

Measure K Charter School Committee Members

Blue Oak Charter School: Susan Domenighini & Buck Ernest

Inspire School of Arts and Sciences: Doris Luther, co-chair & Jen Josephson

Chico Country Day Charter School: Margaret Reece, co-chair & Lori McGlone

Nord Country School: Lisa Speegle & Kathy Dahlgren

CORE Butte Charter School: Mary Cox, Vice Chair & Susan Smith

Sherwood Montessori: Michelle Yezbick & Monica Woodward

Forest Ranch Charter School: Kiersten Morgan & Christia Marasco

Wildflower Open Classroom: Tom Hicks & Jonas Herzog

Chico Unified School District Measure K Charter School Committee Meeting Notice

Date: April 27, 2020

Time/Location: 3:30pm via Zoom

Join Zoom Meeting

<https://us04web.zoom.us/j/71241238551?pwd=QTllbnVSZjFBRlBWNlZXM0JVt1Q3dz09>

Meeting ID: 712 4123 8551

Password: 6SrCB7

REGULAR MEETING AGENDA

1. REGULAR SESSION

1.1 Call to Order and Roll Call

1.2 Approval of Minutes from Regular Meeting of 2/24/20 & Special Meeting of 2/24/20

2. PUBLIC COMMENTS

3. DISCUSSION/ACTION ITEMS

3.1 Cash flow of Measure K funds in the charter school apportionment

Jaelyn Kruger will present the new budget tracking/cash flow worksheet

3.2 Chico Country Day School: Project Request - Building Project

CCDS is requesting funds for the Kinder/Main Office project

3.3 Appointment of Alternate Committee members for Forest Ranch Charter school.

Forest Ranch will appoint an alternate to the Measure K Committee

4. ITEMS FROM COMMITTEE MEMBERS

Information, Procedures and Conduct of CUSD Measure K Charter School Committee Meetings:

Student Participation:

At the discretion of the Chair, students may be given priority to address items to the Committee

Public input on specific agenda items and those items not on the agenda:

The CUSD Measure K Charter School Committee welcomes and encourages public comments. Any person of the public desiring to speak shall be allowed to speak during public comment time and has the option of speaking once on any agenda item when it is being discussed. Speaking time shall generally be limited to three minutes, unless a longer period is permitted by the Committee Chair. In the case of numerous requests to address the same item, the Committee may select representatives to speak on each side of the item. Each person who addresses the Committee must be first recognized by the presiding officer and give his or her name. Comments must be directed to the Committee as a whole and not to individual committee members. The Committee shall not take action or enter into discussion or dialog on any matter that is not on the meeting agenda, except as allowed by law. Items brought forth at this part of the meeting may be taken under advisement by the Committee and may be placed on the agenda of a subsequent meeting for discussion or action by the Committee at the discretion of the Committee Chair & Vice Chair.

Special Needs: If you have special needs because of a disability or you require assistance or auxiliary aids to participate in the meeting, please contact the CUSD office at 530.891.3000. CUSD will attempt to accommodate your disability.

Copies of Agendas and Related Materials: Materials are available at the meeting, on the CUSD website at www.chicousd.org, or in the district office prior to the meeting @ 1163 East 7th Street, Chico, CA 95928.

5. ADJOURNMENT

4.1 Adjourn; Next meeting May 18, 2020 via Zoom

Measure K Charter School Committee Members

Blue Oak Charter School: Susan Domenighini & Buck Ernest

Inspire School of Arts and Sciences: Doris Luther, co-chair & Dan La Bar

Chico Country Day Charter School: Margaret Reece, co-chair & Lori McGlone

Nord Country School: Lisa Speegle & Kathy Dahlgren

CORE Butte Charter School: Mary Cox, Vice Chair & Susan Smith

Sherwood Montessori: Michelle Yezbick & Monica Woodward

Forest Ranch Charter School: Kiersten Morgan & Christia Marasco

Wildflower Open Classroom: Tom Hicks & Jonas Herzo

Chico Unified School District Measure K Charter School Committee Meeting Notice

Date: February 24, 2020

Time/Location: 3:45pm at CORE Butte Charter School, 2847 Notre Dame Blvd, Chico, 95928

DRAFT: REGULAR MEETING MINUTES

1. REGULAR SESSION

1.1 Called to Order at 3:45 p.m.

Attendance:

Blue Oak Charter School: Susan Domenighini

Inspire School of Arts and Sciences: Doris Luther, co-chair

Chico Country Day Charter School: Margaret Reece

Nord Country School: Lisa Speegle

CORE Butte Charter School: Mary Cox

Sherwood Montessori: Michelle Yezbick

Forest Ranch Charter School: Kiersten Morgan (absent)

Wildflower Open Classroom: Tom Hicks

Chico Unified School District: Jacklyn Krueger, Julie Kistle, Mike Weisenborn

1.2 Approval of Regular Agenda

Tom Hicks motions to approve agenda, Doris Luther seconded the motion. Motion passes.

Approved 6/0/0/2	Aye	Nay	Abstain	Absent
BOCS: Susan Domenighini				x
CCDS: Margaret Reece	x			
CBCS: Mary Cox	x			

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Nord: Lisa Speegle	x			
Inspire: Doris Luther	x			
FRCS: Kiersten Morgan				x
Sherwood: Michelle Yezbick	x			
WOC: Tom Hicks	x			

1.3 Approval of Minutes from Regular Meeting of 12/16/19

Tom Hicks motions to approve minutes, Doris Luther seconded the motion with change of name Inspire High School to Inspire School of Arts and Sciences. Motion passes.

Approved 6/0/0/2	Aye	Nay	Abstain	Absent
BOCS: Susan Domenighini				x
CCDS: Margaret Reece	x			
CBCS: Mary Cox	x			
Nord: Lisa Speegle	x			
Inspire: Doris Luther	x			
FRCS: Kiersten Morgan				x
Sherwood: Michelle Yezbick	x			
WOC: Tom Hicks	x			

2. PUBLIC COMMENTS

None

3. DISCUSSION/ACTION ITEMS

3.1 BLUE OAK: Project Request - purchase of furnishings & equipment
 Doris Luther motions to approve Blue Oak project request: purchase of furnishing & equipment. Mary Cox seconded the motion. Motion passes.

Approved 7/0/0/1	Aye	Nay	Abstain	Absent
BOCS: Susan Domenighini	x			
CCDS: Margaret Reece	x			
CBCS: Mary Cox	x			
Nord: Lisa Speegle	x			
Inspire: Doris Luther	x			
FRCS: Kiersten Morgan				x
Sherwood: Michelle Yezbick	x			
WOC: Tom Hicks	x			

3.2 WILDFLOWER: Project Request - Purchase of portable classrooms
Doris Luther motions to approve , Mary Cox seconded the motion. Motion passes.

Approved 7/0/0/1	Aye	Nay	Abstain	Absent
BOCS: Susan Domenighini	x			
CCDS: Margaret Reece	x			
CBCS: Mary Cox	x			
Nord: Lisa Speegle	x			
Inspire: Doris Luther	x			
FRCS: Kiersten Morgan				x
Sherwood: Michelle Yezbick	x			
WOC: Tom Hicks	x			

3.3 Appointment of Alternate Committee members for Inspire School of Arts & Sciences & Forest Ranch Charter school.

Jen Josephson from Inspire School of Arts will replace Dan LaBar's seat on the committee. Doris Luther motions to approve Jen Josephson as an alternate committee member for Inspire School of Arts & Sciences. Susan Domenighini seconded the motion. Motion passes.

Approved 7/0/0/1	Aye	Nay	Abstain	Absent
BOCS: Susan Domenighini	x			
CCDS: Margaret Reece	x			
CBCS: Mary Cox	x			
Nord: Lisa Speegle	x			
Inspire: Doris Luther	x			
FRCS: Kiersten Morgan				x
Sherwood: Michelle Yezbick	x			
WOC: Tom Hicks	x			

3.4 Cash flow of Measure K funds in the charter school apportionment
 Julie Kistle and Jacklyn Kruger shared information about how charters can use the 15.34% of \$152 million funds from total allocation before the final bond sales dates to support larger projects. The Committee will need to plan for cash flow for larger projects. Jacklyn will bring a tracking sheet to the Committee in the March meeting.

4. ITEMS FROM COMMITTEE MEMBERS

5. ADJOURNMENT

4.1 Adjourned at 4:20 p.m.
 Next meeting March 30, 2020 at CORE Butte Charter

Measure K Charter School Facilities Committee

Project Recommendation Form for Consideration by CUSD Board of Trustees

GENERAL INFORMATION:

Name of School	Chico Country Day School
Address of School	102 West 11 th Street, Chico, CA 95928
Contact Name	Margaret Reece
Contact Phone/Email	margaret@chicocountryday.org ; 530-895-2650
Year Established	1997
Charter Renewal Date	2020
CDS Code	04-61424-6113773
Charter Number	112
Website	www.chicocountryday.org

1. Type of Project:

- Planning
- Construction
- Health Safety (Including ADA)
- Modernization/Repair/Renovation/Improve
- Purchase or lease Project
- Other (including FF&E)

2. Project Narrative:

The CCDS project was approved by DSA. This project includes the replacement of modular on the site and the construction of three kindergarten classrooms, an administrative building, a special education classroom and a multi-use classroom. Added alternates include a dining canopy seating area, ADA ramp and stairs, a terraced seating area near the gym, and the remodeling of the remaining modular on campus.

3. Charter School Property Project Location: *(If project location is different from address above.)*

102 West 11th Street, Chico, CA 95928

- a. Does your school currently operate on a CUSD School Site: yes no
- b. Does your school lease property/buildings from a private owner: yes no

4. Current enrollment and ADA: 560/538

5. Financial Questions

- a. Was your prior annual audit report free of any negative findings? yes no

CCDS had an audit recommendation in 18/19 regarding vacation accrual.

- b. What were your cash reserves as a percent of expenditures at the end of the prior fiscal year?
CCDS has an undesignated reserve of \$1,972,841.04. The Ending Fund Balance as of July 1, 2019 was \$7,134,612.56 with designations for Prop 1D loan liabilities, fiscal stabilization fund, special education reserves and capital improvements/maintenance reserves.

6. Project Schedule

Please briefly describe the timeline for the project planning and completion.

- Programming/Schematic Design Documents – completed
- Design Development Documents – December 2018-19
- Construction Documents – September/October 2019
- DSA Review & Approval – February 2020
- Bid & Award – April/May 2020

7. Preliminary Estimate (Cost)

Series A- C Allocation	\$5,714,238
Less Previously Allocated Funds	\$1,006,649
Less Current Project Funds Requested	\$4,707,589
Remaining Round Allocation	\$0

School Facilities Projects to be Funded with Proceeds of Bonds

“Bond proceeds will be expended to repair, modernize, replace, renovate, expand, construct, acquire, equip, furnish and otherwise improve the classrooms and school facilities the [charter’s] existing schools, new school sites, and other [charter] owned properties to provide equity among campuses, improved facilities, and student access to instructional technology.”—Measure K

Documentation *(please indicate those completed)*

All Projects

Project Narrative: general scope of work _x_ Included
 Enrollment Capacity: Current Facility and/or Proposed _x_ Included
 Preliminary Estimate (Cost) _x_ Included
 Project Schedule _x_ Included

Building/Modernization/Renovation Projects

Feasibility Study and Site Review _____ Included _x_ Not Applicable
 Enrollment Capacity: Current Facility and/or Proposed _____ Included _x_ Not Applicable
 Pre-Schematics *(to be completed by a District approved architect and/or engineering team)* _____ Included _x_ Not Applicable
 Facility Assessment _____ Included _x_ Not Applicable
 Schematic Drawing(s) *(areas of work)* _x_ Included _____ Not Applicable
 CEQA Process Determination *(pre-CEQA-form)* _____ Included _x_ Not Applicable
 Design Development Drawings _____ Included _x_ Not Applicable
 Design or Bid Estimate _x_ Included _____ Not Applicable
 Construction Documents _x_ Included _____ Not Applicable

For Committee Use:

All necessary documents were included: _x_ yes _____ no
(if no: request for additional documentation)

CORE QUESTIONS:

1. Does the project fall under the bond language? Yes
2. Given the life span of a bond, did the proposal explain how this project was an appropriate use of funds? Yes
3. Has the school demonstrated the feasibility of project completion? Yes

4. Has the local school board approved the project? 3/11/2020

MEASURE K—CHARTER FACILITIES COMMITTEE APPROVAL

Date of Committee Approval: _____4/27/2020_____

Attestation of Committee Secretary: _____

*For questions or clarifications relative to the completion of this application, please contact:
Kevin Bultema at kbultema@chicousd.org or (530) 891-3000 x. 112*

Country Day School - Chico
201 West 11th Street



Sierra West Group
CONSTRUCTION CONSULTANTS

COMPLETE SUMMARY

GROSS SF: 8,180

DATE: 21-May-19

ARCHITECT: GRA

Revised 3-3-20

CURRENT ESTIMATE	GFA	TOTAL COST	BLDG \$/GSF
SITE SCOPE	1.1 ACRES	\$568,671 \$568,671	\$101.30
ADMINISTRATION BUILDING	3604 SF	\$1,397,381 \$1,397,381	\$398.24
KINDERGARTEN BUILDING	4,576 SF	\$1,621,764 \$1,621,764	\$362.68
SUBTOTAL CONSTRUCTION	8,180 SF	\$3,587,816 \$3,587,816	\$479.65
SUBTOTAL CONSTRUCTION		\$3,923,566 \$3,923,566	\$479.65
19.0 GENERAL CONDITIONS	\$358,781	10.0% \$392,357	\$47.97
20.0 CONTINGENCY - UNDOCUMENTED NEEDS	\$118,397	3.0% \$129,478	\$15.83
21.0 LEASE LEASE BACK FACTORS		NOT INCLUDED	
22.0 OVERHEAD & PROFIT	\$203,249	5.0% \$222,270	\$27.17
23.0 BONDS AND INSURANCE	\$106,706	2.5% \$116,692	\$14.27
SUBTOTAL MARK UPS	\$787,133	\$860,796	\$105.23
SUBTOTAL CONSTRUCTION - TODAY'S DOLLARS	\$4,374,949	\$4,784,362	\$584.89
Relocatable Bid`	\$326,645		
TOTAL HARD CONSTRUCTION ON BID DAY	8,180	\$4,701,594 \$4,701,594	\$584.89
ADD ALTERNATE 1- CANOPY		\$250,839	
ADD ALTERNATE 2- ADA RAMP/ STAIRS		\$133,435	
ADD ALTERNATE 3- PORTABLE BUILDING	Add Fire Sprinkler \$26,000	\$172,091	\$198,091
ADD ALTERNATE 4- TIERED SEATING		\$66,710	
		\$649,075	
TOTAL CONSTRUCTION - WITH ALTERNATES		\$5,350,669 \$5,350,669	

DOCUMENT DEDUCT CHANGES:

1. Site: -	\$260,000
2. ADA East Ramp:	\$ 3,500
3. Guard Rails:	\$ 50,000
4. Exterior Door:	\$ 2,750
5. Exterior Glazing:	\$ 12,100
6. Ceramic Wall Tile:	\$ 3,000
7. Restroom Pluming:	\$ 4,025

Total: \$335,375

DOCUMENT 00 41 13

BID FORM

To: Governing Board of **Chico Unified School District** ("District")

From: _____
(Proper Name of Bidder)

1. **Total Bid.** The undersigned declares that the Contract Documents including, without limitation, the Invitation to Bid, the Instructions to Bidders, and the Special Conditions have been read, and agrees and proposes to furnish all necessary labor, materials, and equipment to perform and furnish all work in accordance with the terms and conditions of the Contract Documents, including, without limitation, the Drawings and Specifications for the following project:

Chico Country Day School ("Project" or "Contract")

and will accept in full payment for that Work the following total lump sum amount, all taxes included:

<p><i>COUNTRY DAY CHAPTER SCHOOL - RELOCATABLES</i> Dollars \$ _____</p> <p>Bid Item No. 1 for _____ [IDENTIFY SCOPE COMPONENT OF TOTAL BASE BID - IF APPLICABLE]</p>
<p><i>COUNTRY DAY SCHOOL NEW CLASSROOMS & MODERNIZATION</i> Dollars \$ _____</p> <p>Bid Item No. 2 for _____ [IDENTIFY SCOPE COMPONENT OF TOTAL BASE BID - IF APPLICABLE]</p>
<p>_____ Dollars \$ _____</p> <p>Bid Item No. 3 for _____ [IDENTIFY SCOPE COMPONENT OF TOTAL BASE BID - IF APPLICABLE]</p>
<p>_____ Dollars \$ _____</p> <p>Bid Item No. 4 for _____ [IDENTIFY SCOPE COMPONENT OF TOTAL BASE BID - IF APPLICABLE]</p>
<p>_____ Dollars \$ _____</p> <p>TOTAL BASE BID</p>

NOTE: IF THERE ARE ALLOWANCES IDENTIFIED IN THIS BID FORM, DO NOT INCLUDE ANY ALLOWANCE(S) AMOUNTS IN THESE BID AMOUNTS.

2. **Additive/Deductive Alternates:** [LIST ANY, IF APPLICABLE]

Alternate #1

<p><u>NEW DINING CANOPY & ACCESS PRY P</u> Dollars \$ _____</p> <p>[ADD DESCRIPTION] Additive/Deductive:</p>
--

Alternate #2

<p><u>EXISTING MOD BRCK. MODIFICATIONS</u> Dollars \$ _____</p> <p>[ADD DESCRIPTION] Additive/Deductive:</p>
--

Descriptions of alternates are primarily scope definitions and do not necessarily detail the full range of materials and processes needed to complete the construction.

3. **Unit Price(s).** The Bidder's Base Bid includes the following unit price(s), which the Bidder must provide and the District may, at its discretion, utilize in valuing additive and/or deductive change orders:

[LIST ANY, IF APPLICABLE]

4. **Allowance(s).** The Bidder's Base Bid shall **NOT** include the following potential Allowance(s). The District will add some or all of the following Allowance(s) amount(s) to the successful bidder's Contract, at the District's discretion. Contractor shall be permitted to invoice for Work under an Allowance in the identical structure as a Change Order.

Not Applicable

5. **Contract Review.** The undersigned has reviewed the Work outlined in the Contract Documents and fully understands the scope of Work required in this bid, understands the construction and project management function(s) is described in the Contract Documents, and that each Bidder who is awarded a contract shall be in fact a prime contractor, not a subcontractor, to the District, and agrees that its bid, if accepted by the District, will be the basis for the Bidder to enter into a contract with the District in accordance with the intent of the Contract Documents.
6. **Requests for Clarification.** The undersigned has notified the District in writing of any discrepancies or omissions or of any doubt, questions, or ambiguities about the meaning of any of the Contract Documents, and has contacted the Construction Manager before bid date to verify the issuance of any clarifying Addenda.
7. **Contract Time.** The undersigned agrees to commence work under this Contract on the date established in the Contract Documents and to complete all work within the time specified in the Contract Documents.
8. **Contractual Provisions.** The undersigned hereby acknowledges and agrees to be bound by following provisions and all provisions in the Contract Documents:

- The liquidated damages clause of the General Conditions and Agreement.

ALTERNATE #3
NEW TERRACED SEATING @ GYM

ALTERNATE #4
NEW TERRACED SEATING @ DINING CANOPY

- The “Changes in the Work” provisions in the General Conditions that limit the permitted charges and mark-ups on change orders and on the amount of home office overhead that the successful bidder can receive from the District.
- The “Claims” provisions in the General Conditions that delineate the required process to submit and process disputes and claims.

9. **Bid Open for 90 Days.** It is understood that the District reserves the right to reject this bid and that the bid shall remain open to acceptance and is irrevocable for a period of ninety (90) days.

10. **Attachments.** The following documents are attached hereto:

- The Bid Bond on the District's form or other security
- The Designated Subcontractors List
- The Noncollusion Declaration
- Iran Contracting Act Certification

11. **Addenda Acknowledgement.** Receipt and acceptance of the following addenda is hereby acknowledged:

No. _____, Dated _____	No. _____, Dated _____
No. _____, Dated _____	No. _____, Dated _____
No. _____, Dated _____	No. _____, Dated _____
<input type="checkbox"/> Or check here if no addenda were issued.	

12. **Bidder’s License.**

- Bidder acknowledges that the license required for performance of the Work is as stated in the Invitation to Bid.
- Bidder certifies that it is, at the time of bidding, and shall be throughout the period of the contract, licensed by the State of California to do the type of work required under the terms of the Contract Documents. Bidder further certifies that it is regularly engaged in the general class and type of work called for in the Contract Documents.

13. **Labor Harmony.** The undersigned hereby certifies that Bidder is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the Work.

14. **DIR Registration.** Bidder shall ensure that it and its Subcontractors comply with the registration and compliance monitoring provisions of Labor Code section 1771.4, including furnishing its CPRs to the Labor Commissioner, and are registered pursuant to Labor Code section 1725.5.

15. **Prequalification.** The Bidder confirms that it has been prequalified by the District. In addition, the bidder confirms that, in addition, if components of the Project will be performed by electrical, mechanical, or plumbing subcontractors, then each of those electrical, mechanical, and plumbing first-tier subcontractors with the following license classifications have also been prequalified by the District: C-4, C-7, C-10, C-16, C-20, C-34, C-36, C-38, C-42, C-43, and/or C-46.

16. **SWPPP QSP.** Bidder specifically acknowledges and understands that if it is awarded the Contract, it shall perform the Work of the Project related to being the District's Qualified SWPPP (Storm Water Pollution Prevention Plan) Practitioner ("QSP") and that the Bidder is certified to be the District's QSP, as required by the current California State Water Board's Construction General Permit.

17. **General Acknowledgement.** The Bidder represents that it is competent, knowledgeable, and has special skills with respect to the nature, extent, and inherent conditions of the Work to be performed. Bidder further acknowledges that there are certain peculiar and inherent conditions existent in the construction of the Work that may create, during the Work, unusual or peculiar unsafe conditions hazardous to persons and property. Bidder expressly acknowledges that it is aware of such peculiar risks and that it has the skill and experience to foresee and to adopt protective measures to adequately and safely perform the Work with respect to such hazards.

18. **False Claims Act.** Bidder expressly acknowledges that it is aware that if a false claim is knowingly submitted (as the terms "claim" and "knowingly" are defined in the California False Claims Act, Cal. Gov. Code, §12650 et seq.), the District will be entitled to civil remedies set forth in the California False Claim Act. It may also be considered fraud and the Contractor may be subject to criminal prosecution.

Furthermore, Bidder hereby certifies to the District that all representations, certifications, and statements made by Bidder, as set forth in this bid form, are true and correct and are made under penalty of perjury.

Dated this _____ day of _____ 20 _____

Signature _____

Signed by (Print Name) _____

Title of Person Signing _____

Name of Bidder _____

Type of Organization _____

Address of Bidder _____

Taxpayer's Identification No. of Bidder _____

Telephone Number _____

Fax Number _____

E-mail _____ Web page _____

Bidder's DIR Registration No.: No.: _____

Contractor's License No(s): No.: _____ Class: _____ Expiration Date: _____

No.: _____ Class: _____ Expiration Date: _____

No.: _____ Class: _____ Expiration Date: _____

If Bidder is a corporation, provide the following:

Name of Corporation: _____

President: _____

Secretary: _____

Treasurer: _____

Manager: _____

END OF DOCUMENT

PROJECT MANUAL
for
COUNTRY DAY SCHOOL - CHICO

102 WEST 11th STREET
CHICO, CALIFORNIA 95928

October 4, 2019

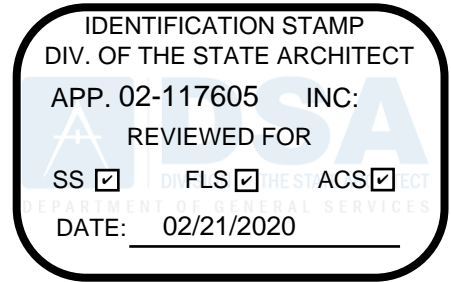
Prepared by:

GRA ARCHITECTURE, INC.
205 23rd Street, Suite 130
Sacramento, California 95816

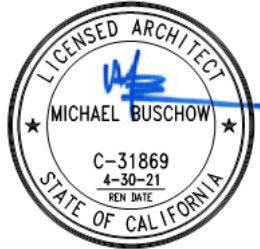
Project #18-06

Project Specifications
for:

Country Day School
Classrooms and Mods
Chico Unified School District



Owner:
Chico Unified School District
1163 E 7th Street
Chico, CA. 95928
(530) 891-3140



Architect:
GRA Architecture
205 23rd Street, Suite 130
Sacramento, CA 95816
(916) 498-7900

Michael P. Buschow

California Registration #C-31869

Civil:
Robertson Erickson Civil Engineers
888 Manzanita Court, Suite 101
Chico, CA 95926
(503)894-3500



Russ Erickson

California Registration #58460

Structural Engineer:
Bevier Structural Engineering, Inc.
2479 Sunrise Blvd.
Gold River, CA 95670
(916) 631-3030



William Bevier

California Registration #S-2271

Mechanical Engineer
Turley & Associates
2431 Capitol Ave.
Sacramento, CA 95816
(916) 325-1065



Brian Provencal

California Registration #M030446

Electrical Engineer:
The Engineering Enterprise
1125 High Street
Auburn, CA 95603
(530) 375-0135



Scott Wheeler

California Registration # E015491

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- Section 07 42 13 Metal Wall Panels
- Section 07 54 00 Thermoplastic Membrane Roofing (Mechanically Attached)
- Section 07 60 00 Flashing and Sheet Metal
- Section 07 72 33 Roof Hatches
- Section 07 84 00 Firestopping
- Section 07 84 43 Fire-Resistant Joint Sealants
- Section 07 90 00 Joint Protection

DIVISION 08 – OPENINGS

- Section 08 11 00 Metal Door and Frames
- Section 08 14 16 Flush Wood Doors
- Section 08 31 13 Access Doors and Frames
- Section 08 41 13 Aluminum-Framed Entrances and Storefronts
- Section 08 70 00 Hardware
- Section 08 80 00 Glazing

DIVISION 09 - FINISHES

- Section 09 21 16 Gypsum Board Assemblies
- Section 09 22 36 Lath
- Section 09 24 00 Portland Cement Plastering
- Section 09 28 13 Cementitious Backing Boards

Section 09 30 13	Ceramic Tiling
Section 09 51 00	Acoustical Ceilings
Section 09 61 00	Flooring Treatment
Section 09 65 00	Resilient Flooring
Section 09 68 00	Carpeting
Section 09 77 33	Fiberglass Reinforced Polyester (FRP) Panels
Section 09 90 00	Painting and Coating
DIVISION 10 - SPECIALTIES	
Section 10 11 00	Visual Display Surfaces
Section 10 14 00	Signage
Section 10 28 13	Toilet Accessories
Section 10 44 00	Fire Protection Specialties
Section 10 99 00	Miscellaneous Specialties
DIVISION 11 – EQUIPMENT (NOT USED)	
DIVISION 12 - FURNISHINGS	
Section 12 20 00	Window Treatments
Section 12 24 13	Roller Window Shades
DIVISION 13 - SPECIAL CONSTRUCTION (NOT USED)	
DIVISION 14 - CONVEYING EQUIPMENT (NOT USED)	
<i>DIVISION 15 thru DIVISION 20 - RESERVED</i>	
DIVISION 21 - FIRE SUPPRESSION	
Section 21 05 00	Automatic Fire Protection System
DIVISION 22 – PLUMBING	
Section 22 05 00	Plumbing and Utilities
DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING	
Section 23 05 00	Mechanical Work - General Requirements
Section 23 05 10	Heating, Ventilating and Air Conditioning
<i>DIVISION 24 - RESERVED</i>	
DIVISION 25 - INTEGRATED AUTOMATION (NOT USED)	
DIVISION 26 – ELECTRICAL	
Section 26 00 10	Basic Electrical Requirements
Section 26 00 90	Electrical Demolition
Section 26 05 19	Building Wire and Cable
Section 26 05 26	Grounding and Bonding
Section 26 05 29	Electrical Hangers and Supports
Section 26 05 31	Conduit

Section 26 05 33	Boxes
Section 26 05 43	Underground Ducts and Structures
Section 26 05 46	Signal Systems Raceway
Section 26 05 53	Electrical Identification
Section 26 09 26	Network Lighting Control System
Section 26 24 16	Panelboards
Section 26 27 16	Cabinets and Enclosures
Section 26 27 26	Wiring Devices
Section 26 28 16	Overcurrent Protective Devices
Section 26 28 19	Disconnect Switches
Section 26 29 00	Motor Controls
Section 26 43 13	Surge Protective Devices (SPD)
Section 26 51 00	Interior Lighting
Section 26 56 00	Exterior Lighting
Section 26 61 16	Fire Alarm System
Section 26 65 16	Security Alarm Monitoring System
Section 26 71 13	Telecommunications Cabling Systems
Section 26 76 13	School Communication System

DIVISION 27 – COMMUNICATIONS

Section 27 51 26	Assistive Listening System (ALS)
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DIVISION 28 - ELECTRONIC SAFETY AND SECURITY (NOT USED)

See Division 26 - Electrical

DIVISION 29 and DIVISION 30 - RESERVED

DIVISION 31 – EARTHWORK

Section 31 10 00	Site Clearing
Section 31 20 00	Earth Moving
Section 31 50 00	Excavation Support and Protection

DIVISION 32 - EXTERIOR IMPROVEMENTS

For Landscaping and Irrigation Specifications reference the Landscaping Drawings

Section 32 12 13	Concrete Paving
Section 32 12 16	Asphalt Paving

DIVISION 33 - UTILITIES

Section 33 11 13	Water Distribution System
Section 33 30 00	Sanitary Sewage Systems
Section 33 41 00	Storm Utility Drainage Piping

END OF DOCUMENT

DOCUMENT 01 11 00

SUMMARY OF WORK

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any);
- 1.1.4. Submittals; and
- 1.1.5. Temporary Facilities and Controls.

