base, designed for attachment to face of concrete form.
    a. Products: Subject to compliance with requirements, provide one of the following:
        i) Speed Dowel.
        ii) Equal product in accordance with Division 1 requirements for product substitutions.

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

1. Equip bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. Where legs of wire bar supports contact forms, use gray, all-plastic bar supports.

E. Recycled Content of Steel Reinforcement: As specified in “LEED v4 Requirements” Article.

2.8 CONCRETE MATERIALS

A. Cementitious Materials: Use the following cementitious materials, of the same type, brand, and source throughout Project:
1. Portland Cement: ASTM C 150 gray portland cement, Type II/V.
2. Recycled Content: As specified in “LEED v4 Requirements” Article.

B. Normal-Weight Aggregates: ASTM C 33, Class 4M coarse aggregate, uniformly graded. Provide aggregates from a single source.
1. Maximum Coarse-Aggregate Size: 1-1/2 inches, except as noted below.
a. Maximum Coarse-Aggregate Size for Base Slabs to Receive Seeded Exposed Aggregate Pavement Finishes: 3/4 inch.
b. Maximum Coarse-Aggregate Size for Slabs to Receive Stamped Concrete Finish: **3/4 inch**.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
3. Recycled Content: As specified in “LEED v4 Requirements” Article.

C. Exposed Aggregate, Seeded: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, as follows:
1. Aggregate Source: ***[Lyngso Garden Materials, Inc.]***
2. Aggregate Name: ***[Red River Pebbles.]***
a. Colors: ***[Mixture of browns, reddish browns, tans, greys, and blacks.]***
b. Size (average): ***[3/8 inch.]***
c. Shape: ***[Rounded pebbles.]***

D. Water: Potable and complying with ASTM C 94.

E. Air-Entraining Admixture: ASTM C 260.

F. Chemical Admixtures: Where used, provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

G. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
1. Products: Subject to compliance with requirements, provide one of the following products or product by one of the following manufacturers:
a. Bomanite Corporation; Integral Color.
b. Davis Colors.
c. Scofield, L.M. Company; CHROMIX Admixtures.
d. Solomon Colors.
e. Equal product in accordance with Division 1 requirements for product substitutions.
2. Color***[s]***: As selected by Architect from manufacturer's full range.For bidding purposes, assume ***[two]*** different colors in equal quantities for each color.

[or]

3. Color***[s]***:
a. CP-1: ***[Scofield CHROMIX Admixture #5130 "Spring Beige."]***
b. CP-2: ***[Scofield CHROMIX Admixture #C-21 "Adobe Tan."]***
4. Color***[s]***: As specified in Section 09 06 00 "Colors and Finishes."

H. Carbon Black: Tinting agent for darkening concrete mix as required to match tint of existing concrete.

2.9 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in concrete paving, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Euclid Chemical Company; PSI Fiberstrand 100.
b. FORTA Corporation; Mighty-Mono.
c. SI Concrete Systems; Fibermesh 150.
d. GCP Applied Technologies, Inc; Grace Microfiber.
e. Equal product in accordance with Division 1 requirements for product substitutions.

2.10 CAST-IN ACCESSORIES FOR SITE CONCRETE

A. Safety Tread Nosings for Concrete Steps: Extruded aluminum units, with abrasive filler strips consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions and length as required to terminate 2 inches from ends of steps.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. American Safety Tread Company, Inc.; Type 9511.
    b. Balco Inc.; R-315P.
    c. Wooster Products, Inc.; Type 231BF.
2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
3. Dimension and Configuration: 3 inches wide, without lip.
4. Provide units meeting requirements of California Building Code (Title 24) and Americans with Disabilities Act for the visually impaired.
5. Color of Ribbed Filler Strips: ***[Black]***.
6. Provide integral anchors at underside of safety tread nosings, for embedding units in concrete.
7. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

B. Skateboard Deterrent: Manufacturer's cast-in projection for deterring skateboard activity on concrete surfaces.
1. Product: Subject to compliance with requirements, provide the following:
    a. Skatestoppers; ***[Celebreeze]***.
2. Material: White Tombasil (copper/nicket/zinc alloy).
    a. Finish: Brushed satin finish.
3. Profile: Tapered fin with projecting nosing; inside profile to conform to profile of concrete edge.
    a. Provide embedment flange with mechanical keyways for casting into concrete.
    b. Inside Radius at Concrete Edge: 1/2 inch.
4. Dimensions: 10 inches long by 1/2 inch wide.

2.11 SURFACE COLORING MATERIALS

A. Pigmented Mineral Dry-Shake Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
1. Products: Subject to compliance with requirements, provide one of the following:
    a. Bomanite Corporation; Color Hardener.
    b. Scofield, L.M. Company; LITHOCHROME Color Hardener.
    c. Equal product in accordance with Division 1 requirements for product substitutions.
2. Color***[s]***: For bidding purposes, assume ***[two]*** different colors in equal quantities for each color.

[or]

3. Color***[s]***:
    a. DS-1: ***[Scofield #A-59 "Beige Cream."]***
    b. DS-2: ***[Scofield #A-50 "Slate Gray."]***
4. Color***[s]***: As specified in Section 09 06 00 "Colors and Finishes."

B. Pigmented Powder Release Agent: Factory-packaged, dry combination of surface-conditioning and dispersing agents interground with color pigments that facilitates release of stamp mats. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
1. Products: Subject to compliance with requirements, provide one of the following:
    a. Bomanite Corporation; Release Agent.
    b. Scofield, L.M. Company; LITHOCHROME Antiquing Release.
    c. Equal product in accordance with Division 1 requirements for product substitutions.

2. Color***[s]***: As selected by Architect from manufacturer's full range.
    a. For bidding purposes, assume ***[two]*** different colors in equal quantities for each color.

[or]

3. Color***[s]***:
    a. PRA-1: ***[Scofield #A-53, "Arizona Tan."]***
    b. PRA-2: ***[Scofield #A-29 "Terra Cotta."]***

[or]

4. Color***[s]***: As specified in Section 09 06 00 "Colors and Finishes."

C. Liquid Release Agent: Manufacturer's standard clear, evaporating formulation that facilitates release of stamp mats and texture rollers.
1. Products: Subject to compliance with requirements, provide one of the following:
    a. Bomanite Corporation; Liquid Release.
    b. Scofield, L.M. Company; LITHOTEX Liquid Release.
    c. Equal product in accordance with Division 1 requirements for product substitutions.

2.12 STAMPING DEVICES

A. Stamp Mats: Semirigid polyurethane mats with projecting textured and ridged underside capable of imprinting texture and joint patterns on plastic concrete.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Bomanite Corporation.
        i) Pattern: ***[Canyon Stone]***.

b. Scofield, L.M. Company.

i) Pattern: ***[Canyon Stone]***.

c. Manufacturer of equal products in accordance with Division 1 requirements for product substitutions.

2.13 STAIN MATERIALS

A. Concrete Stain: Penetrating/reactive stain with wetting agents and high-grade, UV-stable metallic salts that react with calcium hydroxide in cured concrete to produce permanent, variegated, or translucent color effects.

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

a. Bomanite Corporation; Con-Color.

b. Scofield, L.M. Company; LITHOCHROME Tintura Stain.

c. Equal product in accordance with Division 1 requirements for product substitutions.

2. Color***[s]***: As selected by Architect from manufacturer's full range.

a. For bidding purposes, assume ***[two]*** different colors in equal quantities for each color.