1.2. SUMMARY OF WORK COVERED BY CONTRACT DOCUMENTS

The Work consists of the following:

- 1.2.1. Project consists of modernization of a Relocatable Modular Building, a 10,100 S.F. New Kindergarten and After School Classrooms, Administration Area, Restrooms, Library, and Covered Entry Canopy Facility. The Project also includes a New Outdoor Dining Canopy.

1.3. CONTRACTS

Perform the Work under a single, fixed-price Contract.

1.4. DEFERRED APPROVAL ITEMS

- 1.4.1. All items that are subject to subsequent review and approval by the Division of the State Architect shall be as indicated below. No deferred approval items shall be installed until the Contractor has complied with all the processes in the Contract Documents, including Division 01 Document "Submittals."
- 1.4.2. Deferred approval items for this Project are the following: Project:
 - 1.4.2.1 There are no scheduled Deferred Approval Items.

1.5. SPECIAL PROJECT REQUIREMENTS

- 1.5.1. Hours of Work: Work is to be performed during regular work hours. Contractor shall coordinate its operations with activities taking place at each campus such as summer school. Contractor shall ensure that there are no disruptions to such activities.

1.6. WORK BY OTHERS

- 1.6.1. Work to be performed and completed prior to the start of the Project:

1.6.1.1. Asbestos removal/abatement. N/A

1.6.1.2. Lead paint removal/abatement. N/A

1.7. CODES, REGULATIONS AND STANDARDS

- 1.7.1. The codes, regulations, and standards adopted by the State and federal agencies having jurisdiction shall govern minimum requirements for the Project. Where codes, regulations, and standards conflict with the Contract Documents, these conflicts shall be brought to the immediate attention of the District and the Architect.
- 1.7.2. Codes, regulations, and standards are as published effective as of date of bid opening, unless otherwise specified or indicated.

1.8. EXAMINATION OF EXISTING CONDITIONS

- 1.8.1. Contractor shall be held to have examined the Project Site and acquainted itself with the conditions of the Site and of the streets and roads approaching the Site.
- 1.8.2. Prior to commencement of Work, Contractor shall survey the Site and existing buildings and improvements to observe existing damage and defects such as cracks, sags, broken, missing or damaged glazing, other building elements and Site improvements, and other damage.
- 1.8.3. Should Contractor observe cracks, sags, and other damage to and defects of the Site and adjacent buildings, paving, and other items not indicated in the Contract Documents, Contractor shall immediately report same to the District and the Architect.

1.9. CONTRACTOR'S USE OF PREMISES

- 1.9.1. Contractor shall take all reasonable precautions for the safety of the students and the school employees throughout the duration of the Project.
- 1.9.2. If unoccupied and only with District's prior written approval, Contractor may use the building(s) at the Project Site without limitation for its operations, storage, and office facilities for the performance of the Work. If the District chooses to beneficially occupy any building(s), Contractor must obtain the District's written approval for Contractor's use of spaces and types of operations to be performed within the building(s) while so occupied. Contractor's access to the building(s) shall be limited to the areas indicated.

- 1.9.3. If the space at the Project Site is not sufficient for Contractor's operations, storage, office facilities and/or parking, Contractor shall arrange and pay for any additional facilities needed by Contractor, at no expense to District.
- 1.9.4. Contractor shall not interfere with others use of or access to occupied portions of the building(s) or adjacent property.
- 1.9.5. Contractor shall maintain corridors, stairs, halls, and other exit-ways of building clear and free of debris and obstructions at all times.
- 1.9.6. No one other than those directly involved in the demolition and construction or specifically designated by the District or the Architect shall be permitted in the areas of Work during demolition and construction activities.

1.10. PROTECTION OF EXISTING STRUCTURES AND UTILITIES

- 1.10.1. The Drawings show above-grade and below-grade structures, utility lines, and other installations that are known or believed to exist in the area of the Work. Contractor shall locate these existing installations before proceeding with excavation and other operations that could damage same; maintain them in service, where appropriate; and repair damage to them caused by the performance of the Work. Should damage occur to these existing installations, the costs of repair shall be at the Contractor's expense and made to the District's satisfaction.
- 1.10.2. Contractor shall be alert to the possibility of the existence of additional structures and utilities. If Contractor encounters additional structures and utilities, Contractor will immediately report to the District for disposition of same as indicated in the General Conditions.

1.11. UTILITY SHUTDOWNS AND INTERRUPTIONS

- 1.11.1. Contractor shall give the District a minimum of three (3) days written notice in advance of any need to shut off existing utility services or to effect equipment interruptions. District will set exact time and duration for shutdown, and will assist Contractor with shutdown. Work required to re-establish utility services shall be performed by the Contractor.
- 1.11.2. Contractor shall obtain District's written approval as indicated in the General Conditions in advance of deliveries of material or equipment or other activities that may conflict with District's use of the building(s) or adjacent facilities.

1.12. STRUCTURAL INTEGRITY

- 1.12.1. Contractor shall be responsible for and supervise each operation and work that could affect structural integrity of various building elements, both permanent and temporary.
- 1.12.2. Contractor shall include structural connections and fastenings as indicated or required for complete performance of the Work.

1.13. ENVIRONMENTAL REQUIREMENTS

- 1.13.1. This Project has been designated to incorporate environmental concepts established as part of the Collaboration for High Performance Schools. To the extent possible, materials, processes, procedures, and equipment included in these Specifications shall comply with sustainable design practices.

END OF DOCUMENT

DOCUMENT 01 12 10

CONTRACT FORMS AND SUBMITTALS

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any);
- 1.1.4. Submittals; and
- 1.1.5. Construction Schedule.

2. REQUIREMENTS OF THE DISTRICT

2.1. Contractor shall utilize the District's forms as indicated below. This requirement also applies to submittals, including the requirement that the Contractor and its Subcontractors, as indicated, utilize the software, internet and specific programs on this Project as indicated herein.

2.2. The link to the District's on-line document, submittal, and forms program can be found at:

2.3. DISTRICT FORMS

All forms identified below shall utilize District forms available at the above referenced link. Contractor must only utilize these forms, including the programs, processes and software indicated below.

- 2.3.1. **Request for Information.** Contractor shall comply with all applicable provisions in Contract Documents relating to Requests for Information. Contractor shall submit all of its Requests for Information using District's Form attached hereto.
- 2.3.2. **Construction Directive.** Contractor shall comply with all applicable provisions in Contract Documents relating to Changes in the Work. All Construction Directives shall be issued using District's Form attached hereto.
- 2.3.3. **Price Request.** Contractor shall comply with all applicable provisions in Contract Documents relating to Price Requests. All Price Requests shall be issued using District's Form attached hereto.

- 2.3.4. **Proposed Change Order.** Contractor shall comply with all applicable provisions in Contract Documents relating to Changes in the Work. Contractor shall submit all of its Proposed Change Orders using District's Form attached hereto.
- 2.3.5. **Change Order.** Contractor shall comply with applicable provisions in Contract Documents relating to Changes in the Work. All Change Orders shall be issued using District's Form in the General Conditions, Document 00 70 00-46.

2.4. CONTRACTOR SUBMITTALS

All submittals required by the Contract Documents shall be submitted using the programs, processes and software indicated below. If no specific program or format is indicated, then Microsoft Word or Microsoft Excel is acceptable.

2.4.1. Preliminary Construction Schedule

- 2.4.1.1. Utilize Primavera P6 Project Management® software (latest version) by Oracle (PCM) (<http://www.oracle.com/us/industries/engineering-and-construction/index.html>) or another program if pre-approved by the District.

2.4.2. Schedule of Values

- 2.4.2.1. Utilize PCM or another program if pre-approved by the District.

2.4.3. Contractor's Completed Subcontractor List

2.4.4. Contractor's Safety Plan

2.4.5. Schedule of Submittals

- 2.4.5.1. Utilize PCM or another program if pre-approved by the District.

2.4.6. Operations and Maintenance Manual & Instructions

END OF DOCUMENT

DOCUMENT 01 20 00

PRICE AND PAYMENT PROCEDURES

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any).

1.2. DESCRIPTION

- 1.2.1. This Document contains procedures to be followed by the Contractor to request payment.
- 1.2.2. **IF THERE IS ANY INCONSISTENCY IN THIS DOCUMENT WITH THE PROVISIONS IN THE GENERAL CONDITIONS AND THE SPECIAL CONDITIONS THAT THE CONTRACTOR SHALL COMPLY WITH RELATED TO CHANGES AND/OR REQUESTS FOR CHANGES (e.g., "PAYMENTS," "SCHEDULE OF VALUES"), THOSE PROVISIONS IN THE GENERAL CONDITIONS AND THE SPECIAL CONDITIONS SHALL TAKE PRECEDENCE.**

1.3. SECTION INCLUDES

- 1.3.1. Schedule of Values.
- 1.3.2. Application for Payment.

1.4. SCHEDULE OF VALUES

- 1.4.1. Provide a breakdown of the Contract Price with enough detail to facilitate continued evaluation of Applications for Payment and Progress Reports.
- 1.4.2. Contractor must update and resubmit the Schedule of Values before the next Invoice or Application for Payment when Change Orders or Construction Change Directives result in a change in the Contract Price.
- 1.4.3. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule. Comply with the provisions in the General Conditions regarding the Schedule of Values.
 - 1.4.3.1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:

- 1.4.3.1.1. Application for Payment forms.
- 1.4.3.1.2. Submittal Schedule.
- 1.4.3.1.3. Contractor's Construction Schedule.
- 1.4.3.2. Submit the Schedule of Values to District as indicated in the Contract Documents and, if an updated Schedule of Values is needed, then no later than ten (10) days before the date scheduled for submittal of the next Application(s) for Payment.
- 1.4.3.3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.
- 1.4.4. 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.
 - 1.4.4.1. Identification: Include the following Project identification on the Schedule of Values:
 - 1.4.4.1.1. Project name and location.
 - 1.4.4.1.2. Name of District's Representative.
 - 1.4.4.1.3. DSA Application #.
 - 1.4.4.1.4. District's name and address.
 - 1.4.4.1.5. Date of submittal.
 - 1.4.4.2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
 - 1.4.4.2.1. Related Specification document, section or division.
 - 1.4.4.2.2. Description of the Work.
 - 1.4.4.2.3. Name of subcontractor.
 - 1.4.4.2.4. Name of manufacturer or fabricator.
 - 1.4.4.2.5. Name of supplier.
 - 1.4.4.2.6. Change Orders (numbers) that affect value.

1.4.4.2.7. Dollar value.

1.4.4.2.7.1. Percentage of the Contract Price to nearest one-hundredth percent, adjusted to total 100 percent.

1.4.4.3. Provide a breakdown of the Contract Price in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide several line items for principal subcontract amounts, where appropriate. Include separate line items under required principal subcontracts for operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training.

1.4.4.4. Round amounts to nearest whole dollar; total shall equal the Contract Price.

1.4.4.5. 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.

1.4.4.6. 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.

1.4.4.7. Allowances (if any): Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.

1.4.4.8. Each item in the Schedule of Values and Applications for Payments shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

1.4.5. Schedule Updating: Update and resubmit the Schedule of Values before the next Application for Payment if there is a change in the Contract Price.

1.5. APPLICATIONS FOR PAYMENT

1.5.1. **Form:** Contractor shall utilize AIA Form G702 - Application and Certificate for Payment and AIA Form G703 - Continuation Sheet, or District-approved form with the same information as these AIA forms.

1.5.2. **Content and Format:** District shall use Schedule of Values for listing items in its Application for Payment.

1.5.3. Each Application for Payment shall be consistent with previous applications and payments as certified and paid for by District.

END OF DOCUMENT

DOCUMENT 01 21 00

ALLOWANCES

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISION

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions including without limitation, Contract Terms and Definitions;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any).
- 1.1.4. Agreement;
- 1.1.5. Bid Form; and

1.2. SUMMARY

1.2.1. **THE SPECIFIC ALLOWANCES FOR THIS PROJECT ARE AS LISTED IN THE AGREEMENT.**

1.2.2. This Document includes administrative and procedural requirements governing Allowances.

1.2.3. Certain items are specified in the Contract Documents by Allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements may be issued by Change Order or similar document.

1.3. SELECTION AND PURCHASE

1.3.1. At the earliest practical date after award of the Contract, Contractor shall advise District of the date when final selection and purchase of each product or system described by an Allowance must be completed to avoid delaying the Work.

1.3.2. At District's request, obtain proposals for each Allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

1.3.3. Purchase products and systems selected by District from the designated supplier.

1.4. SUBMITTALS

1.4.1. Submit proposals for purchase of products or systems included in Allowances, in the form specified for Change Orders.

- 1.4.2. Submit invoices or delivery slips to show actual quantities of materials delivered to the Site for use in fulfillment of each Allowance.
- 1.4.3. Coordinate and process submittals for Allowance items in same manner as for other portions of the Work.

1.5. COORDINATION

Coordinate Allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6. PAYMENT FOR ALLOWANCES

- 1.6.1. Allowance shall include all-inclusive cost to Contractor of specific products and materials under Allowance and Contractor may bill its time, materials, and other items in the identical structure as a Change Order.

1.7. UNUSED MATERIALS

- 1.7.1. Return unused materials purchased under an Allowance to manufacturer or supplier for credit to District, after installation has been completed and accepted.
- 1.7.2. If requested, prepare and deliver unused material for storage by District when it is not economically practical (as determined by District) to return the material for credit. If directed, deliver unused material to District's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

2. EXECUTION

2.1. EXAMINATION

Examine products covered by an Allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

2.2. PREPARATION

Coordinate materials and their installation for each Allowance with related materials and installations to ensure that each Allowance item is completely integrated and interfaced with related work.

END OF DOCUMENT

DOCUMENT 01 23 00

ALTERNATES AND UNIT PRICING

1. ALTERNATES AND UNIT PRICES

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any);
- 1.1.4. Bid Form and Proposal; and
- 1.1.5. Instruction to Bidders.

2. ALTERNATES

2.1. DESCRIPTION

An amount proposed by Contractor and stated in its Bid Form for certain work defined in the Instruction to Bidders, Bid Form or Contract Documents that may be added to or deducted from the Base Bid amount. The acceptance or rejection of any of the alternates is strictly at the option of the District and subject to District's acceptance of Contractor's stated prices contained in this Proposal.

The cost or credit for each alternate is the net addition to or deduction from the Contract Price to incorporate the alternate into the Work. No other adjustments are made to the Contract Price.

2.2. GENERAL:

- 2.2.1. Coordination: Contractor shall modify or adjust adjacent work as necessary to completely integrate work of the alternate into the Project.
 - 2.2.1.1. Include as part of each alternate, miscellaneous devices, accessories and similar items incidental to or required for a complete installation whether or not indicated as part of the alternate.
 - 2.2.1.2. Include as part of each alternate, the costs of related coordination, modification, or adjustments.
- 2.2.2. If District accepts an alternate, Contractor shall perform the work of the alternate under the same conditions as other Work required by Contract Documents.
- 2.2.3. Notification: Immediately following award of the Contract, Contractor shall notify all of its Subcontractor(s) in writing of the status of each alternate. Indicate if alternates have

been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

- 2.2.4. Schedule of Alternates: A Schedule of Alternates is included at the end of this Document. Specifications referenced in the Schedule of Alternates contain requirements for materials necessary to achieve the Work described under each alternate.

3. UNIT PRICING

3.1. DESCRIPTION

An amount proposed by Contractor and stated in its Bid Form for certain work defined in the Instruction to Bidders and Bid Form that may be priced by unit. The acceptance or rejection of any of the unit prices is strictly at the option of the District and subject to District's acceptance of Contractor's stated prices contained in the Bid Form and may be subsequently negotiated prior to incorporation on Change Order(s).

3.2. GENERAL

Contractor shall completely state all required figures based on Unit Prices required in the Bid Form. Where scope of Work is decreased, all Work pertaining to the item, whether specifically stated or not, shall be omitted and where scope of Work is increased, all work pertaining to that item required to render same ready for use on the Project in accordance with intention of Drawings and Specifications shall be included in an agreed upon price amount.

3.3. UNIT PRICES

Furnish unit prices for each of the named items on a square foot, lineal foot, or per each basis, as requested and applicable. Unit prices shall include all labor, materials, services, profit, overhead, insurance, bonds, taxes, and all other incidental costs of Contractor, subcontractors, and supplier(s).

4. EXECUTION

4.1. SCHEDULE OF ALTERNATES

- 4.1.1 ADDITIVE ALTERNATE #1: New Dining Canopy and Access Ramp (see Drawing 1/A1.0, Drawing 2/A1.2, and Drawing 1/A2.2).
- 4.1.2 ADDITIVE ALTERNATE #2: Existing Modular Building Modifications (see Drawing 1/A1.0, and Drawing 3/A2.0).
- 4.1.3 ADDITIVE ALTERNATE #3: New Terraced Seating at Gymnasium (see Drawing 1/A1.0, and Drawing 3/A1.2).
- 4.1.4 ADDITIVE ALTERNATE #4: New Terraced Seating at Dining Canopy (see Drawing 1/A1.0, and Drawing 6/A1.2).

END OF DOCUMENT

DOCUMENT 01 25 10

PRODUCT OPTIONS AND SUBSTITUTIONS

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any); and
- 1.1.4. Instructions to Bidders.

1.2. DOCUMENT INCLUDES

- 1.2.1. Product options.
- 1.2.2. Limitations on Substitutions.
- 1.2.3. Regulatory Requirements.
- 1.2.4. Substitution Representation.
- 1.2.5. Submittal Procedure.
- 1.2.6. District's Review.

1.3. DEFINITIONS

- 1.3.1. Requests for changes in products, materials, or equipment required by Contract Documents proposed by the Contractor prior to and after award of the Contract are considered requests for substitutions. Contractor must refer to the Instructions to Bidders, the General Conditions and the Special Conditions for limitations on when requests for substitution(s) are permitted on Project. The following are not considered substitutions:
 - 1.3.1.1. Revisions to Contract Documents requested by the District or Architect.
 - 1.3.1.2. Specified options of products, materials, and equipment included in Contract Documents.
- 1.3.2. Whenever in the Specifications any material, product, thing, or service is indicated or specified by grade, patent, or proprietary name, or by name of manufacturer, that Specification shall be deemed to be used for the purpose of facilitating the description

of the material, product, thing, or service, and shall be deemed to be followed by the words "or equal," except:

1.3.2.1. When designated to match other material, product, thing, or service in use on a particular public improvement either completed or in the course of completion;
or

1.3.2.2. When designated as a field test or experiment.

1.4. PRODUCT OPTIONS

1.4.1. **Products Specified by Reference Standards or by Description Only:** Any Product meeting those standards or description.

1.4.2. **Products Specified by Naming One or More Manufacturers with or without Provision for Substitution:** Products of manufacturers named and meeting specifications with substitution of Products or manufacturer only when submitted under provisions of this section.

1.5. LIMITATIONS ON SUBSTITUTIONS

1.5.1. **Requests for substitution prior to bid or after bid, shall only be permitted as indicated in and in accordance with requirements specified in the Instructions to Bidders and the Special Conditions.**

1.5.2. The Bid shall be based upon the standards of quality established by those items of equipment and/or materials which are specifically identified in the Contract Documents.

1.5.3. Burden of proof of merit of requested substitution is the responsibility of the Contractor.

1.5.4. It is the sole responsibility of Contractor to submit the proper content of any requests for substitutions. Incomplete submittals will be rejected.

1.6. REGULATORY REQUIREMENTS

1.6.1. It shall be the responsibility of Contractor to obtain all regulatory approvals required for proposed substitutions.

1.6.2. All regulatory approvals shall be obtained for proposed substitutions prior to submittal of substitution request to Architect.

1.6.3. All costs incurred by the District in obtaining regulatory approvals for proposed substitutions to include the costs of the Architect and any authority having jurisdiction over the Project shall be reimbursed to the District. Costs of these services shall be reimbursed regardless of final acceptance or rejection of substitution.

1.6.4. Substitutions of materials or work procedures which affect the health, safety and welfare of the public shall have prior approval of the Division of the State Architect (DSA) in accordance with the provisions of DSA IR A-6. When substitutions of materials

or work procedures are required to be approved by DSA per IR A-6, a Construction Change Document (CCD) Submittal documenting the proposed modifications shall be prepared and submitted to DSA in accordance with the requirements of DSA IR A-6 submittal requirements. The duties and responsibilities of the District, the Architect, the Contractor, and Project Inspector with respect to each particular CCD shall be as noted in DSA IR A-6.

1.7. SUBSTITUTION REPRESENTATION

- 1.7.1. In submitting a request for substitution, Contractor makes the representation that:
- 1.7.2. Contractor has investigated the proposed substitution and determined that it meets or exceeds the quality level of the specified product;
- 1.7.3. Contractor has determined that all components of the proposed substitution are identical and fully interchangeable with the product name and number specified;
- 1.7.4. Contractor will provide the same warranty or guarantee for the substitution as for the specified product;
- 1.7.5. Contractor will coordinate installation and make changes to other work which may be required for the work to be completed with no additional cost to the District;
- 1.7.6. Contractor waives claims for additional cost or time extension which may subsequently become apparent; and
- 1.7.7. Contractor will reimburse District for the cost of District's and Architect's review or redesign services associated with substitution request.

1.8. SUBMITTAL PROCEDURE

- 1.8.1. Submit six (6) copies of each request.
- 1.8.2. Submit request using District's Substitution Request Form as indicated in Contract Forms and Submittals. Substitution requests that are not on District's required form shall be returned without review.
- 1.8.3. Limit each request to one proposed substitution.
- 1.8.4. Request to include sufficient data so that direct comparison of proposed substitution can be made.
- 1.8.5. Provide complete documentation for each request. Documentation shall include the following information, as appropriate, as a minimum:
 - 1.8.5.1. Statement of cause for substitution request.
 - 1.8.5.2. Identify product by specification section and article number.
 - 1.8.5.3. Provide manufacturer's name, address, and phone number. List fabricators,

suppliers, and installers as appropriate.

- 1.8.5.4. List similar projects where proposed substitution has been used, dates of installation and names of Architect and District.
 - 1.8.5.5. List availability of maintenance services and replacement materials.
 - 1.8.5.6. Documented or confirmation of regulatory approval.
 - 1.8.5.7. Product data, including drawings and descriptions of products.
 - 1.8.5.8. Fabrication and installation procedures.
 - 1.8.5.9. Samples of proposed substitutions.
 - 1.8.5.10. Itemized comparison of significant qualities of the proposed substitution with those of the product specified. Significant qualities may include size, weight, durability, performance requirements and visual effects.
 - 1.8.5.11. Coordination information, including a list of changes or modifications needed to other items of work that will become necessary to accommodate proposed substitution.
 - 1.8.5.12. Statement on the substitutions effect on the Construction Schedule.
 - 1.8.5.13. Cost information including a proposal of the net reduction in cost to the Contract Price if the proposed substitution is accepted.
 - 1.8.5.14. Certification that the substitution is equal to or better in every respect to that required by the Contract Documents and that substitution will perform adequately in the application intended.
 - 1.8.5.15. Waiver of right to additional payment or time that may subsequently become necessary because of failure of substitution to perform adequately.
- 1.8.6. Inadequate warranty, vagueness of submittal, failure to meet specified requirements, or submittal of insufficient data will be cause for rejection of substitution request.

1.9. DISTRICT'S REVIEW

- 1.9.1. The District will accept or reject proposed substitution within a reasonable amount of time.
- 1.9.2. If a request is made prior to bid opening and the District has not completed its review, Contractor shall base its bid on the product specified only.
- 1.9.3. There shall be no claim for additional time for review of proposed substitutions.
- 1.9.4. Final acceptance of a substitution submitted prior to the date established for the receipt of bids will be in the form of an addendum.

COUNTRY DAY SCHOOL - CHICO
102 West 11th Street
Chico, California, 95928

GRA Architecture
Project #18-06

END OF DOCUMENT

01 25 10 - 5
May 10, 2019

DOCUMENT 01 26 00

CONTRACT MODIFICATION PROCEDURES

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any);
- 1.1.4. Allowances;
- 1.1.5. Product Options and Substitutions; and
- 1.1.6. Project Coordination.

1.2. DESCRIPTION

- 1.2.1. This Document contains procedures to be followed by the Contractor to request changes in the Contract Time of the Contract Price.
- 1.2.2. **IF THERE IS ANY INCONSISTENCY IN THIS DOCUMENT WITH THE PROVISIONS IN THE GENERAL CONDITIONS AND THE SPECIAL CONDITIONS THAT THE CONTRACTOR SHALL COMPLY WITH RELATED TO CHANGES AND/OR REQUESTS FOR CHANGES (e.g., "Change in the Work"), THOSE PROVISIONS IN THE GENERAL CONDITIONS AND THE SPECIAL CONDITIONS SHALL TAKE PRECEDENCE.**

1.3. SUMMARY

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

1.4. REGULATORY REQUIREMENTS

- 1.4.1. Modifications to the Project, including but not limited to, Construction Change Directives and/or Change Orders and Addendums, which affect the health, safety and welfare of the public shall have prior approval of the Division of the State Architect (DSA) in accordance with the provisions of DSA IR A-6. When such modifications to the Project are required to be approved by DSA per IR A-6, a Construction Change Document (CCD) Submittal documenting the proposed modifications shall be prepared and submitted to DSA in accordance with the requirements of DSA IR A-6 submittal requirements. The duties and responsibilities of the District, the Architect, the

Contractor, and Project Inspector with respect to each particular CCD shall be as noted in DSA IR A-6.

1.5. CONSTRUCTION CHANGE DIRECTIVE

The District may as provided by law, by Construction Directive and without invalidating the Contract, order changes in the Work consisting of additions, deletions, or other revisions.

1.6. PRICE REQUESTS

- 1.6.1. Do not consider Price Requests to be instructions either to stop work in progress or to execute the proposed change.
- 1.6.2. Within time specified in Price Request after receipt of Price Request, submit a quotation estimating cost adjustments to the Contract Price and the Contract Time necessary to execute the change.
 - 1.6.2.1. 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.
 - 1.6.2.2. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 1.6.2.3. Include costs of labor and supervision directly attributable to the change.
 - 1.6.2.4. 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.

1.7. PROPOSED CHANGE ORDERS

Contractor may propose changes by submitting a request for a change on District's Proposed Change Order form (PCO) to District.

- 1.7.1. 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.
- 1.7.2. Comply with Contract Document requirements if the proposed change requires substitution of one product or system for product or system specified.

END OF DOCUMENT

DOCUMENT 01 26 10

REQUESTS FOR INFORMATION

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any);
- 1.1.4. Documentation Requirements;
- 1.1.5. Electronic Data Transfer;
- 1.1.6. Submittals;
- 1.1.7. Contract Closeout and Final Cleaning;
- 1.1.8. Operation and Maintenance Data;
- 1.1.9. Warranties; and
- 1.1.10. Record Documents;

1.2. DESCRIPTION

This Document contains procedures to be followed by the Contractor to request Architect provide additional information necessary to clarify or amplify an item in the Contract Documents that Contractor thinks is not clearly shown or called for in the Drawings or Specifications or other portions of the Contract Documents, or to address issues that have arisen under field conditions.

1.3. PROCEDURES

- 1.3.1. Notification by Contractor:
 - 1.3.1.1. Submit all requirements for clarification or additional information, whether originated by the Contractor, a Subcontractor, or supplier at any tier, in writing to District as required by the Contract Documents.
 - 1.3.1.2. Number RFIs sequentially. Follow RFI number with sequential alphabetical suffix as necessary for each resubmission. For example, the first RFI would be "001." The second RFI would be "002."

- 1.3.1.3. All RFIs shall reference all applicable Contract Document(s), including Specification section(s), detail(s), page number(s), drawing number(s), and sheet number(s), etc. Contractor shall make suggestions and interpretations of the issue raised by each RFI. An RFI cannot modify the Contract Price, Contract Time, or the Contract Documents.
- 1.3.1.4. Limit each RFI to one subject.
- 1.3.1.5. Submit a RFI if one of the following conditions occurs:
 - 1.3.1.5.1. Contractor discovers an unforeseen condition or circumstance that is not described in the Contract Documents.
 - 1.3.1.5.2. Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents.
- 1.3.2. Contractor shall not:
 - 1.3.2.1. Submit an RFI as a request for substitution.
 - 1.3.2.2. Submit an RFI as a submittal.
 - 1.3.2.3. Submit an RFI without first having thoroughly reviewed the Contract Documents.
 - 1.3.2.4. Submit an RFI in a manner that suggests that specific portions of the Contract Documents are assumed to be excluded or by taking an isolated portion of the Contract Documents in part rather than whole.
 - 1.3.2.5. Submit an RFI in an untimely manner without proper coordination and scheduling of Work related trades.
 - 1.3.2.6. If Contractor submits an RFI contrary to the above, Contractor shall pay the cost of any review, which cost shall be deducted from the Contract Price.
- 1.3.3. Contractor shall be liable to the District for all costs incurred by the District associated with the processing, reviewing, evaluating and responding to any RFI, including without limitation, fees of the Architect and any other design consultant to the Architect or the District, that District reasonably determines:
 - 1.3.3.1. Does not reflect adequate or competent supervision or coordination by the Contractor or any Subcontractor; or
 - 1.3.3.2. Does not reflect the Contractor's adequate or competent knowledge of the requirements of the Work or the Contract Documents;

1.3.3.3. Requests an interpretation or decision of a matter where the information sought is equally available to the Contractor; or

1.3.3.4. Is not justified for any other reason.

1.4. RESPONSE TIME

1.4.1. Architect shall review RFIs and issue a response and instructions to Contractor within a reasonable time frame from the date the RFI is received and dated by the District.

1.4.2. Responses from the District will not change any requirement of the Contract unless so noted by the District in the response to the RFI. Should the Contractor contend that a response to an RFI causes a change to the Contract that requires a Change Order, the Contractor shall, before proceeding, give written notice to the District, indicating that the Contractor considers the District's response to the RFI to be a Change Order, as required by the Contract Documents.

1.4.3. Should Contractor direct its Subcontractors to proceed with the Work affected before receipt of a response from Architect, any portion of the Work which is not done in accordance with the Architect's ultimate interpretations, clarifications, instructions, or decisions is subject to removal or replacement at Contractor's sole expense and responsibility.

END OF DOCUMENT

DOCUMENT 01 31 00

COORDINATION AND PROJECT MEETINGS

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS:

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any); and
- 1.1.4. Technical Specifications.

1.2. SECTION INCLUDES

- 1.2.1. Coordination Responsibilities of the Contractor.
- 1.2.2. Field Engineering Responsibilities of the Contractor.
- 1.2.3. Preconstruction Conference.
- 1.2.4. Progress Meetings.
- 1.2.5. Pre-Installation Conferences.
- 1.2.6. Post Construction Dedication.

1.3. COORDINATION RESPONSIBILITIES OF THE CONTRACTOR

- 1.3.1. Coordinate scheduling, submittals, and Work of the Specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- 1.3.2. Prior to commencement of a particular type or kind of Work examine relevant information, contract documents, and subsequent data issued to the Project.
- 1.3.3. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate Work of various sections having interdependent responsibilities for installing, connecting to, and placing in service such equipment.
- 1.3.4. Closing up of holes, backfilling, and other covering up operations shall not proceed until all enclosed or covered Work and inspections have been completed. Verify before proceeding.

- 1.3.5. Coordinate space requirements and installation of mechanical and electrical Work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- 1.3.6. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- 1.3.7. In locations where several elements of mechanical and electrical Work must be sequenced and positioned with precision in order to fit into available space, prepare coordination drawings showing the actual conditions required for the installation. Prepare coordination drawings prior to purchasing, fabricating, or installing any of the elements required to be coordinated.
- 1.3.8. Closing up of walls, partitions or furred spaces, backfilling, and other covering up operations shall not proceed until all enclosed or covered Work and inspections have been completed. Verify before proceeding.
- 1.3.9. Coordinate completion and cleanup of Work of separate sections in preparation for completion and for portions of Work designated for District's occupancy.
- 1.3.10. After District occupancy of Project, coordinate access to Site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of District's activities.
- 1.3.11. Coordinate all utility company Work in accordance with the Contract Documents.
- 1.3.12. Key Personnel Names: Within fifteen (15) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.4. FIELD ENGINEERING RESPONSIBILITIES OF THE CONTRACTOR

- 1.4.1. Contractor shall employ a Land Surveyor registered in the State of California and acceptable to the Architect.
- 1.4.2. Control datum for survey is that established by District provided survey. Contractor to locate and protect survey control and reference points.
- 1.4.3. Replace dislocated survey control points based on original survey control.
- 1.4.4. Provide field engineering services. Establish elevations, lines, and levels utilizing

recognized engineering survey practices.

- 1.4.5. Upon completion of Work, submit certificate signed by the Land Surveyor that elevations and locations of Work are in conformance with Contract Documents. Record deviations on Record Drawings.

1.5. PRECONSTRUCTION CONFERENCE

- 1.5.1. Construction Manager or Project Engineer will schedule a conference immediately after, and in no case more than fifteen (15) days after, receipt of fully executed Contract Documents prior to Project mobilization.
- 1.5.2. Mandatory Attendance: Construction Manager, Project Engineer, Project Inspector, Architect of Record, Contractor, Contractor's Project Manager, and Contractor's Job/Project Superintendent.
- 1.5.3. Optional Attendance: Architect's consultants, and utility company representatives.
- 1.5.4. Construction Manager shall preside at conference and the Project Architect shall prepare and record minutes and distribute copies.
- 1.5.5. Agenda:
 - 1.5.5.1. Execution of Owner-Contractor Agreement.
 - 1.5.5.2. Issue Notice to Proceed.
 - 1.5.5.3. Submission of executed bonds and insurance certificates.
 - 1.5.5.4. Distribution of Contract Documents.
 - 1.5.5.5. Submission of list of Subcontractors, list of Products, Schedule of Values, and Progress Schedule.
 - 1.5.5.6. Designation of responsible personnel representing the parties.
 - 1.5.5.7. Procedures for processing Change Orders.
 - 1.5.5.8. Procedures for Request for Information.
 - 1.5.5.9. Procedures for testing and inspecting.
 - 1.5.5.10. Procedures for processing applications for payment.
 - 1.5.5.11. Procedures for Project closeout.
 - 1.5.5.12. Use of Premises.
 - 1.5.5.13. Work restrictions.

- 1.5.5.14. District's occupancy requirements or options.
- 1.5.5.15. Responsibility for temporary facilities and controls.
- 1.5.5.16. Construction waste management and recycling.
- 1.5.5.17. Parking availability.
- 1.5.5.18. Office, work and storage areas.
- 1.5.5.19. Equipment deliveries and priority.
- 1.5.5.20. Security.
- 1.5.5.21. Progress cleaning.
- 1.5.5.22. Review required submittals and (if applicable) LEED Certification requirements.

1.6. PROGRESS MEETINGS

- 1.6.1. Construction Manager shall schedule and administer meetings throughout progress of the Work at a minimum of every week.
- 1.6.2. Construction Manager or Project Engineer will make arrangements for meetings, prepare agenda, and preside at meetings. Project Architect shall record minutes (Field Reports), and distribute copies.
- 1.6.3. Attendance Required: Job Superintendent, Construction Manager, Project Engineer, Project Inspector, Architect of Record, Subcontractors, and suppliers as appropriate to agenda topics for each meeting.
- 1.6.4. Agenda:
 - 1.6.4.1. Review minutes of previous meetings (Field Reports).
 - 1.6.4.2. Review of Work progress.
 - 1.6.4.3. Field observations, problems, and decisions.
 - 1.6.4.4. Identification of problems which impede planned progress.
 - 1.6.4.5. Review of submittals schedule and status of submittals.
 - 1.6.4.6. Review of off-site fabrication and delivery schedules.
 - 1.6.4.7. Maintenance of construction schedule.
 - 1.6.4.8. Corrective measures to regain projected schedules.

- 1.6.4.9. Planned progress during succeeding work period.
- 1.6.4.10. Coordination of projected progress.
- 1.6.4.11. Maintenance of quality and work standards.
- 1.6.4.12. Effect of proposed changes on progress schedule and coordination.
- 1.6.4.13. Other business relating to Work.

1.6.5. District has authority to schedule mandatory meetings other than those listed, as necessary.

1.7. PRE-INSTALLATION CONFERENCES

- 1.7.1. When required in individual specification section, Contractor shall convene a pre-installation conference prior to commencing Work of the section. Refer to individual specification section for timing requirements of conference.
- 1.7.2. Contractor shall require its Subcontractors and suppliers directly affecting, or affected by, Work of the specific section to attend.
- 1.7.3. Notify the Construction Manager, Project Engineer, Project Inspector, and Architect of Record four (4) days in advance of meeting date.
- 1.7.4. A pre-installation conference may coincide with a regularly scheduled progress meeting.
- 1.7.5. Contractor shall prepare agenda, preside at conference, record minutes, and distribute copies within two (2) days after conference to participants.
- 1.7.6. The purpose of the meeting will be to review Contract Documents, conditions of installation, preparation and installation procedures, and coordination with related Work and manufacturer's recommendations.
- 1.7.7. Pre-installation Schedule: As a minimum, Work being installed under the Contract Documents technical sections will require pre-installation conferences. Contractor shall review the technical specifications and add all additional requirements for pre-installation meetings contained in those sections.

1.8. POST CONSTRUCTION DEDICATION

- 1.8.1. Attendance Required: Project Superintendent, Contractor, Project Manager, major Subcontractors, Construction Manager, Project Engineer, Project Inspector, and Architect of Record.
- 1.8.2. Preparation prior to Dedication: Contractor and appropriate Subcontractors and suppliers shall:

- 1.8.3. Assist District in operation of mechanical devices and systems.
 - 1.8.3.1. Verify operation and adjust controls for communication systems.
 - 1.8.3.2. Assist District in operation of lighting systems.

END OF DOCUMENT

DOCUMENT 01 32 16

CONSTRUCTION SCHEDULE – NETWORK ANALYSIS

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISION

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any);
- 1.1.4. Coordination and Meetings; and
- 1.1.5. Submittals.

1.2. REFERENCES

- 1.2.1. Construction Planning and Scheduling Manual - A Manual for General Contractors and the Construction Industry, The Associated General Contractors of America (AGC).
- 1.2.2. CSI - Construction Specifications Institute MP-2-1 Master Format.
- 1.2.3. U.S. National Weather Service - Local Climatological Data.

1.3. PERFORMANCE REQUIREMENTS

- 1.3.1. Ensure adequate scheduling during construction activities so Work may be prosecuted in an orderly and expeditious manner within stipulated Contract Time.
- 1.3.2. Ensure coordination of Contractor and Subcontractors at all levels.
- 1.3.3. Ensure coordination of submittals, fabrication, delivery, erection, installation, and testing of products, materials and equipment.
- 1.3.4. Ensure on-time delivery of District furnished products, materials and equipment.
- 1.3.5. Ensure coordination of jurisdictional reviews.
- 1.3.6. Prepare applications for payment.
- 1.3.7. Monitor progress of Work.
- 1.3.8. Prepare proper requests for changes to Contract Time.

- 1.3.9. Prepare proper requests for changes to Construction Schedule.
- 1.3.10. Assist in detection of schedule delays and identification of corrective actions.

1.4. QUALITY ASSURANCE

- 1.4.1. Perform scheduling work in accordance with Construction Planning and Scheduling Manual published by the AGC.
- 1.4.2. Maintain one copy of Construction Planning and Scheduling Manual on Site.
- 1.4.3. In the event of discrepancy between the AGC publication and the Contract Documents, provisions of the Contract Documents shall govern.

1.5. QUALIFICATIONS

1.5.1. Scheduler:

- 1.5.1.1. Contractor shall retain a construction scheduler to work in enough capacity to perform all of the Contractor's requirements to prepare the Construction Schedule. The Scheduler shall plan, coordinate, execute, and monitor a cost/resource loaded CPM schedule as required for Project and have a minimum of five (5) years direct experience using Primavera Project Management.
- 1.5.1.2. Scheduler will cooperate with District and shall be available on site for monitoring, maintaining and updating schedules in a timely manner.
- 1.5.1.3. District has the right to reject the Scheduler based upon a lack of experience as required by this Document or based on lack of performance and timeliness of schedule submittals/fragnets on past projects. Contractor shall within seven (7) calendar days of District's rejection, propose another scheduler who meets the experience requirements stated above.

- 1.5.2. **Administrative Personnel:** Five (5) years minimum experience in using and monitoring schedules on comparable projects.

1.6. SUBMITTALS

- 1.6.1. Submit Short Interval Schedule at each Construction Progress Meeting.
- 1.6.2. Submit Time Adjustment Schedule within five (5) days of commencement of a claimed delay.
- 1.6.3. Submit Recovery Schedules as required for timely completion of Work or when demanded by the District.
- 1.6.4. Submit job cost reports when demanded by the District.

- 1.6.5. Submit one (1) reproducible and two (2) copies of each schedule and cost report.
- 1.6.6. Submit large format plotted schedules monthly or at the request of the District or Construction Manager.

1.7. REVIEW AND EVALUATION

- 1.7.1. Contractor shall participate in joint review of Construction Schedule and Reports with District and Architect.
- 1.7.2. Within seven (7) days of receipt of District and/or Architect's comments provide satisfactory revision to Construction Schedule or adequate justification for activities in question.
- 1.7.3. In the event that an activity or element of Work is not detected by District or Architect review, such omission or error shall be corrected by next scheduled update and shall not affect Contract Time.
- 1.7.4. Acceptance by District of corrected Construction Schedule shall be a condition precedent to making any progress payments.
- 1.7.5. Cost-loaded values of Construction Schedule shall be basis for determining progress payments.
- 1.7.6. Review and acceptance by District and Architect of Preliminary Construction Schedule or Construction Schedule does not constitute responsibility whatsoever for accuracy or feasibility of schedules nor does such acceptance expressly or impliedly warrant, acknowledge or admit reasonableness of activities, logic, duration, manpower, cost or equipment loading stated or implied on schedules.

1.8. FORMAT

- 1.8.1. Prepare diagrams and supporting mathematical analyses using Precedence Diagramming Method, under concepts and methods outlined in AGC Construction Planning and Scheduling Manual, or other method pre-approved by District.
- 1.8.2. **Listings:** Reading from left to right, in ascending order for each activity.
- 1.8.3. **Diagram Size:** 42 inches maximum height x width required.
- 1.8.4. **Scale and Spacing:** To allow for legible notations and revisions.
- 1.8.5. Illustrate order and interdependence of activities and sequence of Work.
- 1.8.6. Illustrate complete sequence of construction by activity.
- 1.8.7. Provide legend of symbols and abbreviations used.

1.9. COST AND SCHEDULE REPORTS

1.9.1. **Activity Analysis:** Tabulate each activity of network diagram and identify for each activity:

1.9.1.1. Description.

1.9.1.2. Interface with outside contractors or agencies.

1.9.1.3. Number.

1.9.1.4. Preceding and following number.

1.9.1.5. Duration.

1.9.1.6. Earliest start date.

1.9.1.7. Earliest finish date.

1.9.1.8. Actual start date.

1.9.1.9. Actual finish date.

1.9.1.10. Latest start date.

1.9.1.11. Latest finish date.

1.9.1.12. Total and free float.

1.9.1.13. Identification of critical path activity.

1.9.1.14. Monetary value keyed to Schedule of Values.

1.9.1.15. Manpower requirements.

1.9.1.16. Responsibility.

1.9.1.17. Percentage complete.

1.9.1.18. Variance positive or negative.

1.9.2. **Cost Report:** Tabulate each activity of network diagram and identify for each activity:

1.9.2.1. Description.

1.9.2.2. Number.

1.9.2.3. Total cost.

1.9.2.4. Percentage complete.

1.9.2.5. Value prior to current period.

1.9.2.6. Value this period.

1.9.2.7. Value to date.

1.9.3. **Required Sorts:** List activities in sorts or groups:

1.9.3.1. By activity number.

1.9.3.2. By amount of float time in order of early start.

1.9.3.3. By responsibility in order of earliest start date.

1.9.3.4. In order of latest start dates.

1.9.3.5. In order of latest finish dates.

1.9.3.6. Application for payment sorted by Schedule of Values.

1.9.3.7. Listing of activities on critical path.

1.9.4. Listing of basic input data which generates schedule.

1.10. CONSTRUCTION SCHEDULE

1.10.1. Contractor shall develop and submit a cost loaded preliminary schedule of construction (or Preliminary Construction Schedule) as required by this Document and the Contract Documents. It shall be submitted in computer generated network format and shall be organized by Activity Codes representing the intended sequencing of the Work, and with time scaled network diagrams of activities. The Preliminary Construction Schedule shall include activities such as mobilization, preparation of submittals, specified review periods, procurement items, fabrication items, milestones, and all detailed construction activities.

1.10.2. Upon District's acceptance of the Preliminary Construction Schedule, Contractor shall update the accepted Preliminary Construction Schedule until Contractor's Construction Schedule is fully developed and accepted. Since updates to the Construction Schedule are the basis for payment to Contractor, submittal and acceptance of the Construction Schedule and updates shall be a condition precedent to making of monthly payments, as indicated in the General Conditions.

1.10.3. Failure to submit an adequate or accurate Preliminary Construction Schedule, Construction Schedule, updates thereto or failure to submit on established dates, will be considered a breach of Contract.

1.10.4. Failure to include any activity shall not be an excuse for completing all Work by required

Completion Date.

- 1.10.5. Activities of long intervals shall be broken into increments no longer than fourteen (14) days or a value over \$20,000.00, unless approved by the District or it is a non-construction activity for procurement and delivery.
- 1.10.6. The Construction Schedule shall comply with the following and include the following:
 - 1.10.6.1. Provide a written narrative describing Contractor's approach to mobilization, procurement, and construction during the first thirty (30) calendar days including crew sizes, equipment and material delivery, Site access, submittals, and permits.
 - 1.10.6.2. Shall designate critical path or paths.
 - 1.10.6.3. Procurement activities to include mobilization, shop drawings and sample submittals.
 - 1.10.6.4. Identification of key and long-lead elements and realistic delivery dates.
 - 1.10.6.5. Construction activities in units of whole days limited to fourteen (14) days for each activity except non-construction activities for procurement and delivery.
 - 1.10.6.6. Approximate cost and duration of each activity.
 - 1.10.6.7. Shall contain seasonal weather considerations.
 - 1.10.6.8. Indicate a date for Project Completion that is no later than Completion Date subject to any time extensions processed as part of a Change Order.
 - 1.10.6.9. Conform to mandatory dates specified in the Contract Documents.
 - 1.10.6.10. Contractor shall allow for inclement weather in the Proposed Baseline Schedule by incorporating an activity titled "Rain Day Impact Allowance" as the last activity prior to the Completion Milestone. No other activities may be concurrent with it. The duration of the Rain Day Impact Allowance activity will be in accordance with the Special Conditions, and will be calculated from the Notice to Proceed until the Completion.
 - 1.10.6.11. Level of detail shall correspond to complexity of work involved.
 - 1.10.6.12. Indicate procurement activities, delivery, and installation of District furnished material and equipment.
 - 1.10.6.13. Designate critical path or paths.
 - 1.10.6.14. Subcontractor work at all levels shall be included in schedule.
 - 1.10.6.15. As developed, shall show sequence and interdependence of activities

required for complete performance of Work.

1.10.6.16. Shall be logical and show a coordinated plan of Work.

1.10.6.17. Show order of activities and major points of interface, including specific dates of completion.

1.10.6.18. Duration of activities shall be coordinated with Subcontractors and suppliers and shall be best estimate of time required.

1.10.6.19. Shall show description, duration and float for each activity.

1.10.7. **Activity.** An activity shall meet the following criteria:

1.10.7.1. Any portion or element of Work, action, or reaction that is precisely described, readily identifiable, and is a function of a logical sequential process.

1.10.7.2. Descriptions shall be clear and concise. Beginning and end shall be readily verifiable. Starts and finishes shall be scheduled by logical restraints.

1.10.7.3. Responsibility shall be identified with a single performing entity.

1.10.7.4. Additional codes shall identify building, floor, bid opening and/or District's receipt of proposals, whichever is acceptable and CSI classification.

1.10.7.5. Assigned dollar value (cost-loading) of each activity shall cumulatively equal total contract amount. Mobilization, bond and insurance costs shall be separate. General requirement costs, overhead, profit, shall be prorated throughout all activities. Activity costs shall correlate with Schedule of Values.

1.10.7.6. Each activity shall have manpower-loading assigned.

1.10.7.7. Major construction equipment shall be assigned to each activity.

1.10.7.8. Activities labeled start, continue or completion are not allowed.

1.10.8. **Equipment and Materials.** For major equipment and materials show a sequence of activities including:

1.10.8.1. Preparation of shop drawings and sample submissions.

1.10.8.2. Review of shop drawings and samples.

1.10.8.3. Finish and color selection.

1.10.8.4. Fabrication and delivery.

1.10.8.5. Erection or installation.

1.10.8.6. Testing.

1.10.9. Include a minimum of fifteen (15) days prior to Completion Date for punch lists and clean up. No other activities shall be scheduled during this period.

1.11. SHORT INTERVAL SCHEDULE

1.11.1. The Four-Week Rolling Schedule shall be based on the most recent District Accepted Construction Schedule or Update. It shall include weekly updates to all construction, submittal, fabrication/procurement, and separate Work Contract activities. Contractor shall ensure that it accurately reflects the current progress of the Work.

1.11.2. Shall be fully developed horizontal bar-chart-type schedule directly derived from Construction Schedule.

1.11.3. Prepare schedule on sheet of sufficient width to clearly show data.

1.11.4. Provide continuous heavy vertical line identifying first day of week.

1.11.5. Provide continuous subordinate vertical line identifying each day of week.

1.11.6. Identify activities by same activity number and description as Construction Schedule.

1.11.7. Show each activity in proper sequence.

1.11.8. Indicate graphically sequences necessary for related activities.

1.11.9. Indicate activities completed or in progress for previous two (2) week period.

1.11.10. Indicate activities scheduled for succeeding three (3) week period.

1.11.11. Further detail should be added if necessary to monitor schedule or if requested by District.

1.12. REQUESTED TIME ADJUSTMENT SCHEDULE

1.12.1. Updated Construction Schedule shall not show a Completion Date later than the Contract Time, subject to any time extensions processed as part of a Change Order.

1.12.2. If an extension of time is requested, a separate schedule entitled "Requested Time Adjustment Schedule" shall be submitted to District and Architect.

1.12.3. Indicate requested adjustments in Contract Time which are due to changes or delays in completion of Work.

1.12.4. Extension request shall include forecast of Project Completion date and actual achievement of any dates listed in Contract Documents.