[or]

3. Color***[s]***:

a. CS-1: ***[Scofield LITHOCHROME Tintura #6007, "Wheat Grain."]***

b. CS-2: ***[Scofield LITHOCHROME Tintura #2047 "Autumn Honey."]***

[or]

4. Color***[s]***: As specified in Section 09 06 00 "Colors and Finishes."

2.14 CURING AND SEALING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz/sq yd, dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

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

a. BASF Construction Chemicals, LLC; MasterKure ER50.

b. Euclid Chemical Company; Eucobar.

c. Meadows, W.R., Inc.; Sealtight Evapre.

d. Sika Corporation, Inc.; SikaFilm.

e. Equal product in accordance with Division 1 requirements for product substitutions.

2. VOC Content: Complies with requirements specified in “CALGreen Requirements” Article.

E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

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

a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.

b. Dayton Superior Corporation; Clear Resin Cure J11W.

c. Euclid Chemical Company; Kurez DR VOX.

d. Meadows, W.R., Inc.; 1100 Clear.

e. Equal product in accordance with Division 1 requirements for product substitutions.

2. VOC Content: Complies with requirements specified in “CALGreen Requirements” Article.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: Nondissipating; ASTM C 309, Type 1, Class B; ASTM C 1315, Type 1, Class A (nonyellowing).

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

a. ChemMasters; Polyseal WB.

b. Euclid Chemical Company; Super Diamond Clear VOX.

c. Meadows, W.R., Inc.; Vocomp-25.

d. Equal product in accordance with Division 1 requirements for product substitutions.

2. VOC Content: Complies with requirements specified in “CALGreen Requirements” Article.

G. Sealer for Decorative Concrete: Clear sealer as recommended in writing by manufacturer of decorative concrete system.

1. VOC Content: Complies with requirements specified in “CALGreen Requirements” Article.

2.15 ACCESSORY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as “restricted use” for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

B. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, in preformed strips.

C. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

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

E. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements; Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. BASF Construction Chemicals, LLC; MaserEmaco ADH 1420.
    b. Dayton Superior Corporation; Sure Bond J58.
    c. Meadows, W.R., Inc.; Rezi-Weld 1000.
    d. Equal product in accordance with Division 1 requirements for product substitutions.

F. Chemical Surface Retarder: Water-soluble, liquid-set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

1. Products: Subject to compliance with requirements, provide one of the following
    a. Dayton Superior Corporation; Top-Cast.
    b. Euclid Chemical Company; Concrete Surface Retarder Formula S.
    c. Meadows, W.R., Inc.; TOP-STOP Concrete Surface Retarder.
    d. Sika Corporation; Rugasol-S.
    e. Equal product in accordance with Division 1 requirements for product substitutions.

G. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

H. Sealant: Joint sealant designed for use in horizontal pedestrian traffic bearing joints in exterior concrete construction.

1. Comply with ASTM C 920 as follows:
    a. Grade: NS or P (suitable for sloping surfaces up to 10 percent).
    b. Use Related to Exposure: T (traffic).
    c. Uses Related to Joint Substrates: M
2. Products: Subject to compliance with requirements, provide one of the following:
    a. Pecora Corporation; DynaTred.
    b. BASF Construction Chemicals, LLC; MasterSeal SL 2.

c. Tremco, Inc.; THC-901.

d. Equal product in accordance with Division 1 requirements for product substitutions.

3. Color***[s]***: Match color of adjacent paving, unless indicated otherwise.

[or]

4. Color***[s]***: As selected by Architect from manufacturer's full range. ***[or insert manufacturer's color #('s) or designation(s) to suit project]***

[or]

5. Color***[s]***:

a. TS-1: ***[Tremco THC-901, "Gray Stone."]***

b. TS-2: ***[Tremco THC-901, "Sandalwood Beige 112."]***

2.16 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete as determined by either laboratory trial mixes or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.

2. For decorative concrete treatments, obtain each color, type, and variety of concrete mixture from a single manufacturer with resources to provide concrete of consistent quality in appearance and physical properties.

3. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 days): 3000 psi.

2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.55.

3. Slump Limit: 4 inches, plus or minus 1 inch.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 3 percent plus or minus 1 percent.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

E. Chemical Admixtures: use admixtures according to manufacturer's written instructions.

1. Use admixtures 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.

F. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu yd.

G. Carbon Black: Where pouring concrete adjacent to existing concrete, add carbon black to concrete mixture in amount as required to match tint of existing concrete.

1. Obtain Architect's approval of mockup panel with tint to match existing concrete, as specified in Quality Assurance Article.

H. Color Pigment: Where indicated, add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.17 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94 ***[and ASTM C 1116]***. Furnish batch certificates for each batch discharged and used in the Work.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrade surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

1. Refer to Section 31 20 00 "Earthwork" for preparation of subgrade.

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

3.2 PREPARATION

A. General: Immediately before placing base course and concrete materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive base course and paving, and is free of mud, frost, snow, or ice.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry prepared subgrade or surface of base course.

C. Protect adjacent construction from discolorations and spillage during application of color hardeners, release agents, stains, curing compounds, and sealers.

3.3 PLACEMENT OF BASE COURSE

A. Place and compact aggregate base course to thicknesses required for each section. Comply with requirements of Caltrans Standard Specification Section 26.

1. Placement Layers:

a. Place base course 6 inches or less in compacted thickness in a single layer.

b. Place base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

2. Shape base course to required elevations and grades.

3. Compact aggregate base course at optimum moisture content to 95 percent relative compaction according to ASTM D 1557.

4. Proof-roll prepared base course surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected are ready to receive paving.

B. Remove loose material from compacted base course surface immediately before placing concrete.

3.4 EDGE FORMS AND SCREED CONSTRUCTION – ON GRADE CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to achieve required elevations and slopes in finished concrete surfaces. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork and screeds for grade and alignment to following tolerances:

1. Top of Forms: Not more than 1/8 inch in 10 feet.

2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in 10 feet.

C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.5 FORMWORK CONSTRUCTION – EXPOSED VERTICAL CONCRETE SURFACES

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, unit structure can support such loads.

B. Construct formwork so concrete elements are of size, shape, alignment, elevation, and position indicated, straight, and true to line and level, within tolerance limits of ACI 117.

C. Construct forms to result in cast-in-place concrete that complies with ACI 117.

D. Form Ties: Ties shall not leave fractures, spalls, depressions, or other surface disfigurations.

1. Ties shall not leave metal closer than 1-1/2 inches to exposed surface.

E. In addition to ACI 303.1 limits on form panel deflection, limit cast-in-place architectural concrete irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch.

F. Construct forms tight to prevent loss of concrete mortar.

G. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Seal form joints and penetrations at form ties with form joint tape or form joint sealant to prevent cement paste leakage.
2. Do not use rust-stained steel form-facing material.
3. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms, only.

H. Chamfer exposed outside corners and edges where indicated on Drawings, to produce smooth form lines and tight edge joints.

I. Limit deflection of form-facing panels so as not to exceed ACI 303.1 requirements.

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

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

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

M. Coat contact surfaces of forms with surface retarder, according to manufacturer's written instructions, before placing reinforcement.

N. Place form liners accurately to provide finished surface texture indicated, and as required to achieve the appearance of an uninterrupted pattern across the entire area of concrete receiving form liner finish. Provide solid backing and attach securely to prevent deflection and maintain stability of liners during concreting. Prevent form liners from sagging and stretching in hot weather. Seal joints of form liners and form liner accessories to prevent mortar leaks.

1. Clean form liner panel prior to each use. Do not use damaged form liners.
2. Coat form liner with form-release agent immediately prior to concrete placement, to avoid accumulation of foreign material on surface of form liner.
    a. Protect reinforcing steel from form-release agent.