- 1.12.5. To the extent that any requests are pending at time of any Construction Schedule update, Time Adjustment Schedule shall also be updated.
- 1.12.6. Schedule shall be a time-scaled network analysis.
- 1.12.7. Accompany schedule with formal written time extension request and detailed impact analysis justifying extension.
- 1.12.8. Time impact analysis shall demonstrate time impact based upon date of delay, and status of construction at that time and event time computation of all affected activities. Event times shall be those as shown in latest Construction Schedule.
- 1.12.9. Activity delays shall not automatically constitute an extension of Contract Time.
- 1.12.10. Failure of Subcontractors shall not be justification for an extension of time.
- 1.12.11. Float is not for the exclusive use or benefit of any single party. Float time shall be apportioned according to needs of Project, as determined by the District.
- 1.12.12. Float suppression techniques such as preferential sequencing, special lead/lag logic restraints, extended activity durations, or imposed dates shall be apportioned according to benefit of Project.
- 1.12.13. Extensions will be granted only to extent that time adjustments to activities exceed total positive float of the critical path and extends Completion date.
- 1.12.14. District shall not have an obligation to consider any time extension request unless requirements of Contract Documents, and specifically, but not limited to these requirements, are complied with.
- 1.12.15. District shall not be responsible or liable for any construction acceleration due to failure of District to grant time extensions under Contract Documents should requested adjustments in Contract Time not substantially comply with submission and justification requirements of Contract for time extension requests.
- 1.12.16. In the event a Requested Time Adjustment Schedule and Time Impact Analysis are not submitted within ten (10) days after commencement of a delay it is mutually agreed that delay does not require a Contract Time extension.

1.13. RECOVERY SCHEDULE

- 1.13.1. When activities are behind Construction Schedule a supplementary Recovery Schedule shall be submitted.
- 1.13.2. Contractor shall prepare and submit to the District a Recovery Schedule whenever activities are behind Construction Schedule or at any time requested by the District, at no cost to the District.
- 1.13.3. Form and detail shall be sufficient to explain and display how activities will be

rescheduled to regain compliance with Construction Schedule and to complete the Work by the Completion Date.

- 1.13.4. Maximum duration shall be one (1) month and shall coincide with payment period.
- 1.13.5. Ten (10) days prior to expiration of Recovery Schedule, Contractor shall have to show verification to determine if activities have regained compliance with Construction Schedule. Based upon this verification the following will occur:
 - 1.13.5.1. Supplemental Recovery Schedule will be submitted to address subsequent payment period.
 - 1.13.5.2. Construction Schedule will be resumed.

1.14. UPDATING SCHEDULES

- 1.14.1. Review and update schedules at least ten (10) days prior to submitting an Application for Payment.
- 1.14.2. Maintain schedules to record actual prosecution and progress.
- 1.14.3. Approved Change Orders which affect schedules shall be identified as separate new activities.
- 1.14.4. Change Orders of less than \$5,000.00 value or less than three (3) days duration need not be shown unless critical path is affected.
- 1.14.5. No other revisions shall be made to schedules unless authorized by District.
- 1.14.6. **Schedule Narrative Report:** Contractor shall include a written report to explain the Monthly Schedule Update. The narrative shall, at a minimum, include the following headings with appropriate discussions of each topic:
 - 1.14.6.1. Activities or portions of activities completed during previous reporting period.
 - 1.14.6.2. Actual start dates for activities currently in progress.
 - 1.14.6.3. Deviations from critical path in days ahead or behind.
 - 1.14.6.4. List of major construction equipment used during reporting period and any equipment idle.
 - 1.14.6.5. Number of personnel by trade engaged on Work during reporting period.
 - 1.14.6.6. Progress analysis describing problem areas.
 - 1.14.6.7. Current and anticipated delay factors and their impact.
 - 1.14.6.8. Proposed corrective actions and logic revisions for Recovery Schedule.

1.14.6.9. Proposed modifications, additions, deletions and changes in logic of Construction Schedule.

1.14.6.10. In updating the Schedule, Contractor shall not modify Activity ID numbers, schedule calculation rules/criteria, or the Activity Coding Structure required.

1.14.7. Schedule update will form basis upon which progress payments will be made.

1.14.8. District will not be obligated to review or process Application for Payment until the Construction Schedule and Schedule Narrative Report have been submitted.

1.15. DISTRIBUTION

1.15.1. Following joint review and acceptance of updated schedules distribute copies to District, Architect, and all other concerned parties.

1.15.2. Instruct recipients to promptly report in writing any problem anticipated by projections shown in schedules.

2. PRODUCTS

2.1. SCHEDULING SOFTWARE

Contractor shall utilize District-approved software and shall employ the Critical Path Method (CPM) in the development and maintenance of the Construction Schedule. The scheduling software shall be capable of being resource loaded with manpower, costs and materials. It shall also be capable of generating time-scaled logic diagrams, resource histograms and profiles, bar charts, layouts and reports with any and/or all activity detail.

2.2. ELECTRONIC DATA

Provide compact disk(s) that contain a back-up of the Proposed Baseline Schedule data on it and in a format approved by the District.

END OF DOCUMENT

DOCUMENT 01 33 00

SUBMITTALS

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISION

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions;
- 1.1.2. Special Conditions;
- 1.1.3. Instructions to Bidders;
- 1.1.4. Summary of Work;
- 1.1.5. Contract Forms and Submittals;
- 1.1.6. Product Options and Substitutions;
- 1.1.7. Requests for Information;
- 1.1.8. Contract Closeout and Final Cleaning;
- 1.1.9. Operation and Maintenance Data;
- 1.1.10. Warranties;
- 1.1.11. Record Documents;
- 1.1.12. Demonstration and Training;

1.2. DOCUMENT INCLUDES

- 1.2.1. Submittal procedures – Use of Primavera.
- 1.2.2. Shop drawings.
- 1.2.3. PCM (or other pre-approved program) Electronic Submittal Process
- 1.2.4. Product data.
- 1.2.5. Samples.
- 1.2.6. Manufacturers' Instructions.
- 1.2.7. Manufacturers' Certificates.

- 1.2.8. Mock-Up.
- 1.2.9. Deferred approval requirements.

1.3. SUBMITTAL PROCEDURES – USE OF PRIMAVERA OR ANOTHER PRE-APPROVED PROGRAM

Contractor shall utilize District-approved software for the submittal process.

- 1.3.1. Contractor shall transmit each submittal in conformance with requirements of this Document. For each submittal, Contractor shall:
 - 1.3.1.1. Sequentially number the transmittal forms. Resubmitted submittals must have the original number with an alphabetic suffix;
 - 1.3.1.2. Identify Project and Architect's project number, Contractor, Subcontractor or supplier; pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate;
 - 1.3.1.3. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the Work and Contract Documents. Submittals without Contractor's stamp and signature will be returned without review.
- 1.3.2. Coordinate preparation and processing of submittals with performance of Work. Transmit each submittal sufficiently in advance of performance of Work to avoid delay.
 - 1.3.2.1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 1.3.2.2. Coordinate transmittal of different types of submittals for related parts of Work so processing will not be delayed because of the need to review submittals concurrently for coordination.
 - 1.3.2.3. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- 1.3.3. Comply with Contract Documents for list of submittals and time requirements for scheduled performance of Work.
- 1.3.4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
- 1.3.5. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
- 1.3.6. Provide space for Contractor and Architect review stamps.

- 1.3.7. Revise and resubmit submittals as required, identify all changes made since previous submittal.
- 1.3.8. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.
- 1.3.9. Submittals not requested will not be recognized or processed. Submittals not requested will be returned without review.

1.4. SHOP DRAWINGS

- 1.4.1. Prepare Project-specific information, drawn accurately to scale. Do not reproduce Contract Documents or copy standard information as the basis of shop drawings. Standard information prepared without specific reference to the Project is not a shop drawing.
- 1.4.2. Do not use or allow others to use Shop Drawings which have been submitted and have been rejected.
- 1.4.3. Preparation: Fully illustrate requirements in Contract Documents. Include the following information, as applicable:
 - 1.4.3.1. Dimensions.
 - 1.4.3.2. Identification of products.
 - 1.4.3.3. Fabrication and installation drawings.
 - 1.4.3.4. Roughing-in and setting diagrams.
 - 1.4.3.5. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - 1.4.3.6. Shop work manufacturing instructions.
 - 1.4.3.7. Templates and patterns.
 - 1.4.3.8. Schedules.
 - 1.4.3.9. Design calculations.
 - 1.4.3.10. Compliance with specified standards.
 - 1.4.3.11. Notation of coordination requirements.
 - 1.4.3.12. Notation of dimensions established by field measurements.
 - 1.4.3.13. Relationship to adjoining construction clearly indicated.

1.4.3.14. Seal and signature of professional engineer if specified.

1.4.3.15. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

1.4.3.16. All deviations from the Contract Documents, clearly indicated.

1.4.3.17. Copy of letter indicating acceptance of deviations indicated on the submittal.

1.4.4. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).

1.4.5. Do not use Shop Drawings without an appropriate final stamp from the Contractor and District indicating action taken in connection with construction.

1.4.6. Deviations from Contract Documents require specific written acceptance by the District of the noted deviation and clear indication on the submittal.

1.5. ELECTRONIC SUBMITTAL PROCESS

1.5.1. Submittal Procedure for Large Format Shop Drawings.

1.5.1.1. Contractor shall provide six (6) paper copies of the large format Shop Drawings directly to the District and the Construction Manager (CM) and Contractor will upload/post an electronic transmittal (with a detailed description of the submittal including the subject, specification number and number of drawings) on PCM (or other pre-approved program).

1.5.1.2. Contractor shall verify that the Schedule of Submittals and all submittal log(s) on PCM (or other pre-approved program) are accurate and up to date.

1.5.1.3. The District and Architect will review and markup each Submittal and provide changes to Contractor for Contractor's incorporation into the Submittal.

1.5.1.4. This process will continue until the Contractor has provided a Submittal that is acceptable to the District and the Architect.

1.5.1.5. Once a Submittal is accepted, the District will provide a final accepted Submittal to the Contractor and the Contractor will closeout that one Submittal.

1.5.1.6. Contractor shall send one (1) copy of the completed record submittal of the large format documents to a vendor (Ford Graphics is suggested) for scanning and posting on PCM (or other pre-approved program).

1.5.2. Product Data, Calculations and Small Format Drawings

1.5.2.1. Contractor shall upload/post one (1) electronic copy (from manufacturer's

website or pre-scanned) of the product literature, data, calculations, and/or small format shop drawings to PCM (or other pre-approved program) with a Transmittal (with a detailed description of the submittal) directly to the CM.

- 1.5.2.2. The District and Architect will review and markup each Submittal and provide changes to Contractor for Contractor's incorporation into the Submittal.
- 1.5.2.3. This process will continue until the Contractor has provided a Submittal that is acceptable to the District and the Architect.
- 1.5.2.4. Once a Submittal is accepted, the District will provide a final accepted Submittal to the Contractor and the Contractor will closeout that one Submittal.
- 1.5.2.5. Contractor shall send one (1) copy of the completed record submittal of the large format documents to a vendor (Ford Graphics is suggested) for scanning and posting on PCM (or other pre-approved program).

1.5.3. Sample Submittal Procedure – (Product / Assembly Samples)

- 1.5.3.1. Contractor shall provide four (4) physical samples directly to the District and the CM and Contractor will upload/post an electronic transmittal (with a detailed description of the submittal including the subject, specification number and number of drawings) on PCM (or other pre-approved program).
- 1.5.3.2. The District and Architect will review and markup each Submittal and provide changes to Contractor for Contractor's incorporation into the Submittal.
- 1.5.3.3. This process will continue until the Contractor has provided a Submittal that is acceptable to the District and the Architect.
- 1.5.3.4. Once a Submittal is accepted, the District will provide a final accepted Submittal to the Contractor and the Contractor will closeout that one Submittal.
- 1.5.3.5. Contractor shall send one (1) copy of the completed record submittal of the large format documents to a vendor (Ford Graphics is suggested) for scanning and posting on PCM (or other pre-approved program).

1.6. PRODUCT DATA

- 1.6.1. In addition to the above requirements, mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.
- 1.6.2. After review, distribute in accordance with the above provisions and provide copies for Record Documents described in the Contract Documents.

1.7. SAMPLES

- 1.7.1. In addition to the above requirements, submit samples to illustrate functional and aesthetic characteristics of the Product in accordance with this Document, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- 1.7.2. Where specific colors or patterns are not indicated, provide materials and products specified in the full range of color, texture and pattern for selection by District. Range shall include standard stocked color/texture/pattern, standard color/texture/pattern not stocked, but available from manufacturer, and special color/ texture/pattern available from manufacturer as advertised in product data and brochures. Unless otherwise indicated in individual specification sections, District may select from any range at no additional cost to District.
- 1.7.3. Include identification on each sample, with full Project information.
- 1.7.4. Submit the number of samples that Contractor requires, plus one that will be retained by Architect and one by District.
- 1.7.5. Reviewed samples which may be used in the Work are indicated in individual specification Sections.

1.8. MANUFACTURERS' INSTRUCTIONS

- 1.8.1. When specified in individual specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.
- 1.8.2. Identify conflicts between manufacturers' instructions and Contract Documents.

1.9. MANUFACTURERS' CERTIFICATES

- 1.9.1. When specified in individual specification Sections, submit manufacturers' certificates to Architect for review, in quantities specified for Product Data.
- 1.9.2. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- 1.9.3. Certificates may be recent or previous test results on material or Product, but must be acceptable to District.

1.10. MOCK-UP

- 1.10.1. Where indicated, provide mock-ups as required. Mock-ups shall be prepared per the specifications and shall accurately and reasonably represent the quality of construction the Contractor will provide. If the mock-up or portions thereof do not adequately represent the quality of the work specified, the Contractor shall modify the mock-up as needed.
- 1.10.2. Once completed to the District's satisfaction, the mock-up shall serve as the standard of

quality for the work.

1.10.3. All mock-ups, at District's option, shall remain the property of the District. If not required by the District, Contractor shall remove and dispose of the mock-up.

1.10.4. Where indicated, on-site mock-ups, if accepted, may be integrated into the Work.

1.11. ARCHITECT'S REVIEW OF SUBMITTALS

1.11.1. Submittals will be reviewed and stamped by the Architect "No exceptions taken," "Submit specified item" or "Make corrections noted" to indicate full or conditioned approval or "Revise and resubmit" or "Rejected" to indicate disapproval. Terms are defined as follows:

1.11.1.1.No Exceptions Taken: Accepted subject to its compatibility with future submittals and additional partial submittals for portions of the work not covered in this submittal. Does not constitute approval or deletion of specified or required items not shown in the partial submittal.

1.11.1.2.Submit specified item: Submit to the Architect the items indicated for review.

1.11.1.3.Correct as noted: Same as 1., except that minor corrections as noted shall be made by the Contractor. No resubmittal required.

1.11.1.4.Revise and resubmit: Rejected because of major inconsistencies or errors which shall be resolved or corrected by the Contractor prior to subsequent review by the Architect.

1.11.1.5.Rejected: Submitted material does not conform to plans and specifications in major respect. For example, wrong size, model, capacity or material. Resubmit.

1.11.1.6.Receipt Acknowledged. Received, recorded and distributed without further action.

1.11.2. Submittals reviewed by the Architect which have been stamped shall be deemed to have the following language affixed and made a part thereof, regardless of the initial or subsequent readability of the actual stamp.

1.11.2.1. Corrections or comments made on submittals during this review do not relieve the contractor from compliance with the requirements of the drawings and specifications. This check is for review of general conformance with the design concept of the project and general compliance with information given in the Contract Documents. The contractor is responsible for confirming and correlating all quantities and dimensions, selection of fabrication processes and techniques of

construction, coordinating the work of the trades; and performing the work in a safe and satisfactory manner.

1.11.3. Architect's review of submittals shall be completed within ten working days of the date of submission. Any requests by Architect for additional time shall not be unreasonably withheld.

1.11.4. Architect's review of submittals has, as a primary objective, to assist in the completion of the project on time and in conformance with the Contract requirements by permitting review of material and fabricated items prior to ordering. Architect's review of submittals is based only on the data presented and extends only to conformance with general design intent and information contained in the Contract Documents.

1.11.5. Architect's approval of submittals does not constitute final acceptance or unqualified approval of items or work proposed or put in place, nor does it constitute acceptance of responsibility for the accuracy, coordination or completeness of submittals. Architect's approval of submittals does not relieve the Contractor from the responsibility for errors, omissions, or compliance with all the requirements of the Contract Documents.

1.11.6. Reimbursement of the Architect's costs for review:

1.11.6.1. Architect will record all time and expenses incurred to review submittals requiring more than two reviews.

1.11.6.2. Contractor shall reimburse the District through deduction from amounts due the Contractor upon receipt of the Architect's billing and that of the Architect's consultants at standard billing rates for all time and expenses incurred in unanticipated reviews.

1.11.7. Architect's review of submittals does not change the Contract in any manner.

1.12. RESUBMITTAL

1.12.1. Make all corrections or revisions required by reviewer's comments at Contractor's expense and resubmit as initially specified above. No additional costs will be authorized for corrections or revisions.

1.12.2. Product data and shop drawings:

1.12.2.1. Revise initial drawings or data and resubmit as initially specified.

1.12.2.2. Indicate changes which have been made other than those requested by reviewer.

1.12.3. Submit new samples as initially specified.

1.13. DISTRIBUTION

- 1.13.1. Distribute only submittals with Architect/Engineer (and DSA as applicable) stamps of review. Contractor is responsible for coordination of submittals and comments following review. Contractor to provide all additional reproduction costs for copies required by the Contractor at its expense. No additional costs will be authorized for Contractor costs pertaining to submittals.

1.14. DEFERRED APPROVAL REQUIREMENTS

- 1.14.1. Installation of deferred approval items shall not be started until detailed plans, specifications, and engineering calculations have been accepted and signed by the Architect or Engineer in general responsible charge of design and signed by a California registered Architect or professional engineer who has been delegated responsibility covering the work shown on a particular plan or specification and approved by the agency having authority (e.g., State Fire Marshall, Division of the State Architect, gas company, electrical utility company, water district, etc.). Deferred approval items for this Project are as indicated in the Summary of Work.
- 1.14.2. Unless otherwise indicated in the Contract Documents or if District provides written approval of a longer time period, Contractor shall submit all deferred approval items for approval within thirty (30) days of the notice to proceed with the Construction Phase.
- 1.14.3. Deferred approval drawings and specifications become part of the approved documents for the Project when they are submitted to and approved by DSA.
- 1.14.4. Submit material using electronic submittal process as defined above.
- 1.14.5. Identify and specify all supports, fasteners, spacing, penetrations, etc., for each of the deferred approval items, including calculations for each and all fasteners.
- 1.14.6. Submit documents to Architect for review prior to forwarding to DSA.
- 1.14.7. Documents shall bear the stamp and signature of the Structural, Mechanical, or Electrical Engineer licensed in the State of California who is responsible for the work shown on the documents.
- 1.14.8. Architect and its subconsultants will review the documents only for conformance with design concept shown on the documents. The Architect will then forward the Submittal to agency having authority for approval.
- 1.14.9. Contractor shall respond to review comments made by DSA and revise and resubmit submittal to the Architect for re-submittal to DSA.
- 1.14.10. Contractor is notified that significant lead time is required for deferred approval review by DSA and shall schedule work accordingly. No extension of Contract Time will be allowed for delays incurred by deferred approval review. The Architect is not responsible for DSA delays in deferred approval review.

END OF DOCUMENT

DOCUMENT 01 40 00

QUALITY REQUIREMENTS

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any);
- 1.1.4. Drawings;
- 1.1.5. Construction Schedule – Network Analysis;
- 1.1.6. General Definitions and References.

1.2. SUMMARY

- 1.2.1. This Document includes administrative and procedural requirements for quality assurance and quality control.
- 1.2.2. Testing and inspecting services by the District are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Documents' requirements.
 - 1.2.2.1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Specifications for those activities. Requirements in those Specifications may also cover production of standard products.
 - 1.2.2.2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Documents' requirements.
 - 1.2.2.3. Requirements for Contractor to provide quality-assurance and -control services required by District, District's consultants, or authorities having jurisdiction are not limited by provisions of this Document.

1.3. DEFINITIONS

- 1.3.1. 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.

- 1.3.2. 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 District or its consultants.
- 1.3.3. Mock-ups: Full-size, physical assemblies that are constructed on-site. Mock-ups 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; they are not Samples. Approved mock-ups establish the standard by which the Work will be judged.
- 1.3.4. Laboratory Mock-ups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.
- 1.3.5. 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.
- 1.3.6. Product Testing: Tests and inspections that are performed by an NRTL (National Recognized Testing Laboratory), an NVLAP (National Voluntary Laboratory Accreditation Program), or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- 1.3.7. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- 1.3.8. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

1.4. CONFLICTING REQUIREMENTS

- 1.4.1. 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 uncertainties and requirements that are different but apparently equal, to District for a decision before proceeding.
- 1.4.2. 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 District for a decision before proceeding.

1.5. SUBMITTALS

- 1.5.1. Qualification Data: For testing agencies specified in "Quality Assurance" below 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.

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

1.5.2.1. Specification number and title.

1.5.2.2. Description of test and inspection.

1.5.2.3. Identification of applicable standards, codes or regulations.

1.5.2.4. Identification of test and inspection methods.

1.5.2.5. Number of tests and inspections required.

1.5.2.6. Time schedule or time span for tests and inspections.

1.5.2.7. Entity responsible for performing tests and inspections.

1.5.2.8. Requirements for obtaining samples.

1.5.2.9. Unique characteristics of each quality-control service.

1.5.3. Reports: Prepare and submit certified written reports that include the following:

1.5.3.1. Date of issue.

1.5.3.2. Project title and number.

1.5.3.3. Name, address, and telephone number of testing agency.

1.5.3.4. Dates and locations of samples and tests or inspections.

1.5.3.5. Names of individuals making tests and inspections.

1.5.3.6. Description of the Work and test and inspection method.

1.5.3.7. Identification of product and Specification.

1.5.3.8. Complete test or inspection data.

1.5.3.9. Test and inspection results and an interpretation of test results.

1.5.3.10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.

1.5.3.11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Documents' requirements.

1.5.3.12. Name and signature of laboratory inspector.

1.5.3.13. Recommendations on retesting and reinspecting.

1.5.3.14. Descriptions of deficiencies noted, and corrective action undertaken to resolve such deficiencies.

1.5.3.14.1. Deficiencies observed shall immediately be brought to the attention of the Contractor's field superintendent, and trade foreman. In the event deficiencies are not corrected, or if an interpretation of the Contract Documents is required, the Testing Agency shall immediately notify the District and applicable consultant, Architect, or Engineer.

1.5.3.14.2. The Testing Agency shall maintain a deficiency list of all items not corrected and shall reinspect the area after the deficiency has been corrected. The list shall include a description of the deficiency, the date and time the deficiency was observed, who was notified, the date of reinspection and description of any corrective action taken. Distribute the deficiency list at least once per month.

1.5.3.15.15. At the end of the Project, the Testing Agency shall submit a final signed report stating whether the work tested and inspected conforms to the Contract Documents' requirements.

1.5.4. Permits, Licenses, and Certificates: For District'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.

1.6. QUALITY ASSURANCE

1.6.1. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specifications specify additional requirements.

1.6.2. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance. Where required by the individual Specifications, Installer employing workers trained and approved by manufacturer, Installer being acceptable to manufacturer, and/or Installer being an authorized representative of manufacturer for both installation and maintenance.

1.6.3. 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.

- 1.6.4. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- 1.6.5. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of California, and who is experienced in providing engineering services of the kind indicated.
- 1.6.6. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.
- 1.6.7. Specialists: Certain Specifications may 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.
 - 1.6.7.1. Requirement for specialists shall not supersede building codes or regulations governing the Work.
- 1.6.8. Testing Agency Qualifications: An NRTL, an NVLAP, Division of the State of Architect's Accepted Laboratory, or an independent agency with the experience and capability to conduct testing and inspecting indicated; and with additional qualifications stated in individual Specifications; and where required by and acceptable to authorities having jurisdiction.
 - 1.6.8.1. NRTL: A Nationally Recognized Testing Laboratory according to 29 CFR 1910.7.
 - 1.6.8.2. NVLAP: A testing agency accredited according to NIST's (National Institute of Standards and Technology) National Voluntary Laboratory Accreditation Program.
 - 1.6.8.3. Tests shall be made by an accredited testing agency with a minimum of 5 years of experience in the specific type of testing to be performed. Except as otherwise provided, sampling and testing of all materials and the laboratory methods and testing equipment shall be in accordance with the applicable standards and methods of the California Building Standards code.
 - 1.6.8.4. For each type of inspection and testing service to be performed, the Testing Agency shall submit certification, signed and sealed by the Agency's professional engineer, of compliance with all applicable requirements of the following:
 - 1.6.8.4.1. ASTM E329, "Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction."
 - 1.6.8.4.2. "Recommended Requirements for Independent Laboratory Qualifications" published by the American Council of Independent Laboratories.

- 1.6.8.5. Furnish written certification to the District that all equipment to be used has been calibrated in accordance with applicable ASTM standards within the last year and is in proper working order.
- 1.6.8.6. Testing Agency Personnel Qualifications: Testing and inspection services shall be performed only by trained and experienced technicians currently qualified for the work they are to perform. Documentation of such training and experience shall be submitted to the District and/or its consultants upon request.
- 1.6.8.7. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.
- 1.6.8.8. 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.
- 1.6.9. Preconstruction Testing: Where a testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1.6.9.1. Contractor responsibilities include the following:
 - 1.6.9.1.1. Verify by its Quality Assurance/Quality Control procedures that an element is ready for testing prior to requesting a test.
 - 1.6.9.1.2. Provide test specimens representative of proposed products and construction.
 - 1.6.9.1.3. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - 1.6.9.1.4. Provide sizes and configurations of test assemblies, mock-ups, and laboratory mock-ups to adequately demonstrate capability of products to comply with performance requirements.
 - 1.6.9.1.5. Build site-assembled test assemblies and mock-ups using installers who will perform same tasks for Project.
 - 1.6.9.1.6. Build laboratory mock-ups at testing facility using personnel, products, and methods of construction indicated for the completed Work.

- 1.6.9.1.7. When testing is complete, remove test specimens, assemblies, mock-ups, and laboratory mock-ups; do not reuse products on Project.
- 1.6.9.2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to District 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' requirements.
- 1.6.10. Mock-ups: Before installing portions of the Work requiring mock-ups, build mock-ups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1.6.10.1. Build mock-ups in location and of size indicated or, if not indicated, as directed by District or its consultant.
 - 1.6.10.2. Notify District and its consultants seven (7) days in advance of dates and times when mock-ups will be constructed.
 - 1.6.10.3. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 1.6.10.4. Obtain District and its consultant's approval of mock-ups before starting work, fabrication, or construction.
 - 1.6.10.4.1. Allow seven (7) days for initial review and each re-review of each mock-up.
 - 1.6.10.5. Incorporate seismic design of nonstructural components as listed in Division 01 Document "Seismic Design Requirements for Non-Structural Components" into mock-ups.
 - 1.6.10.6. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 1.6.10.7. Demolish and remove mock-ups when directed, unless otherwise indicated.
- 1.6.11. Laboratory Mock-Ups: Comply with requirements of preconstruction testing and those specified in individual Specifications in Divisions 02 through 49.