O. Remove forms without damage to concrete. Comply with ACI 347.

3.6 STEEL REINFORCEMENT INSTALLATION

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

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

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

D. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

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

E. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.7 JOINTS

A. General: Form construction, expansion, control, and isolation joints, and tool edges true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than 1/2 hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of paving strips, unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Expansion Joints at Paving: Form expansion joints, sectioning concrete paving into areas as indicated. If not indicated, provide expansion joints at a maximum spacing of 20 feet.

1. Install doweled joint assemblies where indicated, parallel to slab, and perpendicular to joint, using one of the following:
    a. Install dowel sleeve and dowel at slab mid-depth in accordance with manufacturer’s written instructions.
    b. Install dowel bars and support assemblies. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
2. Extend fiber expansion joint filler strip full width and depth of joint, with top edge of filler strip 1/2 inch below finished concrete surface.

3. Furnish joint filler in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.
4. Do not extend reinforcing across expansion joints.
5. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Control Joints at Paving: Form weakened-plane control joints, sectioning concrete paving into areas as indicated. If not indicated, provide control joints at a maximum spacing of 6 feet. Construct control joints to a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4 inch radius. Repeat grooving of control joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
a. Where sawed joint terminates at adjoining vertical surface, fully extend sawed joint to edge of paving and vertical surface.

E. Control Joints at Cast-In-Place Vertical Surfaces: Form weakened-plane control joints true to line with faces perpendicular to surface plane of cast-in-place concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

F. Isolation Joints: Form isolation joints of preformed fiber joint filler strips abutting curbs, catch basins, manholes, inlets, structures, walks, or other fixed objects, and where indicated.
1. Extend fiber expansion joint filler strip full width and depth of joint, with top edge of filler strip 1/2 inch below finished concrete surface.
2. Furnish joint filler in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.
3. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

3.8 CONCRETE PLACEMENT

A. Inspection: Before placing site concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

C. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

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

E. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

F. Concrete Paving:

1. Remove snow, ice, or frost from base course surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
2. Moisten base course to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
3. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
4. Screed paving surfaces with a straightedge and strike off.
    a. Where concrete is being poured adjacent to existing concrete, strike off flush with existing concrete.
5. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
    a. At concrete to receive seeded exposed aggregate finish, finishing of surface elevation to allow for volume growth due to addition of the seeding aggregate, to achieve final elevations.
6. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

G. Cast-In-Place Vertical Surfaces: Deposit concrete continuously in one layer or in horizontal layers of such thickness not to exceed formwork design pressure, and such that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

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

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture

temperature of not less than 50 deg F and not more than 80 deg F at point of placement.

2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators.

I. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and base course just before placing concrete. Keep base course moisture uniform without standing water, soft spots, or dry areas.

J. Tactile Warning Surfaces: Form blockouts in concrete for installation of tactile warning surface panels specified in Section 32 17 26 "Tactile Warning Surfaces." Screed surface of concrete where panels are to be installed to elevation, so that edges of installed panels will be flush with surrounding concrete paving. Refer to Section 32 17 26 "Tactile Warning Surfaces" for installation of tactile warning surface panels.

K. Skateboard Deterrents: Install skateboard deterrents in accordance with manufacturer's written instructions, at locations indicated and spacings indicated.

3.9 CONCRETE CURBS AND GUTTERS

A. Construct concrete curbs, gutters, and sidewalks in conformance with requirements of Caltrans Standard Specifications Section 73.

B. Steel trowel surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Provide expansion joints at 20 feet on center maximum.

1. Fill expansion joint with joint filler material, shaped to match cross-section of curb, with outer edge of filler material 1/2 inch below finished concrete surface.
2. Where joints occur in adjacent paving, joints in curb to align with joints in paving.

3.10 CONCRETE CURB RAMPS

A. Construct concrete curb ramps in conformance with requirements of United States Justice Department's 2010 ADA Standards for Accessible Design, and California Building Code (Title 24, Part 2).

B. Form safety grooves as indicated in “Concrete Paving Finish” Article.

3.11 CONCRETE STEPS

A. Form safety grooves as indicated in “Concrete Paving Finish” Article.

[or]

B. Install cast-in safety tread nosings at front edge of steps in accordance with manufacturer’s written instructions. Safety tread nosings shall terminate 2 inches from ends of steps, and finish flush with top of adjacent concrete tread surface.

3.12 PIGMENTED MINERAL DRY-SHAKE HARDENER

A. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surface according to manufacturer’s written instructions and as follows:

1. Uniformly spread dry-shake hardener at a rate recommended in writing by manufacturer, and as required to match appearance of approved mockup panel.
2. Uniformly distribute approximately two-thirds of dry-shake hardener over concrete surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.

B. After final power floating, apply finish as specified in “Concrete Paving Finish” Article.

C. At concrete paving to receive stamped finish, apply finish pattern as specified in “Concrete Stamping” Article.

3.13 DECORATIVE CONCRETE STAMPING

A. Mat Stamping: After floating and while concrete is plastic, apply mat-stamped finish in accordance with manufacturer’s written instructions.

1. Pigmented Powder Release Agent: Uniformly distribute onto still-plastic concrete at rate recommended in writing by manufacturer.

[or]

2. Liquid Release Agent: Apply liquid release agent to the concrete surface and stamp mat. Uniformly mist surface of concrete at rate recommended in writing by manufacturer.
3. After application of release agent, accurately align and place stamp mats in sequence, as required to achieve the appearance of an uninterrupted pattern across the entire area of stamped concrete.
4. Uniformly load mats and press into concrete to produce required imprint pattern and depth of imprint on concrete surface. Gently remove stamp mats. hand stamp edges and surfaces unable to be imprinted by stamp mats.

5. Remove residual release agent according to manufacturer's written instructions, but not fewer than three days after stamping concrete. High-pressure wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.

3.14 CONCRETE PAVING FINISH

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
   1. Surfaces With a Slope of 6 Percent or Less: Medium textured broom finish.
      a. Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
         i) Static Coefficient of Friction for Wet Surfaces, as tested per ASTM C 1028: 0.60 minimum.
   2. Surfaces With a Slope of Greater Than 6 Percent: Coarse textured broom finish.
      a. Draw a stiff bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, striated texture, 1/16-inch deep.
         i) Static Coefficient of Friction for Wet Surfaces, as tested per ASTM C 1028: 0.80 minimum.
   3. Areas Being Patched Into Existing Concrete: Match finish texture of existing concrete.

C. Final Tooling: Tool edges of paving, gutters, curbs, planters, joints, and other exposed edges formed in fresh concrete with an edging tool to a 1/4-inch radius.. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.

D. Safety Grooves:
   1. Form safety grooves at concrete steps and curb ramps as indicated, using a jointer while concrete is still fresh.
   2. Cut uniform grooves to dimensions and spacing as indicated.
   3. Strike grooves before and after brooming.

E. Apply sealant over joint fillers. Do not apply sealant before concrete staining, sandblasting, and sealing operations are complete.
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, grease, water, surface dirt, and frost. Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.
      a. Remove laitance and form release agents from concrete.

2. Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
    a. Place sealants so they directly contact and fully wet joint substrates.
    b. Completely fill recesses in each joint configuration.
    c. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
3. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
    a. Remove excess sealant from surfaces adjacent to joints.
    b. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
    c. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.15 CAST-IN-PLACE CONCRETE VERTICAL SURFACE FINSHES

A. Exposed Concrete Finish, General: 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 with portland cement to match finish of exposed concrete.

B. 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.
    1. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.
    2. Final Tooling: Tool edges of curbs, planters, joints, and other exposed edges formed in fresh concrete with an edging tool to a 1/4-inch radius.. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.

C. Vertical Surfaces: Except where sandblasting is indicated, at exposed vertical surfaces, provide smooth rubbed finish not later than one day after form removal.
    1. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

    [or]

    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 surrounding concrete. 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.

D. Form-Liner Finish: Produce a textured surface free of pockets, streaks, and honeycombs, and of uniform appearance, color, and texture.

3.16 SPECIAL CONCRETE PAVING FINISHES

A. Seeded Exposed-Aggregate Finish:

1. Preparation: Prior to concrete placing, thoroughly wash seeding aggregate so that it is free of all dust, dirt, and clay particles. Aggregate shall be in a damp condition but without free surface water at time of seeding.
2. Chemical Surface Retarder: Apply chemical surface retarder to concrete surfaces. Apply according to manufacturer's written instructions after placing, screeding and floating.
3. Seeding: Immediately after initial floating, spread a single layer of aggregate uniformly on paving surface. Tamp aggregate evenly into plastic concrete, and float finish to entirely embed aggregate with mortar cover of 1/16 inch.
    a. Spray-apply chemical surface retarder to pavement according to manufacturer's written instructions.
    b. Cover pavement surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
    c. When concrete is sufficiently hard to allow removal of excess mortar without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon-bristle broom. Do not use wire-bristle brooms. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
    d. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required, and flush water runs clear.
4. Curing and Sealing Compound: Apply nonyellowing curing and sealing compound uniformly to floors and slabs indicated 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. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

B. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate on paving surface according to manufacturer's written instructions and as follows:

1. Uniformly spread at a rate of 25 lb/100 sq ft, dampened slip-resistive aggregate over pavement surface in two applications. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.
2. Uniformly distribute approximately two-thirds of slip-resistive aggregate over paving surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage, and embed by power floating.
3. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.

4. After curing, lightly work surface with a steel-wire brush or abrasive stone and water to expose nonslip aggregate.

C. Rock-Salt Finish: After initial floating, uniformly spread rock salt over paving surface at a rate of 5 lb/100 sq ft.

1. Embed rock salt into plastic concrete with roller or magnesium float.
2. Cover paving surface with 1 mil thick polyethylene sheet and remove sheet when concrete has hardened and seven-day curing period has elapsed.
3. After seven-day curing period, saturate concrete with water and broom-sweep surface to dissolve remaining rock salt, thereby leaving pits and holes.

3.17 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection and ACI 105.1 for hot-weather protection during curing.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq ft per hour 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.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods for Non-Decorative Concrete: Cure concrete according to ACI 308.1, by moisture curing, moisture-retaining cover curing, curing compound, or a combination of these as follows***[, except, use curing compound method on concrete with color pigment or dry-shake hardener, in accordance with written recommendations of color pigment and dry-shake hardener manufacturer]***.

1. Moist Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and end lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected

to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

F. Curing Method for Decorative Concrete: Apply curing/sealing compound in accordance with written instructions of manufacturer of decorative concrete system.

3.18 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot long, unleveled straightedge not to exceed 1/4 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie-bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Control Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.19 FINISH TREATMENTS OF CURED CONCRETE

A. Sandblast Finish: Apply sandblast finish at locations indicated and to match appearance of approved mockup panel. Sandblasting to be applied uniformly across entire area indicated to receive each type of sandblast finish. For each type of texture, match appearance of approved mockup panel.

1. Mask off adjacent areas not to receive sandblast finish, as required to protect from overspray of sandblasting.
2. Allow concrete to cure a minimum of 14 days prior to sandblasting.
3. Use abrasive grit of the proper type and gradation to expose aggregate and surrounding matrix surfaces to match appearance of mockup panel as follows:
    a. Light Cut: Approximately 1/16 inch depth.
    b. Medium Cut: Approximately 1/8 to 3/16 inch depth.
4. Blast corners and edges of patterns carefully, using backup boards in order to maintain a uniform corner or edge line.
5. Use same nozzle, nozzle pressure, and blasting technique as used for mockup panel.
6. Maintain control of abrasive grit and concrete dust in area of sandblasting. Clean up and remove all abrasive grit, concrete dust, and debris at end of each day of sandblasting operations.

7. Sealing Compound: Apply nonyellowing sealing compound uniformly to slabs in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

B. Staining: Apply concrete stains in conformance with manufacturer's written instructions, and to match appearance of approved mockup panel.
   1. Allow concrete to cure a minimum of 14 days prior to staining.
   2. Prepare surfaces according to manufacturer's written instructions and as follows:
      a. Clean concrete thoroughly by scraping, applying solvents or stripping agents, sweeping and pressure washing, or scrubbing with a rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry.
         i) Do not use acidic solutions to clean surfaces.
      b. Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by method recommended by stain manufacturer. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.
   3. Allow paving surface to dry before applying stain. Verify readiness of paving to receive stain according to ASTM D 4263 by tightly taping 18-by-18-inch, 4-mil-thick polyethylene sheet to a representative area of paving surface. Apply stain only if no evidence of moisture has accumulated under sheet after 16 hours.
   4. Apply concrete stain in conformance with manufacturer's written instructions, and to match appearance of approved mockup panel. Repeat application of stain as needed obtain color consistent with approved mockup.
   5. Rinse until water is clear. Control, collect, and legally dispose of runoff.
   6. Sealing Compound: Apply nonyellowing clear sealing compound over stained concrete surfaces in accordance with stain manufacturer's written instructions.

3.20 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
   1. Notify Owner's testing agency at least 2 working days prior to date when observation and testing services are needed.

B. Inspections:
   1. Steel reinforcement placement.
   2. Steel reinforcement welding.
   3. Verification of use or required design mixture.
   4. Concrete placement, including conveying and depositing.
   5. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 will be performed according to the following requirements:

1. Testing Frequency: Provide at least one composite sample for each 50 cu yds or fraction thereof of each concrete mixture placed each day.
    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31; cast and laboratory-cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39; one specimen to be tested at 7 days and two specimens at 28 days.
    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

D. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

E. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

H. Remove and replace site concrete that test reports and inspections indicate do not comply with specified requirements.

I. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

J. Concrete Batch Plant Tickets.: Submit to Project Inspector, load identification tickets for each load of concrete delivered to site. Refer to Part 1 “Submittals” Article for required information for batch tickets.

3.21 REPAIRS AND PROTECTION

A. Remove and replace site concrete that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive. Filled areas to match surrounding concrete in surface treatment and color.

C. Remove base rock and concrete spillage from all planting areas.

D. Clean exposed site concrete surfaces carefully. Brushing and cleaning, if used, to be preceded and followed with a thorough rinsing of clear water. Sandblasting not allowed for cleaning purposes.

E. Detailing of Stamped Concrete: Grind concrete “squeeze” left from tool placement. Color ground areas with slurry of color hardener mixed with water and bonding agent. Remove excess release agent with high-velocity blower.

F. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

G. Maintain site concrete free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 17 23

PAVEMENT MARKINGS

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:
   1. Removal of existing painted striping and markings from asphalt paving.
   2. Parking lot pavement striping.
   3. Accessible parking loading zone striping and parking symbol.

B. Related Sections include:
   1. Section 09 91 00 ”Painting” for general exterior and interior painting.
   2. Section 10 14 00 ”Signage” for pole-mounted parking and traffic control signs.
   3. Section 32 12 16 ”Hot-Mix Asphalt Paving” for asphalt concrete paving.

1.3 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI A117.1: Standard on Accessible and Usable Buildings and Facilities.

B. California Building Code (CBC) – California Code of Regulations, Title 24, Part 2.

C. State of California Department of Transportation (Caltrans): Specification No. PTWB-01, Paint, Waterborne Traffic Line, White, Yellow and Black.

D. Code of Federal Regulations (CFR):
   1. 40 CFR, Part 59, Subpart D: National Volatile Organic Compound Emission Standards.