1.7. QUALITY CONTROL

- 1.7.1. Regulatory Requirements: In accordance with the provisions of the State of California, Division of the State Architect (DSA), the District shall employ a Project Inspector who is approved to perform such duties by the Division of the State Architect (DSA). The Contractor shall provide an on-site field office for the exclusive use of the Project Inspector in accordance with Document 01 50 00, Paragraph 1.2.8.2.

- 1.7.2. District Responsibilities: Where quality-control services are indicated as District's responsibility, District will engage a qualified testing agency to perform these services.
 - 1.7.2.1. District will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting the testing agencies are engaged to perform.
 - 1.7.2.2. 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 Price will be adjusted by Change Order per the Contract Documents.
- 1.7.3. Tests and inspections not explicitly assigned to District are Contractor's responsibility. 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.
 - 1.7.3.1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform the quality-control services.
 - 1.7.3.1.1. Contractor shall not employ same entity engaged by District, unless agreed to in writing by District.
 - 1.7.3.2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 - 1.7.3.3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - 1.7.3.4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 1.7.3.5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- 1.7.4. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Document "Submittal Procedures."
- 1.7.5. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents' requirements.
- 1.7.6. Testing Agency Responsibilities: Cooperate with District, District's consultants, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

- 1.7.6.1. Notify District, District's consultants, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
- 1.7.6.2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
- 1.7.6.3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
- 1.7.6.4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
- 1.7.6.5. Do not release, revoke, alter, or increase the Contract Documents' requirements or approve or accept any portion of the Work.
- 1.7.6.6. Do not perform any duties of Contractor.
- 1.7.7. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify testing agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1.7.7.1. Access to the Work.
 - 1.7.7.2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 1.7.7.3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 1.7.7.4. Facilities for storage and field curing of test samples.
 - 1.7.7.5. Delivery of samples to testing agencies.
 - 1.7.7.6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 1.7.7.7. Security and protection for samples and for testing and inspecting equipment at Project Site.
 - 1.7.7.8. Furnish tools, samples of materials, design mixes, equipment and assistance as requested.
 - 1.7.7.9. Provide and maintain, for the sole use of the Testing Agency, adequate facilities for the safe storage and proper curing of concrete test cylinders on the project site for the first 24 hours after casting as required by ASTM C31, Method of Making and Curing Concrete Test Specimens in the Field.

1.7.7.10. Build and store masonry test prisms in a manner acceptable to the Testing Agency. Prisms to be tested shall remain at the job site until moved by Testing Agency personnel.

1.7.7.11. Notify Testing Agency at least 10 working days in advance of any qualification testing for welding required herein.

1.7.7.12. Notify Testing Agency at least 24 hours prior to expected time for operations requiring testing or inspection services.

1.7.7.13. Make arrangements with the Testing Agency and pay for additional samples and tests made for the Contractor's convenience or for retesting of failed samples.

1.7.7.14. For deficiencies requiring corrective action, submit in writing a description of the deficiency and a proposed correction to the District. After review and approval, the proposed corrective action shall be implemented and inspected by the Testing Agency. It is Contractor's responsibility to ascertain that the deficiency is corrected and inspected prior to the work being covered.

1.7.7.15. Retention of an independent Testing Agency by the District shall in no way relieve Contractor of responsibility for performing all work in accordance with the Contract Documents' requirements.

1.7.8. 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.

1.7.8.1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.8. TESTS AND SPECIAL INSPECTIONS

1.8.1. Tests and Special Inspections: District will engage a qualified testing agency to conduct tests and special inspections required by authorities having jurisdiction as follows:

1.8.1.1. The tests listed on the approved DSA-103 Form for the Project.

1.8.2. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specifications, and as follows:

1.8.2.1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.

1.8.2.2. Notifying District, District's consultants, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.

- 1.8.2.3. Submitting a certified written report of each test, inspection, and similar quality-control service to District, with copy to Contractor and to authorities having jurisdiction.
- 1.8.2.4. Submitting a final report of special tests and inspections at Project Completion, which includes a list of unresolved deficiencies.
- 1.8.2.5. Interpreting tests and inspections and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
- 1.8.2.6. Retesting and reinspecting corrected work.

2. PRODUCTS

2.1. GENERAL

- 2.1.1. Do not use any materials or equipment represented by samples until tests, if required, have been made and the materials or equipment found to be acceptable. Any product which becomes unfit for use after acceptance shall not be incorporated into the Work.

3. EXECUTION

3.1. TEST AND INSPECTION LOG

- 3.1.1. Prepare a record of tests and inspections. Include the following:
 - 3.1.1.1. Date test or inspection was conducted.
 - 3.1.1.2. Description of the Work tested and inspected.
 - 3.1.1.3. Date test or inspection results were transmitted to District.
 - 3.1.1.4. Identification of testing agency or special inspector conducting test or inspection.
- 3.1.2. Maintain log at Project Site. Post changes and modifications as they occur. Provide access to test and inspection log for District's reference during normal working hours.

3.2. REPAIR AND PROTECTION

- 3.2.1. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 3.2.1.1. Provide materials and comply with installation requirements specified in other Specifications. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
 - 3.2.1.2. Comply with Document "Cutting and Patching" and all related Contract Documents' requirements.
- 3.2.2. Protect construction exposed by or for quality-control service activities.
- 3.2.3. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF DOCUMENT

COUNTRY DAY SCHOOL - CHICO
102 West 11th Street
Chico, California, 95928

GRA Architecture
Project #18-06

01 40 00 - 12
May 10, 2019

DOCUMENT 01 42 13

ABBREVIATIONS AND ACRONYMS

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions including without limitation, Contract Terms and Definitions; and
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any).

1.2. ABBREVIATIONS AND ACRONYMS FOR STANDARDS AND REGULATIONS

1.2.1. Abbreviations and Acronyms for 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 as indicated in Thomson Gale™ (www.gale.com), Gale Research's "Encyclopedia of Associations" or "Encyclopedia of Associations: National Organizations of the U.S," or in Columbia Books' "National Trade & Professional Associations of the U.S."

1.2.2. Some of the applicable abbreviations and acronyms referenced in the Specifications or other Contract Documents have the following meanings, subject to updates or revisions based on the above-referenced publications:

- AA: Aluminum Association
- AAMA: Architectural Aluminum Manufacturers Association
- AASHTO: American Association of State Highway and Transportation Officials
- ABPA: Acoustical and Board Products Association
- ACI: American Concrete Institute
- AGA: American Gas Association
- AGC: Associated General Contractors
- AHC: Architectural Hardware Consultant
- AI: Asphalt Institute
- AIA: American Institute of Architects
- AIEE: American Institute of Electrical Engineers
- AISC: American Institute of Steel Construction
- AISI: American Iron and Steel Institute
- AMCA: Air Moving and Conditioning Association
- ANSI: American National Standards Institute
- APA: American Plywood Association
- ARI: Air Conditioning and Refrigeration Institute

- ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers
- ASME: American Society of Mechanical Engineers
- ASSE: American Society of Structural Engineers
- ASTM: American Society of Testing and Materials
- AWPB: American Wood Preservers Bureau
- AWPI: American Wood preservers Institute
- AWS: American Welding Society
- AWSC: American Welding Society Code
- AWI: Architectural Woodwork Institute
- AWWA: American Water Works Association
- BIA: Brick Institute of America
- CCR: California Code of Regulations
- CLFMI: Chain Link Fence Manufacturers Institute
- CMG: California Masonry Guild
- CRA: California Redwood Association
- CRSI: Concrete Reinforcing Steel Institute
- CS: Commercial Standards
- CSI: Construction Specifications Institute
- CTI: Cooling Tower Institute
- FGMA: Flat Glass Manufacturer's Association
- FIA: Factory Insurance Association
- FM: Factory Mutual
- FS: Federal Specification
- FTI: Facing Title Institute
- GA: Gypsum Association
- ICC: International Code Council
- IEEE: Institute of Electrical and Electronic Engineers
- IES: Illumination Engineering Society
- LIA: Lead Industries Association
- MIA: Marble Institute of America
- MLMA: Metal Lath Manufacturers Association
- MS: Military Specifications
- NAAMM: National Association of Architectural Metal Manufacturers
- NBHA: National Builders Hardware Association
- NBFU: National Board of Fire Underwriters
- NBS: National Bureau of Standards
- NCMA: National Concrete Masonry Association
- NEC: National Electrical Code
- NEMA: National Electrical Manufacturers Association
- NFPA: National Fire Protection Association/National Forest Products Association
- NMWIA: National Mineral Wool Insulation Association
- NTMA: National Terrazzo and Mosaic Association
- NWMA: National Woodwork Manufacturer's Association
- ORS: Office of Regulatory Services (California)
- OSHA: Occupational Safety and Health Act

- PCI: Precast Concrete Institute
- PCA: Portland Cement Association
- PDCA: Painting and Decorating Contractors of America
- PDI: Plumbing Drainage Institute
- PEI: Porcelain Enamel Institute
- PG&E: Pacific Gas & Electric Company
- PS: Product Standards
- SDI: Steel Door Institute; Steel Deck Institute
- SJI: Steel Joist Institute
- SSPC: Steel Structures Painting Council
- TCA: Tile Council of America
- TPI: Truss Plate Institute
- UBC: Uniform Building Code
- UL: Underwriters Laboratories Code
- UMC: Uniform Mechanical Code
- USDA: United States Department of Agriculture
- VI: Vermiculite Institute
- WCLA: West Coast Lumberman's Association
- WCLB: West Coast Lumber Bureau
- WEUSER: Western Electric Utilities Service Engineering Requirements
- WIC: Woodwork Institute of California
- WPOA: Western Plumbing Officials Association

- 1.2.3. Additional Abbreviations and Symbols: Refer to the above-referenced publications or to Drawings for additional abbreviations and for symbols.

END OF DOCUMENT

DOCUMENT 01 42 16

GENERAL DEFINITIONS AND REFERENCES

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISION

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions including without limitation, Contract Terms and Definitions;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any); and
- 1.1.4. Special Conditions.

1.2. DEFINITIONS

General: Basic Contract definitions are included in the General Conditions of the Contract for Construction. The following are in addition to those definitions.

- 1.2.1. "Alternate": A cost or credit for certain Work that may be added to or deducted from the Project.
- 1.2.2. "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."
- 1.2.3. "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.
- 1.2.4. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- 1.2.5. "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.
- 1.2.6. "Provide": Furnish and install, complete and ready for the intended use.

1.3. QUALITY ASSURANCE

- 1.3.1. For products or workmanship specified by association, trade, or Federal Standards, Contractor shall comply with requirements of the standard, except when more stringent requirements are specified in the Contract Documents, or are required by applicable codes.

- 1.3.2. Contractor shall conform to current reference standard publication in effect on the date of bid opening.
- 1.3.3. Unless directed otherwise by the Contract Documents, Contractor shall obtain copies of referenced standards.
- 1.3.4. Unless directed otherwise by the Contract Documents, Contractor shall maintain a copy of referenced standards at jobsite until Completion.
- 1.3.5. If specified standards conflict with Contract Documents, Contractor shall request clarification from the District or the Architect before proceeding.
- 1.3.6. Governing Codes shall be as shown in the Contract Documents including, without limitation, the Specifications.

1.4. STANDARDS

- 1.4.1. Standard Specifications: References to codes, specifications and standards referred to in the Contract Documents shall mean, and are intended to be, the latest edition, amendment or revision of such reference standard in effect as of the date of these Contract Documents. If those standard specifications are revised prior to Completion of any part of the Work to which such revision would pertain, Contractor may, if acceptable to and approved by the District, perform such Work in accordance with the revised standard specifications.
- 1.4.2. Conflicting Requirements: Where compliance with two or more standards is specified, and the standards may establish different or conflicting requirements for minimum quantities or quality levels, refer requirements that are different, but apparently equal, and uncertainties to the District for a decision before proceeding.
- 1.4.3. 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 the requirements. Refer uncertainties to District for a decision before proceeding.
- 1.4.4. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.
- 1.4.5. Copies from the Publication Source: Where copies of standards are needed for performance of a required construction activity, Contractor shall obtain copies directly from the publication source.

1.5. SCHEDULE OF REFERENCES

The following information is intended only for the general assistance of Contractor. District does not represent the accuracy of the information. Contractor shall independently verify the information for each entity listed below:

AA	Aluminum Association 900 19th Street NW, Suite 300 Washington, DC 20006 www.aluminum.org	202/862-5100
AABC	Associated Air Balance Council 1518 K Street, NW, Suite 503 Washington, DC 20005 www.aabchg.com	202/737-0202
AAMA	American Architectural Manufacturers Association 1827 Walden Office Sq., Suite 104 Schaumburg, IL 60173-4268 www.aamanet.org	847/303-5664
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, Suite 249 Washington, DC 20001 www.aashto.org	202/624-5800
AATCC	American Association of Textile Chemists and Colorists P.O. Box 12215 One Davis Drive Research Triangle Park, NC 27709-2215 www.aatcc.org	919/549-8141
ACI	American Concrete Institute P.O. Box 9094 Farmington Hills, MI 48333-9094 www.aci-int.org	248/848-3700
ACPA	American Concrete Pipe Association 222 West Las Colinas Blvd., Suite 641 Irving, TX 75039-5423 www.concrete-pipe.org	972/506-7216
ADC	Air Diffusion Council 11 South LaSalle St., Suite 1400 Chicago, IL 60603 http://www.flexibleduct.org/index.asp	312/201-0101

AFPA	American Forest and Paper Association 1111 19th St., NW, Suite 800 Washington, DC 20036 http://www.afandpa.org/	202/463-2700
AGA	American Gas Association 1515 Wilson Blvd. Arlington VA 22209 www.aga.com	703/841-8400
AHA	American Hardboard Association 1210 W. Northwest Hwy Palatine, IL 60067-1897 http://domensino.com/AHA/default.htm	847/934-8800
AI	Asphalt Institute Research Park Drive P.O. Box 14052 Lexington, KY 40512-4052 www.asphaltinstitute.org	606/288-4960
AIA	The American Institute of Architects 1735 New York Avenue, NW Washington, DC 20006-5292 www.aia.org	202/626-7300
AISC	American Institute of Steel Construction One East Wacker Drive, Suite 3100 Chicago, IL 60601-2001 http://www.aisc.org/	800/644-2400
AITC	American Institute of Timber Construction 7012 S. Revere Pkwy., Suite 140 Englewood, CO 80112 www.aitc-glulam.org	303/792-9559
ALCA	Associated Landscape Contractors of America 12200 Sunrise Valley Drive, Suite 150 Reston, VA 20191 www.alca.org	703/620-6363
ALI	Associated Laboratories, Inc. P.O. Box 152837 1323 Wall St. Dallas, TX 75315 http://www.assoc-labs.com/	214/565-0593
ALSC	American Lumber Standards Committee	301/972-1700

	P.O. Box 210 Germantown, MD 20875	
AMCA	Air Movement and Control Association International, Inc. 30 W. University Drive Arlington Heights, IL 60004-1893 www.amca.org	847/394-0150
ANLA	American Nursery and Landscape Association 1250 Eye Street, NW, Suite 500 Washington, DC 20005	202/789-2900
ANSI	American National Standards Institute 11 West 42nd Street, 13th Floor New York, NY 10036-8002 www.ansi.org	212/642-4900
APA	APA-The Engineered Wood Association P.O. Box 11700 Tacoma, WA 98411-0700 www.apawood.org	206/565-6600
APA	Architectural Precast Association P.O. Box 08669 Fort Myers, FL 33908-0669	941/454-6989
ARI	Air Conditioning and Refrigeration Institute 4301 Fairfax Drive, Suite 425 Arlington, VA 22203 www.ari.org	703/524-8800
ARMA	Asphalt Roofing Manufacturers Association Center Park 4041 Powder Mill Road, Suite 404 Calverton, MD 20705	301/231-9050
ASA	Acoustical Society of America 500 Sunnyside Blvd. Woodbury, NY 11797	516/576-2360
ASCE	American Society of Civil Engineers- World Headquarters 1801 Alexander Bell Drive Reston, VA 20190-4400 www.asce.org	800/548-2723 703/295-6000
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers	800/527-4723 404/636-8400

	1791 Tullie Circle, NE Atlanta, GA 30329-2305 www.ashrae.org	
ASLA	American Society of Landscape Architects 4401 Connecticut Ave., NW, 5th Floor Washington, DC 20008-2369 www.asla.org	202/686-2752
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017-2392 www.asme.org	800/434-2763
ASPE	American Society of Plumbing Engineers 3617 Thousand Oaks Blvd., Suite 210 Westlake, CA 91362-3649	805/495-7120
ASQC	American Society for Quality Control 611 E. Wisconsin Avenue Milwaukee, WI 53201-3005 www.asqc.org	800/248-1946 414/272-8575
ASSE	American Society of Sanitary Engineering 28901 Clemens Road Westlake, OH 44145 www.asse-plumbing.org	216/835-3040
ASTM	American Society for Testing and Materials 100 Barr Harbor Drive West Conshohocken, PA 19428-2959 www.astm.org	610/832-9500
AWCI	Association of the Wall and Ceiling Industries--International 307 E. Annandale Road, Suite 200 Falls Church, VA 22042-2433 www.awci.org	703/534-8300
AWPA	American Wood-Preservers' Association 3246 Fall Creek Highway, Suite 1900 Granbury, TX 76049-7979	817/326-6300
AWS	American Welding Society 550 NW LeJeune Road Miami, FL 33126 www.amweld.org	800/443-9373 305/443-9353
AWWA	American Water Works Association	800/926-7337

	6666 West Quincy Avenue Denver, CO 80235 www.awwa.org	303/794-7711
BHMA	Builders' Hardware Manufacturers Association 355 Lexington Avenue, 17th Floor New York, NY 10017-6603	212/661-4261
CBM	Certified Ballast Manufacturers Association 1422 Euclid Avenue, Suite 402 Cleveland, OH 44115-2094	216/241-0711
CGA	Compressed Gas Association 1725 Jefferson Davis Hwy, Suite 1004 Arlington, VA 22202-4102 www.cganet.com	703/412-0900
CISCA	Ceilings & Interior Systems Construction Association 1500 Lincoln Hwy, Suite 202 St. Charles, IL 60174 www.cisca.org	630/584-1919
CISPI	Cast Iron Soil Pipe Institute 5959 Shallowford Road, Suite 419 Chattanooga, TN 37421	423/892-0137
CPSC	Consumer Product Safety Commission East West Towers 4330 East-West Hwy. Bethesda, MD 20814	800/638-2772
CPPA	Corrugated Polyethylene Pipe Association 432 N. Superior Street Toledo, OH 43604	800/510-2772 419/241-2221
CRA	California Redwood Association 405 Enfrente Drive, Suite 200 Novato, CA 94949	415/382-0662
CRI	Carpet and Rug Institute 310 S. Holiday Avenue Dalton, GA 30722-2048 www.carpet-rug.com	800/882-8846 706/278-3176
CRSI	Concrete Reinforcing Steel Institute 933 N. Plum Grove Road Schaumburg, IL 60173-4758 www.crsi.org	847/517-1200

CTI	Ceramic Tile Institute of America 12061 W. Jefferson Blvd. Culver City, CA 90230-6219	310/574-7800
DHI	Door and Hardware Institute 14170 Newbrook Drive Chantilly, VA 20151-2223 www.dhi.org	703/222-2010
DIPRA	Ductile Iron Pipe Research Association 245 Riverchase Pkwy East, Suite O Birmingham, AL 35244	205/988-9870
DOC	Department of Commerce 14th Street and Constitution Avenue, NW Washington, DC 20230	202/482-2000
DOT	Department of Transportation 400 Seventh Street, SW Washington, DC 20590	202/366-4000
EJMA	Expansion Joint Manufacturers Association 25 N. Broadway Tarrytown, NY 10591-3201	914/332-0040
EPA	Environmental Protection Agency 401 M Street, SW Washington, DC 20460	202/260-2090
FCICA	Floor Covering Installation Contractors Association P.O. Box 948 Dalton, GA 30722-0948	706/226-5488
FM	Factory Mutual 1151 Boston-Providence Turnpike P.O. Box 9102 Norwood, MA 02062-9102 www.factorymutual.com	781/255-4300
FS	Federal Specifications Unit (Available from GSA) 470 East L'Enfant Plaza, SW, Suite 8100 Washington, DC 20407	202/619-8925
GA	Gypsum Association 810 First Street NE, Suite 510 Washington, DC 20002	202/289-5440

	www.usg.com	
GANA	Glass Association of North America 3310 SW Harrison Street Topeka, KS 66611-2279 www.glasswebsite.com/gana	913/266-7013
HMA	Hardwood Manufacturers Association 400 Penn Center Blvd., Suite 530 Pittsburgh, PA 15235-5605 www.hardwood.org	412/828-0770
HPVA	Hardwood Plywood and Veneer Association 1825 Michael Farraday Drive P.O. Box 2789 Reston, VA 22195-0789 www.hpva.org	703/435-2900
IEEE	Institute of Electrical and Electronic Engineers 345 E. 47th Street New York, NY 10017-2394 www.ieee.org	800/678-4333 212/705-7900
IESNA	Illuminating Engineering Society of North America 120 Wall Street, 17th Floor New York, NY 10005-4001 www.iesna.org	212/248-5000
ITS	Intertek Testing Services P.O. Box 2040 607/753-6711 3933 US Route 11 Cortland, NY 13045-7902 www.itsglobal.com	800/345-3851
LMA	Laminating Materials Association 116 Lawrence Street Hillsdale, NJ 07642-2730 www.lma.org	201/664-2700
MCAA	Mechanical Contractors Association of America 1385 Piccard Drive Rockville, MD 20850-4329	301/869-5800
ML/SFA	Metal Lath/Steel Framing Association (A Division of the NAAMM) 8 South Michigan Avenue, Suite 1000 Chicago, IL 60603	312/456-5590
MSS	Manufacturers Standardization Society for the	703/281-6613

	Valve and Fittings Industry 127 Park Street, NE Vienna, VA 22180-4602	
NAA	National Arborist Association P.O. Box 1094 603/673-3311 Amherst, NH 03031-1094 www.natlarb.com	800/733-2622
NAAMM	National Association of Architectural Metal Manufacturers 8 South Michigan Avenue, Suite 1000 Chicago, IL 60603 www.gss.net/naamm	312/782-5590
NAIMA	North American Insulation Manufacturers Association 44 Canal Center Plaza, Suite 310 Alexandria, VA 22314 www.naima.org	703/684-0084
NAPA	National Asphalt Pavement Association NAPA Building 5100 Forbes Blvd. Lanham, MD 20706-4413	301/731-4748
NCSPA	National Corrugated Steel Pipe Association 1255 23rd Street, NW, Suite 850 Washington, DC 20037 www.ncspa.org	202/452-1700
NEBB	National Environmental Balancing Bureau 8575 Grovemont Circle Gaithersburg, MD 20877-4121	301/977-3698
NECA	National Electrical Contractors Association 3 Bethesda Metro Center, Suite 1100 Bethesda, MD 20814-5372	301/657-3110
NEI	National Elevator Industry 185 Bridge Plaza North, Suite 310 Fort Lee, NJ 07024	201/944-3211
NEMA	National Electrical Manufacturers' Association 1300 N. 17th Street, Suite 1847 Rosslyn, VA 22209 www.nema.org	703/841-3200
NFPA	National Fire Protection Association	800/344-3555

	One Batterymarch Park P.O. Box 9101 Quincy, MA 02269-9101 www.nfpa.org	617/770-3000
NHLA	National Hardwood Lumber Association P.O. Box 34518 Memphis, TN 38184-0518 www.natlhardwood.org	901/377-1818
NIA	National Insulation Association 99 Canal Center Plaza, Suite 222 Alexandria, VA 22314 www.insulation.org	703/683-6422
NPA	National Particleboard Association 18928 Premiere Court Gaithersburg, MD 20879-1569 www.pbmdf.com	301/670-0604
NPCA	National Paint and Coatings Association 1500 Rhode Island Avenue, NW Washington, DC 20005-5597 www.paint.org	202/462-6272
NRCA	National Roofing Contractors Association O'Hare International Center 10255 W. Higgins Road, Suite 600 Rosemont, IL 60018-5607 www.roofonline.org	800/323-9545
NRMCA	National Ready Mixed Concrete Association 900 Spring Street Silver Spring, MD 20910 www.nrmca.org	301/587-1400
NSF	NSF International P.O. Box 130140 Ann Arbor, MI 48113-0140 www.nsf.org	313/769-8010
NUSIG	National Uniform Seismic Installation Guidelines 12 Lahoma Court Alamo, CA 94526	510/946-0135
NWWDA	National Wood Window and Door Association 1400 E. Touhy Avenue, G-54 Des Plaines, IL 60018 www.nwwda.org	800/223-2301 847/299-5200

SHA	Occupational Safety and Health Administration (U.S. Department of Labor) 200 Constitution Ave., NW Washington, DC 20210	202/219-8148
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077-1083 www.portcement.org	847/966-6200
PDCA	Painting and Decorating Contractors of America 3913 Old Lee Hwy, Suite 33-B Fairfax, VA 22030 www.pdca.com	800/332-7322 703/359-0826
PDI	Plumbing and Drainage Institute 45 Bristol Drive, Suite 101 South Easton, MA 02375	800/589-8956 508/230-3516
RFCI	Resilient Floor Covering Institute 966 Hungerford Drive, Suite 12-B Rockville, MD 20805-1714	301/340-8580
RIS	Redwood Inspection Service c/o California Redwood Association 405 Enfrente Drive, Suite 200 Novato, CA 94949-7206	415/382-0662
SDI	Steel Deck Institute P.O. Box 25 Fox River Grove, IL 60012 www.sdi.org	847/462-1930
SDI	Steel Door Institute 30200 Detroit Road Cleveland, OH 44145-1967	216/889-0010
SMA	Stucco Manufacturers Association 14006 Ventura Blvd. Sherman Oaks, CA 91403	213/789-8733
SMACNA	Sheet Metal and Airconditioning Contractors National Association, Inc. P.O. Box 221230 Chantilly, VA 20151-1209 www.smacna.org	703/803-2980

SPI	Society of the Plastics Industry, Inc. Spray Polyurethane Division 1801 K Street, NW, Suite 600K Washington, DC 20006 www.socplas.org	800/951-2001 202/974-5200
SSPC	Steel Structures Painting Council 40 24th Street, 6th Floor Pittsburgh, PA 15222-4643	412/281-2331
TCA	Tile Council of America 100 Clemson Research Blvd. Anderson, SC 29625	864/646-8453
TPI	Turfgrass Producers International 1855-A Hicks Road Rolling Meadows, IL 60008	800/405-8873 847/705-9898
UL	Underwriters Laboratories, Inc. 333 Pfingston Road 847/272-8800 Northbrook, IL 60062 www.ul.com	800/704-4050
UNI	Uni-Bell PVC Pipe Association 2655 Villa Creek Drive, Suite 155 Dallas, TX 75234 www.members.aol.com/unibell1	972/243-3902
USDA	U.S. Department of Agriculture 14th St. and Independence Ave., SW Washington, DC 20250	202/720-8732
WA	Wallcoverings Association 401 N. Michigan Avenue Chicago, IL 60611-4267	312/644-6610
WCLIB	West Coast Lumber Inspection Bureau P.O. Box 23145 Portland, OR 97281-3145	503/639-0651
WCMA	Window Covering Manufacturers Association 355 Lexington Ave., 17th Floor New York, NY 10017-6603	212/661-4261
WIC	Woodwork Institute of California P.O. Box 980247 West Sacramento, CA 95798-0247	916/372-9943
WLPDIA	Western Lath/Plaster/Drywall Industries	619/466-9070

COUNTRY DAY SCHOOL - CHICO
102 West 11th Street
Chico, California, 95928

GRA Architecture
Project #18-06

	Association 8635 Navajo Road San Diego, CA 92119	
WMMPA	Wood Moulding & Millwork Producers Association 507 First Street Woodland, CA 95695 www.wmmpa.com	800/550-7889 916/661-9591
WRI	Wire Reinforcement Institute 203 Loudoun Street, SW Leesburg, VA 20175-2718	703/779-2339
WWPA	Western Wood Products Association Yeon Building 522 S.W. 5th Avenue Portland, OR 97204-2122	503/224-3930

END OF DOCUMENT

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May 10, 2019

DOCUMENT 01 45 29

TESTING LABORATORY SERVICES

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISION

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions, including "Tests and Inspections"; and
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any).

1.2. DOCUMENT INCLUDES

- 1.2.1. Observation and Supervision.
- 1.2.2. Testing Laboratories and Agencies
- 1.2.3. Tests and Inspections
- 1.2.4. Selection and Payment
- 1.2.5. District's Testing Laboratory Responsibilities
- 1.2.6. Laboratory reports.
- 1.2.7. Limits on testing laboratory authority.
- 1.2.8. Contractor responsibilities.
- 1.2.9. Schedule of inspections and tests.
- 1.2.10. Project Inspector's Access to Site

1.3. REFERENCES

- 1.3.1. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- 1.3.2. ASTM E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.
- 1.3.3. CBC - California Building Code.

- 1.3.4. UBC - Uniform Building Code.
- 1.3.5. Title 24, Parts 1 and 2, of the California Code of Regulations. Contractor shall keep a copy of these available at the job Site for ready reference during construction
- 1.3.6. DSA - Division of the State Architect, Office of Regulation Services, Structural Safety Section. DSA shall be notified at or before the start of construction.

1.4. OBSERVATION AND SUPERVISION

- 1.4.1. The District and Architect or their appointed representatives will review the Work and the Contractor shall provide facilities and access to the Work at all times as required to facilitate this review. Administration by the Architect and any consulting Structural Engineer will be in accordance with applicable regulations, including, without limitation, 24 C.C.R. § 4-341.
- 1.4.2. One or more Project Inspector(s) approved by DSA and employed by or in contract with the District("Project Inspector"), will observe the Work in accordance with 24 C.C.R. §§ 4-333(b) and 4-342:
- 1.4.3. Project Inspector shall have access to the Work wherever it is in preparation or progress for ascertaining that the Work is in accordance with the Contract Documents and all applicable code sections. Contractor shall provide facilities and access as required and shall provide assistance for sampling or measuring materials.
 - 1.4.3.1. Project Inspector will notify District and Architect and inform Contractor of any observed failure of Work or material to conform to Contract Documents.
 - 1.4.3.2. The Project Inspector shall observe and monitor all testing and inspection activities required.
- 1.4.4. Contractor shall conform with all applicable laws as indicated in the Contract Documents, including, without limitation, to 24 C.C.R. § 4-343. Contractor shall supervise and direct the Work and maintain a competent superintendent on the Project who is authorized to act in all matters pertaining to the Work. The Contractor shall inspect all materials, as they arrive, for compliance with the Contract Documents. Contractor shall reject defective Work or materials immediately upon delivery or failure of the Work or material to comply with the Contract Documents. The Contractor shall submit verified reports as indicated in the Contract Documents, including, without limitation, the Specifications and as required by 24 C.C.R. § 4-336.

1.5. TESTING LABORATORIES AND AGENCIES

- 1.5.1. All testing laboratories shall be approved by the State of California, Division of the State Architect, prior to collecting any samples, observing any Work, or performing any tests.
- 1.5.2. Testing agencies and tests shall be in conformance with the Contract Documents and the requirements of 24 C.C.R. § 4-335.

- 1.5.3. Testing and inspection in connection with earthwork shall be under the direction of the District's consulting soils engineer ("Soils Engineer").
- 1.5.4. Testing and inspection of construction materials and workmanship shall be performed by a qualified laboratory ("Testing Laboratory" or "Laboratory"). The Testing Laboratory shall be under direction of an engineer registered in the State of California, shall conform to requirements of ASTM E329, and shall be employed by or in contract with the District.

1.6. TESTS AND INSPECTIONS

- 1.6.1. Contractor shall be responsible for notifying District and Project Inspector of all required tests and inspections. Contractor shall notify District and Project Inspector forty-eight (48) hours in advance of performing any Work requiring testing or inspection.
- 1.6.2. Contractor shall provide access to Work to be tested and furnish incidental labor, equipment, and facilities to facilitate all inspections and tests.
- 1.6.3. District will pay for first inspections and tests required by the Title 24 and other inspections or tests that District and/or Architect may direct to have made, including, but not limited to, the following principal items:
 - 1.6.3.1. Tests and observations for earthwork and pavings.
 - 1.6.3.2. Tests for concrete mix designs, including tests of trial batches.
 - 1.6.3.3. Tests and inspections for structural steel work.
 - 1.6.3.4. Field tests for framing lumber moisture content.
 - 1.6.3.5. Additional tests directed by District that establish that materials and installation comply with the Contract Documents.
 - 1.6.3.6. Test and observation of welding and expansion anchors.
 - 1.6.3.7. Factory observation of components and assembly of modular prefabrication structures and buildings.
- 1.6.4. District may at its discretion, pay and back charge Contractor for:
 - 1.6.4.1. Retests or reinspections, if required, and tests or inspection required due to Contractor error or lack of required identifications of material.
 - 1.6.4.2. Uncovering of work in accordance with Contract Documents.
 - 1.6.4.3. Testing done on weekends, holidays, and overtime will be chargeable to Contractor for the overtime portion.

1.6.4.4. Testing done off site.

1.6.5. Testing and inspection reports and certifications:

1.6.5.1. If initially received by Contractor, Contractor shall provide to each of the following a copy of the agency or laboratory report of each test or inspection or certification: District; Construction Manager, if any; Architect; Consulting Engineer, if any; Other Engineers on the Project, as appropriate; and; Project Inspector.

1.6.5.2. When the test or inspection is one required by the Title 24, a copy of the report shall also be provided to the DSA.

1.7. SELECTION AND PAYMENT

1.7.1. District will hire and pay for services of an independent Testing Laboratory to perform specified inspection and testing as specified by District's Testing Laboratory.

1.7.2. District's hiring of Testing Laboratory shall in no way relieve Contractor of its obligation to perform work in accordance with requirements of Contract Documents.

1.8. DISTRICT'S TESTING LABORATORY RESPONSIBILITIES

1.8.1. Test samples of mixes submitted by Inspector.

1.8.2. Perform specified inspection, sampling, and testing of Products in accordance with specified standards.

1.8.3. Notify Architect and Contractor of observed irregularities or non-conformance of Work or Products.

1.8.4. Attend preconstruction conferences and progress meetings when requested by Architect.

1.9. LABORATORY REPORTS

1.9.1. After each inspection and test, District shall then submit one copy of laboratory report to Contractor. Reports of test results of materials and inspections found not to be in compliance with the requirements of the Contract Documents shall be forwarded immediately.

1.9.2. Each Testing Laboratory shall submit a verified report covering all of the tests which were required to be made by that agency during the progress of the Project. Such report shall be furnished each time that Work is suspended, covering the tests up to that time and at the Completion of the Project, covering all tests.

1.10. LIMITS ON TESTING LABORATORY AUTHORITY

- 1.10.1. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- 1.10.2. Laboratory may not approve or accept any portion of the Work.
- 1.10.3. Laboratory may not assume any duties of Contractor.
- 1.10.4. Laboratory has no authority to stop the Work.

1.11. CONTRACTOR RESPONSIBILITIES

- 1.11.1. Submit proposed items for testing as required herein and/or as further required in the Contract Documents to Architect for review in accordance with applicable specifications.
- 1.11.2. Cooperate with Laboratory personnel, and provide access to the Work and to manufacturer's facilities.
- 1.11.3. Notify Architect, District, and Testing Laboratory 48 hours prior to expected time for operations requiring inspection and testing services.
- 1.11.4. When tests or inspections cannot be performed after such notice, reimburse District for Laboratory personnel and travel expenses incurred due to the Contractor's negligence.
- 1.11.5. Contractor shall notify District a sufficient time in advance of the manufacture of material to be supplied by Contractor pursuant to the Contract Documents, which must by terms of the Contract be tested, in order that the District may arrange for the testing of same at the source of supply.
 - 1.11.5.1. Any material shipped by the Contractor from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice that such testing and inspection will not be required shall not be incorporated in the Work.
- 1.11.6. Contract and pay for services of District's Testing Laboratory to perform additional inspections, sampling and testing required when initial tests indicate Contractor's work and/or materials does not comply with Contract Documents.

1.12. SCHEDULE OF INSPECTIONS AND TESTS

The Testing Laboratory shall perform tests and inspections for the following in conformance with the California Code of Regulations, Title 24, Part 2: 2016 California Building Code (CBC):

- 1.12.1 The tests listed on the approved DSA-103 Form for the Project.

- 1.12.2 **Plumbing:** Testing as specified in Division 22 and Division 33, including, but not limited to: Sterilization, soil waste and vent, water piping, source of water, gas piping, downspouts and storm drains.
- 1.12.3 **Automatic Fire Sprinklers (where applicable):** Testing as specified in Division 21 shall include, but not be limited to: Hydrostatic pressure.
- 1.12.4 **Heating, Ventilating and Air Conditioning:** Testing as specified in Division 23 shall include, but not be limited to: Ductwork tests, cooling tower tests, boiler tests, controls testing, piping tests, water and air systems, and test and balance of heating and air conditioning systems.
- 1.12.5 **Electrical:** Testing as specified in Division 26, including, but not limited to: Equipment testing, all electrical system operations, grounding system and checking insulation after cable is pulled.

1.13 PROJECT INSPECTOR'S ACCESS TO SITE

- 1.13.1 A Project Inspector employed by the District in accordance with the requirement of State of California Code of Regulations, Title 24, Part 1 will be assigned to the Work. Project Inspector's duties are specifically defined in 24. C.C.R. §4-342, and as indicated in the General Conditions.
- 1.13.2 District and Construction Manager shall at all times have access for the purpose of inspection to all parts of the Work and to the shops wherein the Work is in preparation, and Contractor shall at all times maintain proper facilities and provide safe access for such inspection.
- 1.13.3 The Work in all stages of progress shall be subject to the personal continuous observation of the Inspector. Inspector shall have free access to any or all parts of the Work at any time. Contractor shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary to keep Inspector fully informed respecting the progress and manner of the Work and the character of the materials. Inspection of the Work shall not relieve the Contractor from any obligation set forth in the Contract Documents.
- 1.13.4 The Inspector is not authorized to change, revoke, alter, enlarge or decrease in any way any requirement of the Contract Documents, drawings, specifications or subsequent change orders.
- 1.13.5 Whenever there is insufficient evidence of compliance with any of the provisions of Title 24 or evidence that any material or construction does not conform to the requirements of Title 24, the Division of the State Architect may require tests as proof of compliance. Test methods shall be as specified herein or by other recognized and accepted test methods determined by the Division of the State Architect. All tests shall be performed by a testing laboratory accepted by the Division of the State Architect.

END OF DOCUMENT

DOCUMENT 01 50 00

TEMPORARY FACILITIES AND CONTROLS

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any);
- 1.1.4. Site Standards; and
- 1.1.5. Temporary Tree and Plant Protection.

1.2. TEMPORARY UTILITIES

1.2.1. Electric Power and Lighting:

- 1.2.1.1. Contractor will furnish and pay for power during the course of the work to the extent power is not in the building(s) or on the Site. Contractor shall be responsible for providing temporary facilities required on the Site to point of intended use.
- 1.2.1.2. Contractor shall furnish, wire for, install, and maintain temporary electrical lights wherever it is necessary to provide illumination for the proper performance and/or observation of the Work: a minimum of 20 foot-candles for rough work and 50 foot-candles for finish work.
- 1.2.1.3. Contractor shall be responsible for maintaining existing lighting levels in the Project vicinity should temporary outages or service interruptions occur.

1.2.2. Heat and Ventilation:

- 1.2.2.1. Contractor shall provide temporary heat to maintain environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for the installation and curing of materials, and to protect materials and finishes from damage due to improper temperature and humidity conditions. Portable heaters shall be standard units complete with controls.
- 1.2.2.2. Contractor shall provide forced ventilation and dehumidification, as required, of enclosed areas for proper installation and curing of materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors, and

gases.

1.2.2.3. Contractor shall pay the costs of installation, maintenance, operation, and removal of temporary heat and ventilation, including costs for fuel consumed, required for the performance of the Work.

1.2.3. Water:

1.2.3.1. Contractor will furnish and pay for water during the course of the work. Contractor shall be responsible for providing temporary facilities required.

1.2.3.2. Contractor shall make potable water available for human consumption.

1.2.4. Sanitary Facilities:

1.2.4.1. Contractor shall provide sanitary temporary facilities in no fewer numbers than required by law and such additional facilities as may be directed by the Inspector for the use of all workers. The facilities shall be maintained in a sanitary condition at all times and shall be left at the Site until removal is directed by the District or Contractor completes all Work.

1.2.4.2. Use of toilet facilities in the Site shall not be permitted except by consent of the Project Inspector and District.

1.2.5. Telephone Service:

1.2.5.1. Contractor shall arrange with local telephone service company for telephone service for the performance of the Work. Contractor shall, at a minimum, provide in its field office one line for telephone and one line for fax machine.

1.2.5.2. Contractor shall pay the costs for telephone and fax lines installation, maintenance, service, and removal; for Construction Site Office, Construction Manager's Office and Inspector's Office.

1.2.6. Fire Protection:

1.2.6.1. Contractor shall provide and maintain fire extinguishers and other equipment for fire protection. Such equipment shall be designated for use for fire protection only and shall comply with all requirements of the California Fire, State Fire Marshall and/or its designee.

1.2.6.2. Where on-site welding and burning of steel is unavoidable, Contractor shall provide protection for adjacent surfaces.

1.2.7. Trash Removal:

1.2.7.1. Contractor shall provide trash removal on a timely basis from all Site Offices and throughout the Site.

1.2.8. Temporary Facilities:

1.2.8.1. Contractor shall provide sufficient space and facilities for its own force's needs.

1.2.8.2. In addition, unless otherwise indicated in the Contract Documents, Contractor shall provide the following facilities, trailers, offices, furniture and:

1.2.8.2.1. One (1) 12X20 Project Inspector's Trailer/Office;

1.2.8.2.1.1. Basic furniture: chair, desks, plan table, conference room table, and chairs; and

1.2.8.2.2. Basic services: fixed line for phone, fax, and high speed internet service.

1.3. CONSTRUCTION AIDS

1.3.1. Plant and Equipment:

1.3.1.1. Contractor shall furnish, operate, and maintain a complete plant for fabricating, handling, conveying, installing, and erecting materials and equipment; and for conveyances for transporting workmen. Include elevators, hoists, debris chutes, and other equipment, tools, and appliances necessary for performance of the Work.

1.3.1.2. Contractor shall maintain plant and equipment in safe and efficient operating condition. Damages due to defective plant and equipment, and uses made thereof, shall be repaired by Contractor at no expense to the District.

1.3.2. No District tools or equipment shall be used by Contractor or its subcontractors for the performance of the Work.

1.4. BARRIERS AND ENCLOSURES

1.4.1. Contractor shall obtain District's written permission for locations and types of temporary barriers and enclosures, including fire-rated materials proposed for use, prior to their installation.

1.4.2. Contractor shall provide a six (6) foot high, chain link perimeter fence with posts driven into the ground and fabric screen as a temporary barrier around construction area. Contractor shall provide and maintain temporary enclosures to prevent public entry and to protect persons using other buildings and portions of the Site and/or Premises. Contractor shall remove temporary fence, barriers and enclosure upon Completion of the Work.

1.4.3. Contractor shall provide site access to existing facilities for persons using other buildings and portions of the Site, for the public, and for deliveries and other services and activities.

1.5. SECURITY

Contractor shall secure all construction equipment, machinery and vehicles, park and store only within fenced area, and render inoperable during non-work hours. Contractor is responsible for ensuring that no construction materials, tools, equipment, machinery or vehicles can be used for unauthorized entry or other damage or interference to activities and security of existing facilities adjacent to and in the vicinity of the Project Site.

1.6. TEMPORARY CONTROLS

1.6.1. Noise Control:

1.6.1.1. Contractor acknowledges that adjacent facilities may remain in operation during all or a portion of the Work, and Contractor shall take all reasonable precautions to minimize noise as required by applicable laws and the Contract Documents.

1.6.1.2. Notice of proposed noisy operations, including without limitation, operation of pneumatic demolition tools, concrete saws, and other equipment, shall be submitted to District a minimum of forty-eight (48) hours in advance of their performance.

1.6.2. Noise and Vibration:

1.6.2.1. Equipment and impact tools shall have intake and exhaust mufflers.

1.6.2.2. Contractor shall cooperate with District to minimize and/or cease the use of noisy and vibratory equipment if that equipment becomes objectionable by its longevity.

1.6.3. Dust and Dirt:

1.6.3.1. Contractor shall conduct demolition and construction operations to minimize the generation of dust and dirt, and prevent dust and dirt from interfering with the progress of the Work and from accumulating in the Work and adjacent areas including, without limitation, occupied facilities.

1.6.3.2. Contractor shall periodically water exterior demolition and construction areas to minimize the generation of dust and dirt.

1.6.3.3. Contractor shall ensure that all hauling equipment and trucks carrying loads of soil and debris shall have their loads sprayed with water or covered with tarpaulins, and as otherwise required by local and state ordinance.

1.6.3.4. Contractor shall prevent dust and dirt from accumulating on walks, roadways, parking areas, and planting, and from washing into sewer and storm drain lines.

1.6.4. Surface and Subsurface Water:

Contractor shall not permit surface and subsurface water, and other liquids, to accumulate in or about the vicinity of the Premises. Should accumulation develop, Contractor shall control the water or other liquid, and suitably dispose of it by means of temporary pumps, piping, drainage lines, troughs, ditches, dams, or other methods.

1.6.5. Pollution:

1.6.5.1. No burning of refuse, debris, or other materials shall be permitted on or in the vicinity of the Premises.

1.6.5.2. Contractor shall comply with applicable regulatory requirements and anti-pollution ordinances during the conduct of the Work including, without limitation, demolition, construction, and disposal operations.

1.6.6. Lighting

If portable lights are used after dark, all light must be located so as not to direct light into neighboring property.

1.7. JOB SIGN(S)

1.7.1. General:

1.7.1.1. Contractor shall provide and maintain and locate a Project identification sign with the design, text, and colors designated by District and/or the Architect.

1.7.1.2. Signs other than the specified Project sign and or signs required by law, for safety, or for egress, shall not be permitted, unless otherwise approved in advance by the District.

1.7.2. Materials:

1.7.2.1. Structure and Framing: Structurally sound, new or used wood or metal; wood shall be nominal 3/4-inch exterior grade plywood.

1.7.2.2. Sign Surface: Minimum 3/4-inch exterior grade plywood.

1.7.2.3. Rough Hardware: Galvanized.

1.7.2.4. Paint: Exterior quality, of type and colors selected by the District and/or the Architect.

1.7.3. Fabrication:

1.7.3.1. Contractor shall fabricate to provide smooth, even surface for painting.

1.7.3.2. Size: 4'-0" x 8'-0", unless otherwise indicated.

1.7.3.3. Contractor shall paint exposed surfaces of supports, framing, and surface material with exterior grade paint: one coat of primer and one coat of finish paint.

1.7.3.4. Text and Graphics: As indicated.

1.8. PUBLICITY RELEASES

Contractor shall not release any information, story, photograph, plan, or drawing relating to information about the Project to anyone, including press and other public communications medium, including, without limitation, on website(s).

END OF DOCUMENT

DOCUMENT 01 52 10

SITE STANDARDS

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS:

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions, including without limitation, Site Access, Conditions, and Regulations;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any);
- 1.1.4. Drug-Free Workplace Certification;
- 1.1.5. Tobacco-Free Environment Certification;
- 1.1.6. Criminal Background Investigation/Fingerprinting Certification; and
- 1.1.7. Temporary Facilities and Controls.

1.2. REQUIREMENTS OF THE DISTRICT

1.2.1. Drug-Free Schools and Safety Requirements:

- 1.2.1.1. All school sites and other District Facilities have been declared "Drug-Free Zones." No drugs, alcohol, smoking or the use of tobacco products are allowed at any time in any buildings, Contractor-owned vehicles or vehicles owned by others while on District property. No students, staff, visitors, or contractors are to use drugs on these sites.
- 1.2.1.2. Contractor shall post: "Non-Smoking Area" in a highly visible location on Site. Contractor may designate a smoking area outside of District property within the public right-of-way, provided that this area remains quiet and unobtrusive to adjacent neighbors. This smoking area must be kept clean at all times.
- 1.2.1.3. Contractor shall ensure that no alcohol, firearms, weapons, or controlled substances enter or are used at the Site. Contractor shall immediately remove from the Site and terminate the employment of any employee(s) found in violation of this provision.

- 1.2.2. **Language:** Unacceptable and/or loud language will not be tolerated, "Cat calls" or other derogatory language toward students or public will not be allowed.

1.2.3. Disturbing the Peace (Noise and Lighting):

- 1.2.3.1. Contractor shall observe the noise ordinance of the Site at all times including, without limitation, all applicable local, city, and/or state laws, ordinances, and/or regulations regarding noise and allowable noise levels.
- 1.2.3.2. The use of radios, etc., shall be controlled to keep all sound at a level that cannot be heard beyond the immediate area of use. District reserves the right to prohibit the use of radios at the Site, except for handheld communication radios.
- 1.2.3.3. If portable lights are used after dark, the lights must be located so as not to direct light into neighboring properties.

1.2.4. Traffic:

- 1.2.4.1. Driving on the Premises shall be limited to periods when students and public are not present. If driving or deliveries must be made during the school hours, two (2) or more ground guides shall lead the vehicle across the area of travel. In no case shall driving take place across playgrounds or other pedestrian paths during recess, lunch, and/or class period changes. The speed limit on-the Premises shall be five (5) miles per hour (maximum) or less if conditions require.
- 1.2.4.2. All paths of travel for deliveries, including without limitation, material, equipment, and supply deliveries, shall be reviewed and approved by District in advance. Any damage will be repaired to the pre-damaged condition by the Contractor.
- 1.2.4.3. District shall designate a construction entry to the Site. If Contractor requests, District determines it is required, and to the extent possible, District shall designate a staging area so as not to interfere with the normal functioning of school facilities. Location of gates and fencing shall be approved in advance with District and at Contractor's expense.
- 1.2.4.4. Parking areas shall be reviewed and approved by District in advance. No parking is to occur under the drip line of trees or in areas that could otherwise be damaged.
- 1.2.4.5. All of the above shall be observed and complied with by the Contractor and all workers on the Site. Failure to follow these directives could result in individual(s) being suspended or removed from the work force at the discretion of the District. The same rules and regulations shall apply equally to delivery personnel, inspectors, consultants, and other visitors to the Site.

END OF DOCUMENT

DOCUMENT 01 56 39

TEMPORARY TREE AND PLANT PROTECTION

1. GENERAL

1.1. RELATED DOCUMENTS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any); and
- 1.1.4. Temporary Facilities and Controls.

1.2. SUMMARY

This Document includes the protection and trimming of existing trees that interfere with, or are affected by, execution of the Work, whether temporary or permanent construction.

1.3. DEFINITIONS

Tree Protection Zone: Area surrounding individual trees or groups of trees to remain 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. SUBMITTALS – Arborist not needed for this project.

- 1.4.1. Product Data: For each type of product indicated.
- 1.4.2. 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.
- 1.4.3. Qualification Data: For tree service firm and arborist.
- 1.4.4. 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.
- 1.4.5. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

1.5. QUALITY ASSURANCE

- 1.5.1. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of tree protection and trimming.
- 1.5.2. Arborist Qualifications: An arborist certified by ISA (International Society of Arboriculture) or licensed in the jurisdiction where Project is located.
- 1.5.3. Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance--Standard Practices (Pruning)."
 - 1.5.3.1. Before tree protection and trimming operations begin, meet with District to review tree protection and trimming procedures and responsibilities.

2. PRODUCTS

2.1. MATERIALS

- 2.1.1. Unless otherwise specified, Contractor shall select materials as recommended by arborist or landscape architect.
- 2.1.2. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch (63-mm) sieve and not more than 10 percent passing a 3/4-inch (19-mm) sieve.
- 2.1.3. 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 1 inch (25 mm) in diameter; and free of weeds, roots, and toxic and other nonsoil materials.
 - 2.1.3.1. Obtain topsoil only from well-drained sites where topsoil is 4 inches (100 mm) deep or more; do not obtain from bogs or marshes.
- 2.1.4. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.
- 2.1.5. Chain-Link Fence: Metallic-coated steel chain-link fence fabric of 0.120-inch- (3-mm-) diameter wire; a minimum of 48 inches (1200 mm) high; with 1.9-inch- (48-mm-) diameter line posts; 2-3/8-inch- (60-mm-) diameter terminal and corner posts; 1-5/8-inch- (41-mm-) diameter top rail; and 0.177-inch- (4.5-mm-) diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
- 2.1.6. Select mulch as recommended by arborist or landscape architect.
- 2.1.7. Organic Mulch: Use shredded hardwood, ground or shredded bark, or wood and bark chips, all free of deleterious materials.

3. EXECUTION

3.1. PREPARATION

- 3.1.1. Temporary Fencing: Install temporary fencing around tree protection zones to protect remaining trees and vegetation from construction damage. Maintain temporary fence and remove when construction is complete.
- 3.1.2. Install chain-link fence according to ASTM F 567 and manufacturer's written instructions.
- 3.1.3. 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.
- 3.1.4. Mulch areas inside tree protection zones and other areas indicated.
 - 3.1.4.1. Select mulch as recommended by arborist or landscape architect.
 - 3.1.4.2. Apply 2-inch (50-mm) to 3-inch (75-mm) average thickness of organic mulch. Do not place mulch within 6 inches (150 mm) of tree trunks.
- 3.1.5. Do not store construction materials, debris, or excavated material inside tree protection zones. Do not permit vehicles or foot traffic within tree protection zones; prevent soil compaction over root systems.
- 3.1.6. Maintain tree protection zones free of weeds and trash.
- 3.1.7. Do not allow fires within tree protection zones.

3.2. EXCAVATION

- 3.2.1. Install shoring or other protective support systems to minimize sloping or benching of excavations where construction or utility excavation is near trees to be protected.
- 3.2.2. Do not excavate within tree protection zones, unless otherwise indicated.
- 3.2.3. 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 and comb soil to expose roots.
 - 3.2.3.1. 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.
- 3.2.4. Where utility trenches are required within tree protection zones, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.