E. Federal Standard 595B: Colors.

F. United States Department of Justice:
   1. 2010 ADA Standards for Accessible Design.

1.4 DEFINITIONS

A. VOC: Volatile Organic Compound.

1.5 SUBMITTALS

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

B. Samples for Verification: For colors indicated.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Label each Sample for location and application area.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying pavement striping and markings 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.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups as follows:
      a. Typical removal of existing striping and markings.
      b. Typical parking stall striping.
   2. Obtain Architect's approval of mockups prior to starting pavement striping and marking.
   3. Approved mockups may become part of completed Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
   1. Product name or title of material.
   2. Product description.
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area within temperature range required by manufacturer. Maintain storage containers in a clean condition, free of foreign materials and residue. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

A. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 50 deg F, and not exceeding 95 deg F, or within other temperature ranges as recommended in writing by paint manufacturer.

B. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent, or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Pavement markings for parking stalls designated as accessible, to be in compliance with applicable provisions of the following:
   1. California Building Code (Title 24, Part 2), Chapter 11B.
   2. United States Department of Justice's 2010 ADA Standards for Accessible Design.

2.2 PAVEMENT MARKING PAINT

A. Latex, water-borne product, lead and chromate free, ready mixed, complying with Caltrans State Specification No. PTWB-01.
   1. VOC Content: No more than that allowed by local and federal regulations when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Colors:
      a. Parking stall striping and accessible parking symbols: White, unless indicated otherwise.
      b. Striping for accessible parking stall access aisle: Blue (No. 15090 per Federal Standard 595B) at perimeter border and diagonal hatching.
      c. Accessible parking symbol background: Blue (No. 15090 per Federal Standard 595B).
      d. Playground striping: White.
      e. Curbs at general drop-off areas: White.
      f. Curbs at accessible drop-off areas and accessible parking stalls: Blue (No. 15090 per Federal Standard 595B).
      g. Curbs at No Parking zones: Red.
   3. Products: Subject to compliance with requirements, provide one of the following:
      a. Dunn-Edwards Corporation; VIN-L-STRIPE Traffic Marking Paint W801.
      b. Frazee Paint; 506 Traffic Paint.
      c. Kelly-Moore Paints; 1450 Mark Right, Latex Marking Paint.
      d. Equal product in accordance with Division 1 requirements for product substitutions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.

1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

3.2 REMOVAL OF EXISTING STRIPING AND MARKINGS

A. Remove existing painted pavement striping and markings as indicated, using abrasive blasting or milling methods and equipment specially designed for this purpose. Minimize amount of existing paving material removed as a result of abrasive methods used in removing existing striping and markings. Recover and collect residual blasting materials, paint, and debris, and legally dispose of in a manner acceptable to authorities having jurisdiction.

3.3 PREPARATION

A. Allow paving to cure for a minimum time period of 45 days prior to start of pavement striping and marking, or for minimum time period as recommended in writing by traffic paint manufacturer, whichever is more.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the coatings. Remove dirt, oil, grease, and other foreign matter.

C. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface material film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

3.4 APPLICATION

A. General: Apply pavement marking paint according to manufacturer's written instructions.

1. Apply pavement marking paint with atomizing spray type striping machine equipped with separate thermostatically controlled heating devices for each paint pot and capable of applying paint such that lines and markings have uniform, straight edges, true and smooth alignments and uniform thickness.

2. Apply paint at manufacturer's recommended rates and wet film thickness.
3. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so it cannot run beneath stencil.
4. Refer to Part 2 "Pavement Marking Paint" Article for paint colors.
5. Completed lines, markings, and curbs shall be clean, sharp, and to dimensions indicated.
    a. Ragged ends of segments, fogginess along the sides or objectionable dribbling of paint along the unpainted portions or the stripes will not be permitted.
    b. The finished paint shall have an opaque, well-painted appearance with no black or other discolorations showing through.

B. Pavement Markings:
1. Stripe and mark parking stalls and access aisles as shown on Drawings.
    a. Width of Parking Stall Striping: 4 inches.
    b. Width of Striping at Accessible Parking Stall Access Aisle: 4 inches.
        i) Paint words NO PARKING in 12-inch high letters (color: white) at foot of access aisle.
    c. Paint International Symbol of Accessibility at accessible parking stalls. Center symbol in stall, facing outwards, with lower edge of symbol aligned with end of parking stall, as indicated on Drawings. Symbol to painted white on blue background, in accordance with ANSI A117.1.
2. Stripe playground game areas as shown on Drawings.

C. Curbs: Paint curbs to designate parking or drop-off functions as indicated on Drawings, and as specified in Part 2 "Pavement Marking Paint" Article of this Section.

3.5 CLEANING

A. At completion of pavement striping and marking, and curb painting, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
1. After completing painting, clean adjacent paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging surfaces.

3.6 PROTECTION

A. Exercise reasonable precautions to protect the paint, as applied, during drying time. Remove objectionable tracking and marks.

END OF SECTION 32 17 23

SECTION 32 17 26

TACTILE WARNING SURFACES

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:

1. Tactile warning surface panels with truncated domes for horizontal pedestrian traffic areas.

a. Surface-applied.

1.3 REFERENCES

A. ASTM International (American Society for Testing and Materials):

1. ASTM B 117: Standard Practice for Operating Salt Spray (Fog) Apparatus.
2. ASTM C 501: Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.
3. ASTM C 1028: Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
4. ASTM D 570: Standard Test Method for Water Absorption of Plastics.
5. ASTM D 638: Standard Test Method for Tensile Properties of Plastics.
6. ASTM D 695: Standard Test Method Compressive Properties of Rigid Plastics.
7. ASTM D 790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
8. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
9. ASTM G 26: Standard Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.
10. ASTM G 155: Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.

B. California Building Code (CBC) - California Code of Regulations, Title 24, Part 2.

C. Federal Standard 595B: Colors.

D. United States Department of Justice:

1. 2010 ADA Standards for Accessible Design.

1.4 COORDINATION

A. Coordinate installation of cast-in-place tactile warning surface panels with placement of site concrete as specified in Section 32 13 13 ”Site Concrete.”

B. Verify concrete slump range is within limits as recommended in writing by manufacturer of tactile warning surface cast-in-place panels.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

B. Shop Drawings: Show layout and placement of tactile warning surface panel joints and fasteners.

C. Samples for Initial Selection: Manufacturer’s full range of colors and patterns for tactile warning surfaces, for selection by Architect.

1. Minimum Number of Colors for Selection: Nine.

D. Samples for Verification: 6 inch by 6 inch sample, for each color and type of tactile warning surface.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tactile warning surfaces to include in maintenance manuals. Include manufacturer’s written cleaning instructions.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing tactile warning surfaces and with a record of successful in-service performance.

B. Installer Qualifications: A qualified installer who employs workers for this Project that are trained and approved by manufacturer.

C. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by testing and inspecting agency acceptable to authorities having jurisdiction.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer’s written instructions for delivery, storage, and handling of tactile warning surface panels.

B. Store panels on flat surfaces.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when substrate temperature and ambient temperature, and existing and forecasted weather conditions permit installation of tactile warning surfaces to be performed according to manufacturer's written instructions and warranty requirements.

B. Close area to traffic for 48 hours after tactile warning surface installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements: Comply with requirements for tactile warning surfaces as per the following:
   1. California Building Code (Title 24, Part 2) Chapter 11B.
   2. United States Department of Justice's 2010 ADA Standards for Accessible Design.

2.2 TACTILE WARNING SURFACES - GENERAL

A. General: Manufacturer's detectable warning system consisting of prefabricated panels with raised truncated dome pattern and non-slip surface field area to provide warning and directional assistance to visually impaired pedestrians.

B. Truncated Dome Profile Dimensions:
   1. Base Diameter: 0.9 inch.
   2. Diameter at Top of Truncated Dome: 0.45 inch.
   3. Dome Height: 0.2 inch.
   4. Dome Pattern: In-line square pattern.
      a. Dome Spacing: 1.67 inches minimum, 2.35 inches maximum, center to center, both ways.

2.3 TACTILE WARNING SURFACES - SURFACE-APPLIED PANELS

A. General: Manufacturer's prefabricated polymer or glass and carbon-reinforced composite panels with raised truncated dome pattern; designed for installation over hardened concrete surface; homogeneous color and pattern throughout thickness of material; waterproof and nonabsorbent; ultraviolet light-stable; approved by Division of the State Architect (DSA).
   1. Manufacturers: Subject to compliance with requirements, provide surface-applied tactile warning panels by one of the following:
      a. ADA Solutions, Inc.
      b. Engineering Plastics, Inc.; Armor-Tile.
      c. Manufacturer of equal product in accordance with Division 1 requirements for product substitutions.

B. Panel Dimensions: 24 inches by 36 inches, 24 inches by 48 inches, 24 inches by 60 inches, 36 inches by 48 inches, and 36 inches by 60 inches, as indicated on Drawings.

C. Panel Thickness: 1/8 inch minimum.

D. Color: Yellow - Federal Standard No. 595C, Color No. 33538.

E. Physical Properties:

1. Slip Resistance: Not less than 0.80 static coefficient of friction for wet surfaces, per ASTM C 1028.
2. Water Absorption: 0.13 percent maximum, per ASTM D 570.
3. Compressive Strength: Not less than 23, 800 psi, per ASTM D 695.
4. Tensile Strength: Not less than 12,100 psi, per ASTM D 638.
5. Flexural Strength: Not less than 24, 600 psi, per ASTM D 790.
6. Wear Resistance: Not less than 500, per ASTM C 501.
7. Flame Spread: 15 or less, per ASTM E 84.
8. Weathering: No change or deterioration at 3,000 hours of exposure, per ASTM G 26 or ASTM G 155.
9. Salt and Spray Performance: No deterioration or other effects after 120 hours of exposure, per ASTM B 117.

F. Accessories: As provided by manufacturer of tactile warning surface panels.

1. Adhesive: As recommended by tactile warning surface manufacturer.
   a. VOC Content: Provide adhesive that complies with local regulatory limits for VOC content when calculated according to 40 CFR, Part 59, Subpart D (EPA Method 24).
2. Fasteners: Manufacturer’s standard non-corrosive low-profile-head expansion anchors.
3. Joint and Edge Sealant: As recommended by manufacturer for sealing joints between tactile warning surface panels and at exposed edges of panels.
   a. VOC Content: Provide sealant that complies with local regulatory limits for VOC content when calculated according to 40 CFR, Part 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

B. Do not begin installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of tactile warning surface panels.

B. At areas to receive surface-applied tactile warning panels, verify that substrates are dry and free of curing compounds, sealers, loose material, dust, oils, grease, and other foreign materials that might impair adhesive bond.

C. Prior to installation, clean backside of surface-applied tactile warning surface panels in accordance with manufacturer's written instructions.

3.3 INSTALLATION, GENERAL

A. General: Install tactile warning surface in accordance with manufacturer's written instructions.

B. Lay out tactile warning surface panels in sizes and configurations as shown on Drawings.

C. If not indicated otherwise, lay out panels from center marks established at end points, so panels at opposite ends of run are of equal width. Adjust as necessary to avoid using cut widths equal to less than one-half of a panel width at ends.

D. Maintain correct orientation of each panel, so as to maintain correct alignment of truncated domes from panel to panel.

E. Set panels true and square to adjacent curbs, ramps, and paving edges.

F. Install adjacent panels in accordance with manufacturer's written instructions to maintain correct spacing and alignment of truncated domes from panel to panel.

G. Where cut widths are necessary, cut and fit panels along a clean, straight line.

H. Where occurring adjacent to vertical surfaces, scribe, cut, and fit panels to butt neatly and cleanly to base of vertical surface.

3.4 INSTALLATION - SURFACE-APPLIED TACTILE WARNING SURFACE PANELS

A. Adhere surface-applied panels to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, and other surface imperfections.

B. After panels have been set, install drilled fasteners at manufacturer's specified locations, working in a sequence to prevent buckles in the panels.

C. Remove all concrete dust generated by drilling for fasteners.

D. Seal joints between panels and at exposed edges of panels in accordance with manufacturer's written instructions.

3.5 PROTECTION

A. Do not allow traffic on tactile warning panels until the following conditions have been met:

1. Surface-Applied Panels: Sufficient time has been allowed for adhesive to set as per written instructions of manufacturer.

B. Once conditions have been met for allowing traffic over tactile warning panels, do not move heavy or sharp objects directly over surfaces. Place plywood or hardboard sheets over tactile warning surfaces and under objects while objects are being moved. Slide or roll objects over protective sheets without moving sheets.

3.6 CLEANING

A. Remove adhesive and other surface blemishes using cleaner recommended by tactile surface manufacturer.

B. Clean tactile warning surfaces in accordance with manufacturer's written instructions.

END OF SECTION 32 17 26

SECTION 33 11 16

SITE WATER DISTRIBUTION

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 site distribution piping outside buildings for water service, and the following components:
   1. Valves.
   2. Backflow preventers.
   3. Concrete thrust blocks.

B. The following is to be performed by utility company's separate contractor, and is not included in contract:
   1. Connection to water main in street and underground piping to water meters.
   2. Installation of water meters and accompanying utility boxes.

C. Related Sections include:
   1. Division 22 Section for water service lines below and within buildings.
   2. Section 31 30 00 "Earthwork" for trenching and backfilling for underground water lines, and detectable warning tapes.
   3. Section 31 23 16 "Utility Trenching" for trenching and backfilling for underground water lines, and detectable warning tapes.
   4. Division 32 Section "Irrigation" for irrigation lines.
   5. Section 33 11 19 "Site Fire Protection Water Distribution" for underground site fire protection water lines.

1.3 DEFINITIONS

A. Water Main: Utility's water piping.

B. Water Service: Site domestic water piping.

C. Point of Delivery: Piping outlet from water meter.

D. DN: Dimension Nominal.

E. NPS: Nominal Pipe Size.

F. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product, including the following:
   1. Piping and related specialties.
   2. Valves and accessories.
   3. Valve boxes.
   4. Backflow preventers and accessories.

B. Shop Drawings: For the following:
   1. Precast concrete utility boxes, including frames and covers.
   2. Protective enclosure for backflow preventer.

C. Coordination Drawings: For piping and specialties including relationship to other services in same area. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Field Quality-Control Test Reports: From Contractor.

E. Operation and Maintenance Data: For specialties to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Sections for closeout procedures and operation and maintenance data, include the following:
   1. Valves.
   2. Backflow preventers.
   3. Protective enclosures.

F. Record drawings of installed water service lines and appurtenances in accordance Division 1 Section for project closeout requirements.
   1. Locate and dimension work with reference to permanent landmarks. Indicate materials and sizes of all components.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of piping and specialties and are based on the specific system indicated. Refer to Division 1 Section for product requirements.

B. Regulatory Requirements:
   1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
   2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.

C. Piping materials shall bear label, stamp, or other markings of specified testing agency.

D. NSF Compliance:
   1. Comply with NSF 14 for plastic potable-water-service piping.

2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves according to the following:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends and flange faces.
   3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, according to the following:
   1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
   2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Do not interrupt existing utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect not less than five working days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

B. Information shown regarding locations of existing utilities is based upon available records and data, but shall be regarded as approximate, only. Make minor deviations necessary to conform with actual locations and conditions without extra cost. Verify location and elevation of utilities prior to commencement of excavation.
   1. Exercise extreme care in excavating near existing utilities. Contractor is responsible for damage to existing utilities.