- 3.2.4.1. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

3.3. REGRADING

- 3.3.1. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade beyond tree protection zones. Maintain existing grades within tree protection zones.
- 3.3.2. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist, unless otherwise indicated.
 - 3.3.2.1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.
- 3.3.3. Minor Fill: Where existing grade is 6 inches (150 mm) or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.
- 3.3.4. Moderate Fill: Where existing grade is more than 6 inches (150 mm) but less than 12 inches (300 mm) below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:
 - 3.3.4.1. Carefully place drainage fill against tree trunk approximately 2 inches (50 mm) above elevation of finish grade and extend not less than 18 inches (450 mm) from tree trunk on all sides. For balance of area within drip-line perimeter, place drainage fill up to 6 inches (150 mm) below elevation of grade.
 - 3.3.4.2. Place filter fabric with edges overlapping 6 inches (150 mm) minimum.
 - 3.3.4.3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

3.4. TREE PRUNING

- 3.4.1. Prune trees to remain that are affected by temporary and permanent construction.
- 3.4.2. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
- 3.4.3. Pruning Standards: Prune trees according to ANSI A300 (Part 1), as recommended by arborist report.
- 3.4.4. Adjust pruning requirements per arborist's recommendations.

- 3.4.5. Cut branches with sharp pruning instruments; do not break or chop.
- 3.4.6. Modify below to specific project requirements.
- 3.4.7. Chip removed tree branches and dispose of or spread over areas identified by District.

3.5. TREE REPAIR AND REPLACEMENT

- 3.5.1. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
- 3.5.2. Remove and replace trees indicated to remain that die or are damaged during construction operations or that are incapable of restoring to normal growth pattern.
 - 3.5.2.1. Provide new trees of 6-inch (150-mm) caliper size and of a when damaged trees more than 6 inches (150 mm) in caliper size, measured 12 inches (300 mm) above grade, are required to be replaced. Plant and maintain new trees as specified in Contract Documents.
- 3.5.3. Where recommended by arborist report, aerate surface soil, compacted during construction, 10 feet (3 m) beyond drip line and no closer than 36 inches (900 mm) to tree trunk. Drill 2-inch (50-mm) diameter holes a minimum of 12 inches (300 mm) deep at 24 inches (600 mm) o.c. Backfill holes with an equal mix of augered soil and sand.

3.6. DISPOSAL OF WASTE MATERIALS

- 3.6.1. Burning is not permitted.
- 3.6.2. Disposal: Remove excess excavated material and displaced trees from Site.

END OF DOCUMENT

DOCUMENT 01 57 13

TEMPORARY EROSION, SEDIMENT AND STORM WATER POLLUTION CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Construction erosion and sediment control.
- B. Storm water pollution prevention and control related to construction activities.

1.2 RELATED SECTIONS

- A. Document 01 50 00 – Temporary Facilities and Controls.
- B. Section 31 10 00 – Site Clearing

1.3 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Section 01 42 13 and Section 01 42 16 for definitions, acronyms, and abbreviations.
 - 1. State Water Resources Control Board (SWRCB) Order 2009-0009-DWQ (amended by 2010-0014-DWQ & 2012-0006-DWQ) National Pollutant Discharge Elimination System (NPDES) No. CAS000002 General Permit for Storm Water Discharges Associated With Construction Activity (Construction General Permit).
 - 2. Construction General Permit Fact Sheet.
 - 3. SWPPP – Storm Water Pollution Prevention Plan.
 - 4. Caltrans Storm Water Quality Handbooks, Construction Site Best Management Practices Manual, March 1, 2003

1.4 SUBMITTALS

- A. General: Submit in accordance with Document 01 33 00.
- B. At completion of project, contractor shall submit Storm Water Pollution Prevention Plan (SWPPP) to owner for retention of records. SWPPP shall be kept on file at the project for 3 years after project completion.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with Clean Water Act (CWA) and EPA's NPDES Permit Program.
 - 2. Comply with rules and Regulations of California SWRCB, implemented and enforced by

the Regional Water Quality Control Board (RWQCB).

3. Comply with SWRCB WQ Order 2009-0009-DWQ (amended by 2010-0014-DWQ & 2012-0006-DWQ).
4. Comply with lawful requirements of and obtain permits from local, State, and Federal authorities having jurisdiction as referenced above, including applicable requirements developed to comply with NPDES permits issued by RWQCBs to local agencies.

B. Coordination:

1. Coordinate Work in this Section with Work in related Sections.
2. Coordinate removal of temporary erosion control measures after disturbed areas have become permanently stabilized.

1.6 GENERAL REQUIREMENTS

A. Storm Water Pollution and Prevention Plan:

1. A Storm Water Pollution Prevention Plan (SWPPP) has been prepared by Robertson Erickson Civil Engineers and Surveyors, (530)-894-3500, entitled "Storm Water Pollution and Prevention Plan for Chico County Day School Building Project", dated 2020.
2. Review SWPPP included in the Contract Documents and conduct site investigations to determine the adequacy of SWPPP.
3. Amend the SWPPP as necessary to suit project site conditions and Contractor's intended operations, methods, and equipment; and to comply with regulatory requirements and provisions of this Section.
4. Submit amended SWPPP (as necessary).

B. Acquire from SWRCB a General Permit to Discharge Storm Water Associated with Construction Activity in accordance with SWRCB WQ Order 2009-0009-DWQ (amended by 2010-0014-DWQ & 2012-0006-DWQ).

1. Owner shall file a Notice of Intent (NOI) with the SWRCB and pay appropriate fees with assistance by Engineer.
2. Engineer will submit Storm Water Pollution Prevention Plan (SWPPP) for approval by the SWRCB.
3. Contractor shall implement SWPPP as approved by SWRCB.
4. Contractor's QSP to File a Notice of Termination (NOT) upon final stabilization of disturbed earth.

C. Retain a Qualified SWPPP Practitioner (QSP) to develop and implement a monitoring program and reporting plan in accordance with SWRCB WQ Order 2009-0009-DWQ (amended by 2010-0014-DWQ & 2012-0006-DWQ) Section B: Monitoring Program and Reporting Requirements.

1. Submit quarterly and annual reports to SWRCB via SMARTS system.
2. Submit storm water sampling results to SWRCB via SMARTS system.

- D. QSP shall conduct inspections of the construction site prior to anticipated storm events and after actual storm events. During extended storm events, inspections shall be made each 24-hour period.
- E. QSP shall comply with standard provisions and reporting requirements in SWRCB WQ Order 2009-0009-DWQ (amended by 2010-0014-DWQ & 2012-0006-DWQ) Section C: Standard Provisions.
- F. Owner shall retain records of all monitoring information for at least three years from date generated or as extended per request of the SWRCB or the RWQCB. With the exception of reporting non-compliance to the appropriate RWQCB, Contractor is not required to submit the records, except upon specific request of RWQCB.
- G. Under direction of QSP, Owner shall certify annually that the construction activities follow the requirements of the General Permit from SWRCB. Notify appropriate RWQCB if Contractor cannot certify annual compliance.
- H. Start construction site work only after acquiring a General Permit from SWRCB.
- I. Compliance with SWRCB WQ Order 2009-0009-DWQ (amended by 2010-0014-DWQ & 2012-0006-DWQ) General Permit and related enforcement action requiring reduction or cessation of construction activity shall not be honored as a valid excuse for extension of the Contract Time.
- J. Contractor shall implement SWPPP as approved by SWRCB at the appropriate level to protect water quality at all times throughout the life of the project. Non-storm water BMPs shall be implemented year round.
- K. Contractor shall provide a copy of the SWPPP at the job site for the duration of the project, commencing with the initial mobilization and ending with the termination of coverage under the General Permit.
- L. Contractor shall be responsible for all fines levied by the SWRCB.

1.7 SUBSTITUTIONS

- A. Should Contractor desire to use procedures, materials, equipment, or products that are not specified, but meet the intent of these specifications, and are equal to the products specified, Contractor shall propose these substitutions under provisions of Section 01 60 00.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Materials and systems shall be as described in the BMPs in accordance with Caltrans Storm Water Quality Handbooks, Construction Site Best Management Practices Manual, March 1, 2003.

PART 3 EXECUTION

3.1 INSTALLATION AND MAINTENANCE

- A. Install and implement BMPs in accordance to the SWPPP at appropriate times during construction to protect water quality at all times.
- B. Install materials and systems described in BMPs in accordance with manufacturers' requirements and instructions.
- C. Inspect and maintain BMPs' structures and controls daily.
- D. Maintain order and cleanliness at the construction site. Comply with housekeeping requirements in accordance with Document 01 50 00.
- E. Review non-storm water BMPs prior to related construction activity such as but not limited to dewatering, pavement sawcutting, and weed control. Ensure BMP structures are in place before commencing with construction activity.

END OF DOCUMENT

DOCUMENT 01 60 00

MATERIALS AND EQUIPMENT

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions.
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any); and
- 1.1.4. Imported Materials Certification.

1.2. MATERIALS AND EQUIPMENT

- 1.2.1. Only items approved by the District and/or Architect shall be used.
- 1.2.2. Contractor shall submit lists of Products and other Product information in accordance with the Contract Documents, including, without limitation, the provisions regarding the submittals.

1.3. MATERIALS AND EQUIPMENT COLORS

- 1.3.1. The Contractor shall comply with all schedule(s) of colors provided by the District and/or Architect.
- 1.3.2. No individual color selections will be made until after approval of all pertinent materials and equipment and after receipt of appropriate samples in accordance with the Contract Documents, including, without limitation, the provisions regarding the submittals.
- 1.3.3. Contractor shall request priority in writing for any item requiring advance ordering to maintain the approved Construction Schedule.

1.4. DELIVERY, STORAGE, AND HANDLING

- 1.4.1. Contractor shall deliver manufactured materials in original packages, containers, or bundles (with seals unbroken), bearing name or identification mark of manufacturer. District may inspect materials prior to Contractor unloading the delivered materials. District may reject any materials that do not conform to the Contract Documents.

- 1.4.2. Contractor shall deliver fabrications in as large assemblies as practicable; where specified as shop-primed or shop-finished, package or crate as required to preserve such priming or finish intact and free from abrasion.
- 1.4.3. Contractor shall store materials in such a manner as necessary to properly protect them from damage. Materials or equipment damaged by handling, weather, dirt, or from any other cause will not be accepted.
- 1.4.4. Materials that have been warehoused for long periods of time, stored or transported in improper environment, improperly packaged, inadequately labeled, poorly protected, excessively shipped, deviated from normal distribution pattern, or reassembled are not acceptable.
- 1.4.5. Contractor shall store materials so as to cause no obstructions of sidewalks, roadways, or underground services. Contractor shall protect materials and equipment furnished pursuant to the Contract Documents.
- 1.4.6. Contractor may store materials on Site with prior written approval by District; all materials shall remain under Contractor's control and Contractor shall remain liable for any damage to the materials. Should the Project Site not have storage area available, the Contractor shall provide for off-site storage at no cost to District.
- 1.4.7. When any room in Project is used as a shop or storeroom, Contractor shall be responsible for any repairs, patching, or cleaning necessary due to that use. Location of storage space shall be subject to prior written approval by District.

2. PRODUCTS

2.1. MANUFACTURERS

- 2.1.1. Manufacturers listed in various sections of the Contract Documents are names of those manufacturers that are believed to be capable of supplying one or more of the items specified therein.
- 2.1.2. The listing of a manufacturer does not imply that every product of that manufacturer is acceptable or as meeting the requirements of the Contract Documents.

2.2. FACILITIES AND EQUIPMENT

Contractor shall provide, install, maintain, and operate a complete and adequate facility for handling, execution, disposal, and distribution of materials and equipment as required for proper and timely performance of Work.

2.3. MATERIALS REFERENCE STANDARDS

Where materials are specified solely by reference to "standard specifications" or other general reference, and if requested by District, Contractor shall submit for review data on actual materials proposed to be incorporated into Work, listing name and address of vendor, manufacturer, or producer, and trade or brand names of those materials, and data substantiating compliance with standard specifications.

3. EXECUTION

3.1. WORKMANSHIP

- 3.1.1. Where not more specifically described in any other Contract Documents, workmanship shall conform to methods and operations of best standards and accepted practices of trade or trades involved and shall include items of fabrication, construction, or installation regularly furnished or required for completion (including finish and for successful operation, as intended).
- 3.1.2. Work shall be executed by tradespersons skilled in their respective field of work. When completed, parts shall have been durably and substantially built and present a neat appearance.

3.2. COORDINATION

- 3.2.1. Contractor shall coordinate installation of materials and equipment so as to not interfere with installation of other Work. Adjustment or rework because of Contractor's failure to coordinate will be at no additional cost to District.
- 3.2.2. Contractor shall examine in-place materials and equipment for readiness, completeness, fitness to be concealed or to receive Work, and compliance with Contract Documents. Concealing or covering work constitutes acceptance of additional cost which will result should in-place materials and equipment be found unsuitable for receiving other work or otherwise deviating from the requirements of the Contract Documents.

3.3. COMPLETENESS

Contractor shall provide all portions of the Work, unless clearly stated otherwise, installed complete and operational with all elements, accessories, anchorages, utility connections, etc., in a manner to ensure well-balanced performance, in accordance with manufacturer's recommendations and in accordance with Contract Documents. For example, electric water coolers require water, electricity, and drain services; roof drains require drain systems; sinks fit within countertop, etc. Terms such as "installed complete," "operable condition," "for use intended," "connected to all utilities," "terminate with proper cap," "adequately anchored," "patch and refinish," and "to match similar" should be assumed to apply in all cases, except where completeness of functional or operable condition is specifically stated as not required.

3.4. APPROVED INSTALLER OR APPLICATOR

Contractor shall ensure that all installations are only performed by a manufacturer's approved installer or applicator.

3.5. MANUFACTURER'S RECOMMENDATIONS

All installations shall be in accordance with manufacturer's published recommendations and specific written directions of manufacturer's representative. Should the Contract Documents differ from recommendations of manufacturer or directions of manufacturer's representative, Contractor shall

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102 West 11th Street
Chico, California, 95928

GRA Architecture
Project #18-06

analyze differences, make recommendations to the District and the Architect in writing, and shall not proceed until interpretation or clarification has been issued by the District and/or the Architect.

END OF DOCUMENT

01 60 00 - 4
May 10, 2019

DOCUMENT 01 66 10

DELIVERY, STORAGE AND HANDLING

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions, including, without limitation, Site Access, Conditions and Requirements; and
- 1.1.2. Special Conditions.

1.2. PRODUCTS

- 1.2.1. Products are as defined in the General Conditions.
- 1.2.2. Contractor shall not use and/or reuse materials and/or equipment removed from existing Premises, except as specifically permitted by the Contract Documents.
- 1.2.3. Contractor shall provide interchangeable components of the same manufacturer, for similar components.

1.3. TRANSPORTATION AND HANDLING

- 1.3.1. Contractor shall transport and handle Products in accordance with manufacturer's instructions.
- 1.3.2. Contractor shall promptly inspect shipments to confirm that Products comply with Contract requirements, are of correct quantity, and are undamaged.
- 1.3.3. Contractor shall provide equipment and personnel to properly handle Products to prevent soiling, disfigurement, or damage.

1.4. STORAGE AND PROTECTION

- 1.4.1. Contractor shall store and protect Products in accordance with manufacturer's instructions, with seals and labels intact and legible. Contractor shall store sensitive Products in weather-tight, climate controlled enclosures.
- 1.4.2. Contractor shall place fabricated Products that are stored outside, on above-ground sloped supports.
- 1.4.3. Contractor shall provide off-site storage and protection for Products when Site does not permit on-site storage or protection.

- 1.4.4. Contractor shall cover Products subject to deterioration with impervious sheet covering and provide ventilation to avoid condensation.
- 1.4.5. Contractor shall store loose granular materials on solid flat surfaces in a well-drained area and prevent mixing with foreign matter.
- 1.4.6. Contractor shall provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- 1.4.7. Contractor shall arrange storage of Products to permit access for inspection and periodically inspect to assure Products are undamaged and are maintained under specified conditions.

END OF DOCUMENT

DOCUMENT 01 73 00

EXECUTION

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any);
- 1.1.4. Coordination and Project Meetings;
- 1.1.5. Submittals;
- 1.1.6. Materials and Equipment;
- 1.1.7. Cutting and Patching;
- 1.1.8. Contract Closeout and Final Cleaning; and
- 1.1.9. General Commissioning Requirements.

1.2. SUMMARY

- 1.2.1. This Document includes general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1.2.1.1. Construction layout;
 - 1.2.1.2. Field engineering and surveying;
 - 1.2.1.3. General installation of products;
 - 1.2.1.4. Owner furnished, Contractor installed items;
 - 1.2.1.5. Coordination of District-installed products;
 - 1.2.1.6. Progress cleaning;
 - 1.2.1.7. Staring and adjusting;
 - 1.2.1.8. Protection of installed construction; and

1.2.1.9. Correction of the Work.

1.3. SUBMITTALS

- 1.3.1. Qualification Data: For land surveyor or professional engineer.
- 1.3.2. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.
- 1.3.3. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept the materials as classified, for hazardous waste disposal.
- 1.3.4. Certified Surveys: Submit electronic files and three (3) paper copies signed by land surveyor or professional engineer.
- 1.3.5. Final Property Survey: Submit electronic files and three (3) paper copies showing the Work performed and record survey data.

2. EXECUTION

2.1. EXAMINATION

- 2.1.1. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning Site Work, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
 - 2.1.1.1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
 - 2.1.1.2. Furnish location data for Work related to Project that must be performed by public utilities serving the Project Site.

2.2. PREPARATION

- 2.2.1. Existing Utility Information: Furnish information to local utility 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.
- 2.2.2. 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.

- 2.2.3. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- 2.2.4. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to District per requirements of Document "Requests for Information." Include a detailed description of problem encountered, together with recommendations for any necessary changes to the Contract Documents.

2.3. CONSTRUCTION LAYOUT

- 2.3.1. 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 District and its consultant promptly.
- 2.3.2. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
 - 2.3.2.1. 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.
 - 2.3.2.2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 2.3.2.3. Inform installers of lines and levels to which they must comply.
 - 2.3.2.4. Check the location, level and plumb, of every major element as the Work progresses.
 - 2.3.2.5. Notify District and its consultant when deviations from required lines and levels exceed allowable tolerances.
 - 2.3.2.6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- 2.3.3. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- 2.3.4. 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.
- 2.3.5. 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 District and its consultant.

2.4. FIELD ENGINEERING

- 2.4.1. 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.
 - 2.4.1.1. Do not change or relocate existing benchmarks or control points without prior written approval of District and its consultant. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to District and its consultant before proceeding.
 - 2.4.1.2. Require surveyor to replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- 2.4.2. Benchmarks: Establish and maintain a minimum of two (2) permanent benchmarks on Project Site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 2.4.2.1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2.4.2.2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 2.4.2.3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- 2.4.3. Records: Contractor shall maintain a complete, accurate log of all control and survey Work as it progresses. On request of District or Architect, Contractor shall submit documentation to verify accuracy of field engineering Work at no additional cost to the District.
- 2.4.4. 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.
- 2.4.5. Final Property Survey: Prepare and submit a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey and are in conformance with Contract Documents.
 - 2.4.5.1. 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.

- 2.4.6. Compliance with Laws: Contractor is responsible for meeting all applicable codes, OSHA, safety, and shoring requirements.
- 2.4.7. Nonconforming Work: Contractor is responsible for any re-surveying required by correction of nonconforming Work.

2.5. INSTALLATION

- 2.5.1. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 2.5.1.1. Make vertical Work plumb and make horizontal Work level.
 - 2.5.1.2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 2.5.1.3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
 - 2.5.1.4. Maintain minimum headroom clearance of 7 feet in spaces without a suspended ceiling.
- 2.5.2. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- 2.5.3. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Completion.
- 2.5.4. 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.
- 2.5.5. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels where possible.
- 2.5.6. 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.
- 2.5.7. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 - 2.5.7.1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by District.
 - 2.5.7.2. Allow for building movement, including thermal expansion and contraction.
 - 2.5.7.3. 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.

- 2.5.8. 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.
- 2.5.9. Hazardous Materials: Use products, cleaners, and installation materials that are not classed as hazardous per the MSDS sheets for the products where possible. If hazardous materials are necessary, inform District where and when they will be used no less than 48 hours before use. Take all recommended precautions of the materials' manufacturers to ensure safe use and clean-up.

2.6. DISTRICT-INSTALLED PRODUCTS

- 2.6.1. Site Access: Provide access to Project Site for District's construction forces.
- 2.6.2. Coordination: Coordinate construction and operations of the Work with work performed by District's construction forces.
 - 2.6.2.1. Construction Schedule: Inform District of Contractor's preferred schedule for District's portion of the Work. Adjust Construction Schedule based on a mutually agreeable timetable. Notify District if changes to schedule are required due to differences in actual construction progress.
 - 2.6.2.2. Preinstallation Conferences: Include District's construction forces at preinstallation conferences covering portions of the Work that are to receive District's work. Attend preinstallation conferences conducted by District's construction forces if portions of the Work depend on District's construction.

2.7. PROGRESS CLEANING

- 2.7.1. General: Clean Project Site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 - 2.7.1.1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2.7.1.2. Do not hold materials more than seven (7) days during normal weather or three (3) days if the temperature is expected to rise above 80 degrees F.
 - 2.7.1.3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations. Remove hazardous and unsanitary waste materials daily.
- 2.7.2. Site: Maintain Project Site free of waste materials and debris.

- 2.7.3. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 2.7.3.1. Remove liquid spills promptly.
 - 2.7.3.2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- 2.7.4. 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.
- 2.7.5. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- 2.7.6. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Completion.
- 2.7.7. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- 2.7.8. 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 Completion.
- 2.7.9. 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.
- 2.7.10. 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.

2.8. STARTING AND ADJUSTING

- 2.8.1. Start equipment and operating components to confirm proper operation. Replace or repair malfunctioning units and retest.
- 2.8.2. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- 2.8.3. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- 2.8.4. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Document "Quality Requirements."

2.9. PROTECTION OF INSTALLED CONSTRUCTION

- 2.9.1. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Completion.
- 2.9.2. Comply with manufacturer's written instruction for temperature and relative humidity unless otherwise addressed in the construction planning, sequences, and instructions.

2.10. CORRECTION OF THE WORK

- 2.10.1. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Document "Cutting and Patching."
 - 2.10.1.1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- 2.10.2. Restore permanent facilities used during construction to their specified condition.
- 2.10.3. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- 2.10.4. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- 2.10.5. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF DOCUMENT

DOCUMENT 01 73 10

CUTTING AND PATCHING

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions, including, without limitation, Inspector, Inspections, and Tests, Integration of Work, Nonconforming Work, and Correction of Work, and Uncovering Work;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any);
- 1.1.4. Hazardous Materials Procedures and Requirements;
- 1.1.5. Hazardous Materials Certification;
- 1.1.6. Lead-Based Materials Certification; and
- 1.1.7. Imported Materials Certification.

1.2. CUTTING AND PATCHING

- 1.2.1. Contractor shall be responsible for all cutting, fitting, and patching, including associated excavation and backfill, required to complete the Work or to:
 - 1.2.1.1. Make several parts fit together properly.
 - 1.2.1.2. Uncover portions of Work to provide for installation of ill-timed Work.
 - 1.2.1.3. Remove and replace defective Work.
 - 1.2.1.4. Remove and replace Work not conforming to requirements of Contract Documents.
 - 1.2.1.5. Remove Samples of installed Work as specified for testing.
 - 1.2.1.6. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.
 - 1.2.1.7. Attaching new materials to existing remodeling areas – including painting (or other finishes) to match existing conditions.

- 1.2.2. In addition to Contract requirements, upon written instructions from District, Contractor shall uncover Work to provide for observations of covered Work in accordance with the Contract Documents, remove samples of installed materials for testing as directed by District, and remove Work to provide for alteration of existing Work.
- 1.2.3. Contractor shall not cut or alter Work, or any part of it, in such a way that endangers or compromises the integrity of the Work, the Project, or Work of others.
- 1.2.4. Contractor shall not cut and patch operating elements or safety 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. Operating elements include the following:
 - 1.2.4.1. Primary operational systems and equipment.
 - 1.2.4.2. Air or smoke barriers.
 - 1.2.4.3. Fire-suppression systems.
 - 1.2.4.4. Mechanical systems piping and ducts.
 - 1.2.4.5. Control systems.
 - 1.2.4.6. Communication systems.
 - 1.2.4.7. Conveying systems.
 - 1.2.4.8. Electrical wiring systems.
- 1.2.5. Contractor shall not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing capacity to perform as intended, or that results in increased maintenance or decreased operational life of safety. Miscellaneous elements include the following:
 - 1.2.5.1. Water, moisture or vapor barriers.
 - 1.2.5.2. Membranes and flashings.
 - 1.2.5.3. Exterior curtain-wall construction.
 - 1.2.5.4. Equipment supports.
 - 1.2.5.5. Piping, ductwork, vessels and equipment.
 - 1.2.5.6. Noise and vibration control elements and systems.
 - 1.2.5.7. Shoring, bracing and sheeting.

1.3. REQUEST TO CUT, ALTER, PATCH OR EXCAVATE

- 1.3.1. Contractor shall submit written notice to District pursuant to the applicable notice provisions of the Contract Documents, requesting consent to proceed with the cutting or alteration ("Request") at least ten (10) days prior to any cutting or alterations that may affect the structural safety of the Project, or Work of others, including the following:
 - 1.3.1.1. The Work of the District or other trades.
 - 1.3.1.2. Structural value or integrity of any element of the Project.
 - 1.3.1.3. Integrity or effectiveness of weather-exposed or weather-resistant elements or systems.
 - 1.3.1.4. Efficiency, operational life, maintenance or safety of operational elements.
 - 1.3.1.5. Visual qualities of sight-exposed elements.
- 1.3.2. Contractor's Request shall also include:
 - 1.3.2.1. Identification of the Project.
 - 1.3.2.2. Description of affected Work.
 - 1.3.2.3. Necessity for cutting, alterations, or excavations.
 - 1.3.2.4. Impacts of that Work on the District, other trades, or structural or weatherproof integrity of the Project.
 - 1.3.2.5. Description of proposed Work:
 - 1.3.2.5.1. Scope of cutting, patching, alterations, or excavations.
 - 1.3.2.5.2. Trades that will execute Work.
 - 1.3.2.5.3. Products proposed to be used.
 - 1.3.2.5.4. Extent of refinishing to be done.
 - 1.3.2.6. Alternates to cutting and patching.
 - 1.3.2.7. Cost proposal, when applicable.
 - 1.3.2.8. The scheduled date the Work is to be performed and the duration of time to complete the Work.
 - 1.3.2.9. Written permission of other trades whose Work will be affected.