1.8 COORDINATION

A. Coordinate connection to water main with utility company.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate placement of valve boxes with layout of paving joints and patterns. Refer to Drawings for layout.

PART 2 - PRODUCTS

2.1 PIPING MATERIAL

A. Refer to Part 3 “Piping Applications” Article for applications of pipe, fitting, and joining materials.

2.2 DUCTILE IRON PIPE AND FITTINGS

A. Mechanical Joint, Ductile Iron Pipe: AWWA C151, with mechanical joint, bell joint and plain spigot end unless grooved or flanged ends are indicated.
   1. Mechanical Joint, Ductile Iron Fittings: AWWA C110, ductile iron or gray iron standard pattern or AWWA C153, ductile iron compact pattern.
      a. Glands, Gaskets, and Bolts: AWWA C111, ductile iron or gray iron glands, rubber gaskets, and steel bolts.

2.3 PVC PIPE AND FITTINGS

A. PVC (Iron Pipe Size (IPS)): water pipe 3” and smaller shall conform to ASTM D1785 Schedule 40 and shall have solvent welded joints. Pipe shall be installed in conformance with manufacturer’s recommendations.
   1. PVC Molded Fittings: ASTM D 2466.
      a. Solvent cement for sizes smaller than 4”.

B. PVC (Cast Iron Pipe Size (CIPS)): AWWA C900, Class 150, with bell end with gasket and spigot end; gaskets meeting requirements of ASTM F 477.
   1. PVC Molded Fittings: AWWA C907, Class 150, with bell and spigot or double bell ends. Include elastomeric gasket in each bell.

2.4 JOINING MATERIALS

A. AWWA Transition Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cascade Waterworks Manufacturing Company.
      b. Dresser Industries, Inc.; DMD Division.
      c. JCM Industries.
      d. Viking Johnson.

e. Manufacturer of equal products in accordance with Division 1 requirements for product substitutions.

2. Underground Piping, NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

3. Underground Piping, NPS 2 (DN 50) and Larger: AWWA C219, metal, sleeve-type coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eslon Thermoplastics.

b. Manufacturer of equal products in accordance with Division 1 requirements for product substitutions.

C. Plastic-to-Metal Transition Unions: MSS SP-107, PVC four-part union. Include brass end, solvent cement joint end, rubber O-ring, and union nut.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. NIBCO Inc.

b. Manufacturer of equal products in accordance with Division 1 requirements for product substitutions.

D. Pipe Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. AWWA C110, rubber, flat face, 1/8-inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

E. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

F. Plastic Pipe Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

G. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.5 SLEEVES

A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.6 GATE VALVES

A. Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Stockham Division
b. NIBCO INC.
c. Manufacturer of equal products in accordance with Division 1 requirements for product substitutions.

2. Non-rising Stem Gate Valves:
a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.
i) Standard: MSS SP-80.

2.7 VALVE ACCESSORIES AND SPECIALTIES

A. Tapping Sleeve Assemblies: Comply with MSS SP-60. Include sleeve and valve compatible with drilling machine.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
b. Grinnell Corporation; Mueller Company; Water Products Division
c. United States Pipe and Foundry Company.
d. Manufacturer of equal products in accordance with Division 1 requirements for product substitutions.
2. Tapping Sleeve: Cast iron or ductile iron or stainless steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
3. Valve: AWWA, cast-iron, non-rising-stem, metal seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Non-Traffic Rated Valve Boxes: Valve box and cover per plan.
1. Provide threaded fasteners to secure lid to box.
2. Lid to be inscribed with the word “WATER.”

C. Traffic-Rated Valve Boxes: Valve box and cover per plan.
1. Provide threaded fasteners to secure lid to box.
2. Lid to be inscribed with the word “WATER.”

2.8 WATER METERS

A. Water meters will be furnished and installed by utility company.

2.9 BACKFLOW PREVENTERS

A. Manufacturer:
1. **As specified on plans.**

B. General: AWWA standard, backflow preventers; as approved for use by local water utility.

1. Working Pressure: 150 psig minimum, unless otherwise indicated.
2. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.
3. NPS 2-1/2 (DN 65) and Larger: Bronze, cast iron, steel, or stainless steel body with flanged ends.
    a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast Iron or steel body.
4. Interior Components: Corrosion-resistant materials.
5. Strainer: On inlet, if indicated.

C. Reduced Pressure Principle Backflow Preventers: AWWA C511, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure differential relief valve with ASME A112.1.2, air-gap fitting located between two positive seating check valves.
    1. Maximum Pressure Loss: 12 psig through middle 1/3 of flow range.

2.10 PROTECTIVE ENCLOSURES

A. Protective Enclosure, General: Outdoor, corrosion-resistant enclosure designed to protect above-ground backflow preventers or other water piping specialties from vandalism. Provide size and dimensions indicated, but not less than those required for access to and service of protected unit.
    1. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
        a. LeMeur Welding & Manufacturing.
        b. Manufacturer of equal products in accordance with Division 1 requirements for product substitutions.
    2. Construction: Galvanized, steel-framed wire-mesh enclosure with padlock hasp for access cover.
    3. Finish: Manufacturer’s standard acrylic enamel factory-applied paint finish.

2.11 MISCELLANEOUS MATERIALS

A. Portland Cement Concrete: Minimum compressive strength of 3000 psi, minimum of four sacks of cement per cubic yard of concrete, one-Inch maximum aggregate size, three-inch maximum slump, two to four percent entrained air.
    1. Cement: ASTM C 150, Type I.
    2. Fine Aggregate: ASTM C 33, sand.
    3. Coarse Aggregate: ASTM C33, crushed gravel.
    4. Water: Potable.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 31 20 00 “Earthwork” and Section 31 23 16 “Utility Trenching” for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

C. Do not use flanges, unions, or keyed couplings for underground piping.

D. Flanges, unions, keyed couplings, and special fittings may be used, instead of joints indicated, on piping in utility boxes and vaults.

E. Underground Water Service Piping: Use the following piping materials for each size range:

1. NPS 3/4 to NPS 1-1/2 (DN 20 to DN 40): PVC (IPS); PVC socket fittings and solvent-cemented joints.
2. NPS 2 to NPS 3 (DN 50 to DN 80): PVC (IPS); PVC gasketed fittings
3. NPS 4 and Larger: PVC, AWWA Class 150 pipe; PVC, AWWA Class 150 molded fittings; and gasketed joints.

F. Aboveground Water Service Piping: Ductile iron pipe with grooved ends; ductile iron, grooved end fittings; ductile iron keyed couplings; and grooved joints.

3.3 VALVE APPLICATIONS

A. General Application: Use threaded or flanged end valves for underground installation, as suitable for piping in which valve is installed. Install AWWA, cast-iron, nonrising-stem, resilient-seated gate valves with valve box.

3.4 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of water-service piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

C. Install ductile iron, water-service piping according to AWWA C600 and AWWA C105.

D. Install PVC pipe according to AWWA M23 and ASTM F 645.

E. Select system components with pressure rating equal to or greater than system operating pressure.

F. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

G. Install piping to permit valve servicing.

H. Install water service piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install sleeves for pipes passing through concrete and masonry walls and foundations.

K. Unless indicated otherwise, bury piping with depth of cover over top at least 30 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:

1. Under Driveways and Other Vehicular Traffic Areas: With at least 36 inches cover over top.
2. In Loose Gravelly Soil and Rock: With at least 12 inches additional cover.

L. Install piping by tunneling, jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

M. Restrained Joints: Install underground gasketed-joint water service piping with restrained joints at horizontal and vertical changes in direction. Use concrete thrust blocks or, if indicated, other supports including restrained-joint piping, anchors, and tie rods and clamps.

1. Install concrete thrust blocks at all pipe tees, wyes, bends, crosses, elbows, and risers as detailed on plans.
2. Thrust blocks to bear against undisturbed soil, and sized as indicated on plans.
3. Place thrust blocks so that pipe joints are accessible for inspection and repair.

N. Install water-supply piping with shutoff valve in water supply to each building. Use gate valve and valve box.

3.5 JOINT CONSTRUCTION

A. Make pipe joints according to the following:

1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
2. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer’s written instructions.
3. PVC Piping Solvent-Cement Joints: Ream ends of pipe and remove burrs. Clean and dry joining surfaces. Join pipe and fittings according to ASTM D 2672.

a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

4. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.6 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. Center valve box on valve, setting plumb and level.

1. Install valve box extensions as required to extend down to level of piping

2. Compact soil backfill around valve box to a distance of 4 feet on all sides.

3.7 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of utility company, plumbing and health departments, and authorities having jurisdiction.

B. Install backflow preventer to facilitate service, maintenance, and repair or replacement of components.

C. Do not install backflow preventers with relief drain in area subject to flooding.

D. Support NPS 2-1/2 (DN 65) and larger backflow preventers, valves, and piping near floor and on concrete piers.

3.8 CONNECTIONS

A. Connect water service piping at water supply source and extend to point of connection to building water piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water service piping at building wall until building water piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building water piping systems when those systems are installed.

2. Refer to Division 15 Section for potable-water piping below and within buildings.

B. Connections to Valves and Equipment: Except as otherwise indicated, make piping connections as follows:

1. Install unions adjacent to each valve and at final connection to each piece of equipment having threaded pipe connection.

2. Install flanges adjacent to each valve and at final connection to each piece of equipment having flanged pipe connection.

3.9 IDENTIFICATION

A. Refer to Section 31 20 00 “Earthwork” and Section 31 23 16 “Utility Trenching” for continuous underground warning tape installed over underground water-distribution piping.

3.10 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete slab base level and with top approximately two inches above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.11 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for two hours.

1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for one more hour.

a. Maximum allowable leakage in gallons per hour shall be in accordance with AWWA C605, as determined by the following formula:

$$L = \frac{N \times D \times \text{sq. root of } P}{7{,}400}$$

Where: L = allowable leakage in gallons per hour
N = number of joints in length of pipe tested, in feet
D = nominal (rated) diameter of the pipe, in inches.
P = average test pressure during leakage test, in psig

b. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.12 CLEANING

A. Clean and disinfect water distribution piping as follows:

1. Purge new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.

2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or as described below:

a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.

b. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.

c. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 33 11 16

SECTION 33 33 13

SITE SANITARY SEWERAGE

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 gravity-flow, non-pressure sanitary sewerage outside buildings, including the following components:
   1. Cleanouts.

B. Related Sections include:
   1. Division 22 Section for sanitary sewer lines within and below buildings.
   2. Section 31 20 00 “Earthwork” for trenching and backfilling for underground sanitary sewer lines, and detectable warning tapes.
   3. Section 31 23 16 “Utility Trenching” for trenching and backfilling for underground storm drain lines, and detectable warning tapes.
   4. Section 33 41 00 “Site Storm Drainage” for underground storm drain lines outside buildings.

1.3 DEFINITIONS

A. DN: Dimension Nominal.

B. NPS: Nominal Pipe Size.

C. PVC: Polyvinyl chloride plastic.

D. SDR: Standard Dimension Ratio, derived by dividing the outside diameter of the pipe by the pipe wall thickness.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, including the following:
   1. Piping and related specialties.
   2. Cleanouts.

B. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between manholes, cleanouts, piping, and proximate structures.

C. Field quality-control test reports.

D. Record drawings of installed sanitary sewerage lines and appurtenances in accordance Division 1 Section for project closeout requirements.

1. Locate and dimension work with reference to permanent landmarks. Indicate materials and sizes of all components.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. Do not store plastic pipe and fittings in direct sunlight.

C. Protect pipe, pipe fittings, and seals from dirt and damage.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than seven days in advance of proposed interruption of service.

2. Do not proceed with interruption of service without Architect's written permission.

B. Information shown regarding locations of existing utilities is based upon available records and data, but shall be regarded as approximate, only. Make minor deviations necessary to conform with actual locations and conditions without extra cost. Verify location and elevation of utilities prior to commencement of excavation.

1. Exercise extreme care in excavating near existing utilities. Contractor is responsible for damage to existing utilities.

1.7 COORDINATION

A. Coordinate placement of cleanouts with layout of pavement joints and patterns. Refer to Drawings for layout.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.2 PVC PIPE AND FITTINGS

A. PVC Sewer Pipe and Fittings: NPS 15 (DN 375) and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

2.4 CLEANOUTS

A. Cleanout at Grade: Cast-iron ferrule with gas- and watertight tapered thread plug.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Zurn Industries, Inc.; #Z-1440.
      b. Equal product in accordance with Division 1 requirements for product substitutions.

B. Cleanout Boxes: cast-iron lid with lifting hole and threaded fasteners to secure lid to box.
   1. Cleanout frame and cover per plan.
   2. Lid inscribed with the words “SANITARY SEWER.”

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 31 20 00 “Earthwork” and Section 31 23 16 “Utility Trenching” for excavating, trenching, and backfilling.

3.2 PREPARATION

A. Where connecting to existing sewer lines, verify existing line is free-draining prior to making connection. If required, clean existing line to achieve free-draining condition.

3.3 PIPING APPLICATIONS

A. Gravity-Flow, Nonpressure Sewer Piping: Use the following pipe materials:
   1. NPS 3 (DN 80) to NPS 12 (DN 300): PVC sewer pipe and fittings, gaskets, and gasketed joints.

3.4 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer’s written instructions.

B. Install piping at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install piping free of sags and bends.

D. Use fittings for changes in direction and branch connections unless indicated otherwise.

E. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

F. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

G. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow, at slope indicated, but in no case less than 1 percent.
2. Install piping at elevations and inverts indicated, but in no case with less than 36-inch cover.
3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

H. Clear interior of piping of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.5 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.
2. Join dissimilar pipe materials with pressure-type couplings.

3.6 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sanitary sewerage pipe to cleanout at grade. Use cast-iron soil pipe fittings in sanitary sewerage pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, as detailed on Drawings. Set with top of concrete flush with adjacent paving material, or, if occurring in planted or soil area, 1-inch above surrounding finish grade.

3.7 CONNECTIONS

A. Connect non-pressure, gravity-flow sanitary sewerage piping to building sanitary sewer lines, as indicated on Drawings.

1. Refer to Division 15 Section for plumbing sanitary sewer lines occurring inside and below buildings.

B. Make connections to existing sanitary sewer piping.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus six-inch overlap, with not less than six inches of concrete with 28-day compressive strength of 3000 psi.
2. Protect existing piping to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.8 IDENTIFICATION

A. Refer to Section 31 20 00 “Earthwork” and Section 31 23 16 “Utility Trenching” for continuous underground warning tape installed over underground sanitary sewer piping.

3.9 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:
    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Re-inspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least one working day’s advance notice.
4. Submit separate report for each test.

C. Leaks constitute defects that must be repaired.

D. Replace leaking piping using new materials.

3.10 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

B. Where connecting to existing sewer lines, clean existing line from point-of-connection to nearest downstream manhole or catch basin.

END OF SECTION 33 33 13