1.4. QUALITY ASSURANCE

- 1.4.1. Contractor shall ensure that cutting, fitting, and patching shall achieve security, strength, weather protection, appearance for aesthetic match, efficiency, operational life, maintenance, safety of operational elements, and the continuity of existing fire ratings.
- 1.4.2. Contractor shall ensure that cutting, fitting, and patching shall successfully duplicate undisturbed adjacent profiles, materials, textures, finishes, and colors, and that materials shall match existing construction. Where there is dispute as to whether duplication is successful or has been achieved to a reasonable degree, the District's decision shall be final.

1.5. PAYMENT FOR COSTS

- 1.5.1. Costs caused by ill-timed or defective Work or Work not conforming to Contract Documents, including costs for additional services of the District or its consultants including but not limited to the Architect, inspector(s), engineers, and agents, will be paid by Contractor and/or deducted from the Contract Price by the District.
- 1.5.2. Contractor shall provide written cost proposals prior to proceeding with cutting and patching. District shall only pay for cost of Work if it is part of the Contract Price or if a change has been made to the Contract in compliance with the provisions of the General Conditions. Cost of Work performed upon instructions from the District, other than defective or nonconforming Work, will be paid by District on approval of written Change Order in accordance with the Contract Documents.

2. PRODUCTS

2.1. MATERIALS

- 2.1.1. Contractor shall provide for replacement and restoration of Work removed. Contractor shall comply with the Contract Documents and with the industry standard(s), for the type of Work, and the Specification requirements for each specific product involved. If not specified, Contractor shall recommend a product of a manufacturer or appropriate trade association for approval by the District.
- 2.1.2. Materials to be cut and patched include those damaged by the performance of the Work.

3. EXECUTION

3.1. INSPECTION

- 3.1.1. Contractor shall inspect existing conditions of the Site and the Work, including elements subject to movement or damage during cutting and patching, excavating and backfilling. After uncovering Work, Contractor shall inspect conditions affecting installation of new products.

- 3.1.2. Contractor shall report unsatisfactory or questionable conditions in writing to District as indicated in the General Conditions and shall proceed with Work as indicated in the General Conditions by District.

3.2. PREPARATION

- 3.2.1. Contractor shall provide shoring, bracing and supports as required to maintain structural integrity for all portions of the Project, including all requirements of the Project.
- 3.2.2. Contractor shall provide devices and methods to protect other portions of Project from damage.
- 3.2.3. Contractor shall, provide all necessary protection from weather and extremes of temperature and humidity for the Project, including without limitation any work that may be exposed by cutting and patching Work. Contractor shall keep excavations free from water.

3.3. ERECTION, INSTALLATION AND APPLICATION

- 3.3.1. With respect to performance, Contractor shall ensure its Subcontractors:
 - 3.3.1.1. Execute fitting and adjustment of products to provide finished installation to comply with and match specified tolerances and finishes.
 - 3.3.1.2. Execute cutting and demolition by methods that will prevent damage to other Work, and provide proper surfaces to receive installation of repairs and new Work.
 - 3.3.1.3. Execute cutting, demolition excavating, and backfilling by methods that will prevent damage to other Work and damage from settlement.
 - 3.3.1.4. Contractor shall use original installer or fabricator to perform cutting and patching for:
 - 3.3.1.5. Weather-exposed surfaces and moisture-resistant elements such as roofing, sheet metal, sealants, waterproofing, and other trades.
 - 3.3.1.6. Sight-exposed finished surfaces.
- 3.3.2. Contractor shall ensure its Subcontractors execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes as shown or specified in the Contract Documents including, without limitation, the Drawings and Specifications.
- 3.3.3. Subcontractors shall fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces. Contractor shall conform to all Code requirements for penetrations or the Drawings and Specifications, whichever calls for a higher quality or more thorough requirement. Contractor shall maintain integrity of both rated and non-rated fire walls, ceilings, floors, etc.

- 3.3.4. Contractor's Subcontractors shall restore Work which has been cut or removed and install new products to provide completed Work in accordance with requirements of the Contract Documents and as required to match surrounding areas and surfaces.
- 3.3.5. Contractor's Subcontractors shall refinish all continuous surfaces to nearest intersection as necessary to match the existing finish to any new finish.

END OF DOCUMENT

DOCUMENT 01 77 00

CONTRACT CLOSEOUT AND FINAL CLEANING

1. GENERAL

1.1. RELATED DOCUMENTS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions including, without limitation, Documents on Work and Completion of Work;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any);
- 1.1.4. Submittals;
- 1.1.5. Operation and Maintenance Data;
- 1.1.6. Warranties;
- 1.1.7. Record Documents;
- 1.1.8. Demonstration and Training; and
- 1.1.9. General Commissioning Requirements.

1.2. PRELIMINARY PROCEDURES

- 1.2.1. Before requesting inspection for determining date of Completion, complete the following. List items below that are incomplete in request.
 - 1.2.1.1. Prepare a list of items to be completed and corrected ("Punch List"), the value of items on the list, and reasons why the Work is not complete.
 - 1.2.1.2. Advise District of pending insurance changeover requirements.
 - 1.2.1.3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 1.2.1.4. Obtain and submit releases permitting District unrestricted use of the Work and access to services and utilities. Include certificate of occupancy, operating certificates, and similar releases, if required.
 - 1.2.1.5. Prepare and submit Project Record Documents, operation and maintenance manuals, Completion construction photograph prints and electronic files,

damage or settlement surveys, property surveys, and similar final record information.

- 1.2.1.6. Deliver tools, spare parts, extra materials, and similar items to location designated by District. Label with manufacturer's name and model number where applicable.
- 1.2.1.7. Make final changeover of permanent locks and deliver keys to District. Advise District's personnel of changeover in security provisions.
- 1.2.1.8. Complete startup testing of systems.
- 1.2.1.9. Submit test/adjust/balance records.
- 1.2.1.10. Terminate and remove temporary facilities from Project Site, along with mockups, construction tools, and similar elements.
- 1.2.1.11. Advise District of changeover in heat and other utilities.
- 1.2.1.12. Submit changeover information related to District's occupancy, use, operation, and maintenance.
- 1.2.1.13. Complete final cleaning requirements, including touch-up painting.
- 1.2.1.14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

1.3. RECORD DOCUMENTS AND SHOP DRAWINGS

- 1.3.1. Contractor shall legibly mark each item to record actual construction, including:
 - 1.3.1.1. Measured depths of foundation in relation to finish floor datum.
 - 1.3.1.2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permit surface improvements.
 - 1.3.1.3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 1.3.1.4. Field changes of dimension and detail.
 - 1.3.1.5. Details not on original Contract Drawings
 - 1.3.1.6. Changes made by modification(s).
 - 1.3.1.7. References to related Shop Drawings and modifications.
 - 1.3.1.8. Contractor will provide one set of Record Drawings to District.

1.3.1.9. Contractor shall submit all required documents to District and/or Architect prior to or with its final Application for Payment.

1.4. COMPLETION

1.4.1. Preliminary Procedures: Before requesting inspection for determining date of Completion, complete the following:

1.4.1.1. Submit a final Application for Payment according to the Contract Documents.

1.4.1.2. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

1.4.1.3. Submit pest-control final inspection report and warranty.

1.4.1.4. Instruction of District Personnel:

1.4.1.4.1. Before final inspection, at agreed upon times, Contractor shall instruct District's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems.

1.4.1.4.2. For equipment requiring seasonal operation, Contractor shall perform instructions for other seasons within six (6) months.

1.4.1.4.3. Contractor shall use operation and maintenance manuals as basis for instruction. Contractor shall review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

1.4.1.4.4. Contractor shall prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

1.4.1.4.5. Contractor shall use operation and maintenance manuals as basis for instruction. Contractor shall review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

1.4.2. Inspection: Submit a written request for inspection.

1.4.3. **LIST OF INCOMPLETE ITEMS (PUNCH LIST)** Contractor shall notify District and Architect when Contractor considers the Work complete. Upon notification, District and Architect will prepare a list of minor items to be completed or corrected ("Punch List").

1.4.4. Contractor and/or its Subcontractors shall proceed promptly to complete and correct items on the Punch List. Failure to include an item on Punch List does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

- 1.4.5. Contractor shall comply with Punch List procedures as provided herein and in the Contract Documents, and maintain the presence of a Project Superintendent and Project Manager until the Punch List is complete to ensure proper and timely completion of the Punch List. Under no circumstances shall Contractor demobilize its forces prior to completion of the Punch List. Upon receipt of Contractor's written notice that all of the Punch List items have been fully completed and the Work is ready for final inspection and acceptance, District and Architect will inspect the Work and shall submit to Contractor a final inspection report noting the Work, if any, required in order to reach Completion in accordance with the Contract Documents. Absent unusual circumstances, this report shall consist of the Punch List items not yet satisfactorily completed and any additional Punch List items not originally included.
- 1.4.6. Upon Contractor's completion of all items on the Punch List and any other uncompleted portions of the Work, the Contractor shall notify the District and Architect, who shall again inspect such Work. If the District and Architect find the Work complete and acceptable under the Contract Documents, the District will notify Contractor, who shall then jointly submit to the Architect and District its final Application for Payment.
- 1.4.7. **Costs of Multiple Inspections.** More than two (2) requests of District to make a final inspection shall be considered an additional service of District, the Architect and/or the Inspector, and all subsequent costs will be invoiced to Contractor and withheld from remaining payments, if funds are available.
- 1.4.8. Punch List shall be deemed complete only upon the District's determination that all items on the Punch List, and all updates to the Punch List, are complete.

1.5. WARRANTIES

- 1.5.1. Submittal Time: Submit written warranties on request of District for designated portions of the Work where commencement of warranties other than date of Completion is indicated.
- 1.5.2. Organize warranty documents into an orderly sequence as required by the Division 01 Document "Warranties."

2. PRODUCTS

2.1. MATERIALS

- 2.1.1. 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.

3. EXECUTION

3.1. FINAL CLEANING

- 3.1.1. Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations. Contractor shall use cleaning methods and procedures that reduce the overall impact on human health and the natural environment by reducing the amount of disposed waste, pollution and environmental degradation. If Project is subject to LEED certification, Contractor shall ensure compliance with the applicable LEED requirements for final cleaning of the Site.
- 3.1.2. Contractor shall 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.
 - 3.1.2.1. Complete the following cleaning operations before requesting final inspection:
 - 3.1.2.1.1. Clean Project Site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - 3.1.2.1.2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - 3.1.2.1.3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - 3.1.2.1.4. Remove tools, construction equipment, machinery, and surplus material from Project Site.
 - 3.1.2.1.5. Remove snow and ice to provide safe access to building.
 - 3.1.2.1.6. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - 3.1.2.1.7. Clean all surfaces and other work in accordance with recommendations of the manufacturer.
 - 3.1.2.1.8. Remove spots, mortar, plaster, soil, and paint from ceramic tile, stone, and other finish materials.
 - 3.1.2.1.9. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

- 3.1.2.1.10. Sweep concrete floors broom clean in unoccupied spaces.
 - 3.1.2.1.11. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - 3.1.2.1.12. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - 3.1.2.1.13. Remove labels that are not permanent.
 - 3.1.2.1.14. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 3.1.2.1.14.1. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - 3.1.2.1.15. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - 3.1.2.1.16. Replace parts subject to unusual operating conditions.
 - 3.1.2.1.17. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - 3.1.2.1.18. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - 3.1.2.1.19. Clean ducts, blowers, and coils if units were operated without filters during construction.
 - 3.1.2.1.20. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - 3.1.2.1.21. Leave Project Site clean and ready for occupancy.
- 3.1.3. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests.

- 3.1.4. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on District's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project Site and dispose of lawfully.

END OF DOCUMENT

DOCUMENT 01 78 23

OPERATION AND MAINTENANCE DATA

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions, including, without limitation, Completion of the Work;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any);
- 1.1.4. Submittals;
- 1.1.5. Contract Closeout and Final Cleaning;
- 1.1.6. Warranties;
- 1.1.7. Record Documents;
- 1.1.8. General Commissioning Requirements.

1.2. QUALITY ASSURANCE

- 1.2.1. Contractor shall prepare instructions and data by personnel experienced in maintenance and operation of described products.

1.3. FORMAT

- 1.3.1. Contractor shall prepare data in the form of an instructional manual entitled "OPERATIONS AND MAINTENANCE MANUAL & INSTRUCTIONS" ("Manual").
- 1.3.2. Binders: Contractor shall use commercial quality, 8-1/2 by 11 inch, three-side rings, with durable plastic covers; two inch maximum ring size. When multiple binders are used, Contractor shall correlate data into related consistent groupings.
- 1.3.3. Cover: Contractor shall identify each binder with typed or printed title "OPERATION AND MAINTENANCE MANUAL & INSTRUCTIONS"; and shall list title of Project and identify subject matter of contents.
- 1.3.4. Contractor shall arrange content by systems process flow under section numbers and sequence of the Table of Contents of the Contract Documents.

- 1.3.5. Contractor shall provide tabbed fly leaf for each separate Product and system, with typed description of Product and major component parts of equipment.
- 1.3.6. Text: The content shall include Manufacturer's printed data, or typewritten data on 24 pound paper.
- 1.3.7. Drawings: Contractor shall provide with reinforced punched binder tab and shall bind in with text; folding larger drawings to size of text pages.

1.4. CONTENTS, EACH VOLUME

- 1.4.1. Table of Contents: Contractor shall provide title of Project; names, addresses, and telephone numbers of the Architect, any engineers, subconsultants, Subcontractor(s), and Contractor with name of responsible parties; and schedule of Products and systems, indexed to content of the volume.
- 1.4.2. For Each Product or System: Contractor shall list names, addresses, and telephone numbers of Subcontractor(s) and suppliers, including local source of supplies and replacement parts.
- 1.4.3. Product Data: Contractor shall mark each sheet to clearly identify specific Products and component parts, and data applicable to installation. Delete inapplicable information.
- 1.4.4. Drawings: Contractor shall supplement Product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Contractor shall not use Project Record Documents as maintenance drawings.
- 1.4.5. Text: The Contractor shall include any and all information as required to supplement Product data. Contractor shall provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

1.5. MANUAL FOR MATERIALS AND FINISHES

- 1.5.1. Building Products, Applied Materials, and Finishes: Contractor shall include Product data, with catalog number, size, composition, and color and texture designations. Contractor shall provide information for re-ordering custom manufactured Products.
- 1.5.2. Instructions for Care and Maintenance: Contractor shall include Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- 1.5.3. Moisture Protection and Weather Exposed Products: Contractor shall include Product data listing applicable reference standards, chemical composition, and details of installation. Contractor shall provide recommendations for inspections, maintenance, and repair.
- 1.5.4. Additional Requirements: Contractor shall include all additional requirements as specified in the Specifications.

- 1.5.5. Contractor shall provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.6. MANUAL FOR EQUIPMENT AND SYSTEMS

- 1.6.1. Each Item of Equipment and Each System: Contractor shall include description of unit or system, and component parts and identify function, normal operating characteristics, and limiting conditions. Contractor shall include performance curves, with engineering data and tests, and complete nomenclature, and commercial number of replaceable parts.
- 1.6.2. Panelboard Circuit Directories: Contractor shall provide electrical service characteristics, controls, and communications.
- 1.6.3. Contractor shall include color coded wiring diagrams as installed.
- 1.6.4. Operating Procedures: Contractor shall include start-up, break-in, and routine normal operating instructions and sequences. Contractor shall include regulation, control, stopping, shut-down, and emergency instructions. Contractor shall include summer, winter, and any special operating instructions.
- 1.6.5. Maintenance Requirements: Contractor shall include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- 1.6.6. Contractor shall provide servicing and lubrication schedule, and list of lubricants required.
- 1.6.7. Contractor shall include manufacturer's printed operation and maintenance instructions.
- 1.6.8. Contractor shall include sequence of operation by controls manufacturer.
- 1.6.9. Contractor shall provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- 1.6.10. Contractor shall provide control diagrams by controls manufacturer as installed.
- 1.6.11. Contractor shall provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- 1.6.12. Contractor shall provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- 1.6.13. Contractor shall provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- 1.6.14. Additional Requirements: Contractor shall include all additional requirements as specified in Specification(s).

- 1.6.15. Contractor shall provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.7. SUBMITTAL

- 1.7.1. Concurrent with the Schedule of Submittals as indicated in the General Conditions, Contractor shall submit to the District for review two (2) copies of a preliminary draft of proposed formats and outlines of the contents of the Manual.
- 1.7.2. For equipment, or component parts of equipment put into service during construction and to be operated by District, Contractor shall submit draft content for that portion of the Manual within ten (10) days after acceptance of that equipment or component.
- 1.7.3. On or before the Contractor submits its final application for payment, Contractor shall submit two (2) copies of a complete Manual in final form. The District will provide comments to Contractor and Contractor must revise the content of the Manual as required by District prior to District's approval of Contractor's final Application for Payment.
- 1.7.4. Contractor must submit two (2) copies of revised Manual in final form within ten (10) days after receiving District's comments. Failure to do so will be a basis for the District withholding funds sufficient to protect itself for Contractor's failure to provide a final Manual to the District.

END OF DOCUMENT

DOCUMENT 01 78 36

WARRANTIES

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions, including, without limitation, Warranty/Guarantee/Indemnity;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any);
- 1.1.4. Submittals;
- 1.1.5. Contract Closeout and Final Cleaning;
- 1.1.6. Operation and Maintenance Data;
- 1.1.7. Record Documents;
- 1.1.8. General Commissioning Requirements.

1.2. FORMAT

- 1.2.1. Binders: Contractor shall use commercial quality, 8-1/2 by 11 inch, three-side rings, with durable plastic covers; two inch maximum ring size.
- 1.2.2. Cover: Contractor shall identify each binder with typed or printed title "WARRANTIES" and shall list the title of Project.
- 1.2.3. Table of Contents: Contractor shall provide the title of Project; name, address, and telephone number of Contractor and equipment supplier, and name of responsible principal. Contractor shall identify each item with the number and title of the specific Specification, document, provision, or section in which the name of the Product or Work item is specified.
- 1.2.4. Contractor shall separate each Warranty with index tab sheets keyed to the Table of Contents listing, providing full information and using separate typed sheets as necessary. Contractor shall list each applicable and/or responsible Subcontractor(s), supplier(s), and/or manufacturer(s), with name, address, and telephone number of each responsible principal(s).
- 1.2.5. In addition to all Warranty documentation and information required herein, Contractor shall provide its Guarantee as required by the Contract Documents.

1.3. PREPARATION

- 1.3.1. Contractor shall obtain Warranties, executed in duplicate by each applicable and/or responsible Subcontractor(s), supplier(s), and manufacturer(s), within ten (10) days after completion of the applicable item or Work. Except for items put into use with District's permission, Contractor shall leave date of beginning of time of Warranty until the date of Completion is determined.
- 1.3.2. Contractor shall verify that Warranties.
- 1.3.3. are in proper form, contain full information, and are notarized, when required.
- 1.3.4. Contractor shall co-execute submittals when required.
- 1.3.5. Contractor shall retain warranties until time specified for submittal.

1.4. TIME OF SUBMITTALS

- 1.4.1. Schedule of Warranties. Contractor shall provide District with a Schedule of Warranties at least fourteen (14) days prior to submitting its other required submittals indicated herein. This will provide District the opportunity to review the anticipated Warranties and make any comments, suggestions or revisions the District may require.
- 1.4.2. For equipment or component parts of equipment put into service during construction with District's permission, Contractor shall submit a draft Warranty for that equipment or component within ten (10) days after acceptance of that equipment or component.
- 1.4.3. On or before the Contractor submits its final application for payment, Contractor shall submit all Warranties and related documents in final form. The District shall indicate any Warranty-related Work that is being performed and incomplete at the time Contractor submits its final application for payment. District will provide comments to Contractor and Contractor must revise the content of the Warranties as required by District prior to District's approval of Contractor's final Application for Payment.
- 1.4.4. For items of Work that are not completed until after the date of Completion, Contractor shall provide an updated Warranty for those item(s) of Work within ten (10) days after acceptance, listing the date of acceptance as start of the Warranty period.

END OF DOCUMENT

DOCUMENT 01 78 39

RECORD DOCUMENTS

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions, including, without limitation, Documents on Work and Completion of Work;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any);
- 1.1.4. Submittals;
- 1.1.5. Contract Closeout and Final Cleaning;
- 1.1.6. Operation and Maintenance Data;
- 1.1.7. Warranties;
- 1.1.8. General Commissioning Requirements.

2. RECORD DOCUMENTS OR DRAWINGS

2.1. GENERAL

- 2.1.1. "Record Documents" and "Record Drawings" may also be referred to in the Contract Documents as "As-Built Drawings."
- 2.1.2. As indicated in the Contract Documents, District will provide Contractor with one set of reproducible plans of the original Drawings.
- 2.1.3. Contractor shall maintain at each Project Site one (1) set of marked-up Drawings and shall transfer all changes and information to those marked-up Drawings, as often as required in the Contract Documents, but in no case less than once each month. Contractor shall submit to the Project Inspector one set of reproducible vellums of the Project Record Documents ("As-Built") showing all changes incorporated into the Work since the preceding monthly submittal. The As-Built shall be available at the Project Site. The Contractor shall submit reproducible vellums at the conclusion of the Project following review of the blue line prints.
- 2.1.4. Label and date each Record Document "RECORD DOCUMENT" in legibly printed letters.

- 2.1.5. All deviations in construction, including but not limited to pipe and conduit locations and deviations caused, without limitation, by Change Orders, Construction Directives, RFI's, and Addenda shall be accurately and legibly recorded by Contractor.
- 2.1.6. Locations and changes shall be done by Contractor in a neat and legible manner and, where applicable, indicated by drawing a "cloud" around the changed or additional information.

2.2. RECORD DOCUMENT INFORMATION

- 2.2.1. Contractor shall record the following information:
 - 2.2.1.1. Locations of Work buried under or outside each building, including, without limitation, all utilities, plumbing and electrical lines, and conduits.
 - 2.2.1.2. Actual numbering of each electrical circuit.
 - 2.2.1.3. Locations of significant Work concealed inside each building whose general locations are changed from those shown on the Drawings.
 - 2.2.1.4. Locations of all items, not necessarily concealed, which vary from the Contract Documents.
 - 2.2.1.5. Installed location of all cathodic protection anodes.
 - 2.2.1.6. Deviations from the sizes, locations, and other features of installations shown in the Contract Documents.
 - 2.2.1.7. Locations of underground work, points of connection with existing utilities, changes in direction, valves, manholes, catch basins, capped stubouts, invert elevations, etc.
 - 2.2.1.8. Sufficient information to locate Work concealed in each building with reasonable ease and accuracy.
- 2.2.2. In some instances, this information may be recorded by dimension. In other instances, it may be recorded in relation to the spaces in the building near which it was installed.
- 2.2.3. Contractor shall provide additional Drawings as necessary for clarification.
- 2.2.4. Contractor shall provide in an electronic format as indicated in the Contract Documents, a copy of the Drawings, made from final Shop Drawings marked "No Exceptions Taken" or "Approved as Noted."
 - 2.2.4.1. With the District's prior approval, Contractor may provide these reproducible Drawings in hard copy.

3. RECORD MATERIALS LOG

- 3.1.1. Materials Log shall be submitted prior to Completion.
- 3.1.2. Preparation: Mark Material Log to indicate the actual product installation where installation varies from that indicated in original Material Log.
- 3.1.3. Give particular attention to information on concealed materials and installations that cannot be readily identified and recorded later.
- 3.1.4. Mark copy with the proprietary name and characteristics of products, materials, and equipment furnished, including substitutions and product options selected.
- 3.1.5. Record the name of the manufacturer, supplier, installer, and other information necessary to provide a record of selections made.
- 3.1.6. The working copy of Materials Log shall be consistently maintained throughout construction, and shall be accessible at Project Site.

4. MAINTENANCE OF RECORD DOCUMENTS

- 4.1. Contractor shall store Record Documents apart from documents used for construction as follows:
 - 4.1.1. Provide files and racks for storage of Record Documents.
 - 4.1.2. Maintain Record Documents in a clean, dry, legible condition and in good order.
- 4.2. Contractor shall not use Record Documents for construction purposes.

END OF DOCUMENT

DOCUMENT 01 91 00

COMMISSIONING

1. GENERAL

1.1. RELATED DOCUMENTS AND PROVISIONS

Contractor shall review all Contract Documents for applicable provisions related to the provisions in this document, including without limitation:

- 1.1.1. General Conditions, including, without limitation, Documents on Work and Completion of Work;
- 1.1.2. Special Conditions (if any);
- 1.1.3. Supplemental Conditions (if any);
- 1.1.4. Submittals;
- 1.1.5. Contract Closeout and Final Cleaning;
- 1.1.6. Operation and Maintenance Data;
- 1.1.7. Warranties;
- 1.1.8. Record Documents; and

1.2. SUMMARY

- 1.2.1. Commissioning is a process for validating and documenting that the facility and its systems are constructed and perform in conformity with the Contract Documents.
- 1.2.2. The objective of the commissioning process is to verify that the performance of the facility and its systems meet or exceed the design intent.
- 1.2.3. Commissioning includes special facility start-up processes used to bring the facility to a fully operational state, free of deficiencies in an efficient and timely manner.
- 1.2.4. Training on related systems and equipment operation and maintenance shall be scheduled to commence only after start-up is complete and systems are verified to be 100% complete and functional.

1.3. DESCRIPTION

The following applies to all Contract Documents:

- 1.3.1. **Contractor Startup:** Sub-phase of Contractor's work ending with Acceptance of Work, during which Contractor performs a pre-planned program of activities including starting, testing, inspecting, adjusting balancing, correcting deficiencies and other similar activities.
 - 1.3.1.1. The District, Construction Manager and Architect and the Inspector shall be present to observe, inspect and identify deficiencies in building systems operations.
- 1.3.2. The completion of startup means the entire Construction Project including startup and fine tuning has been performed to the requirements of the Contract Documents and is verified in writing by the District, Construction Manager and Architect.
- 1.3.3. **Fine Tuning:** Fine tuning is the responsibility of Contractors after District occupancy and ending one (1) year after District occupancy. During this time the Contractor is responsible for optimizing systems and correcting deficiencies arising under normal operating conditions.
 - 1.3.3.1. Includes a period after occupancy where systems are optimized under "live" operating conditions and any outstanding construction deficiencies are corrected.
 - 1.3.3.2. Fine Tuning shall extend from date of District occupancy to one year after occupancy.

1.4. DEFINITION OF TERMS

- 1.4.1. **Contractor's Pre-Commissioning Checklists:** Includes installation and start-up items as specified to be completed by the appropriate contractors prior to operational verification through the functional testing process.
- 1.4.2. **Installation Verification Process:** Includes the on-site inspection and review of related system components for conformance to Contract Documents. The Contractor shall verify systems readiness for functional testing procedures prior to the start of functional testing. Deficiencies will be documented by the Inspector for future resolution.
- 1.4.3. **Functional Performance Testing Process:** Includes the documented testing of system parameters, under actual or simulated operating conditions. Final performance commissioning of systems will begin only after the appropriate Contractor certifies that systems are 100% complete and ready for functional testing. The Contractor will be required to schedule, coordinate and perform device tests, calibration and functional performance test procedures.

- 1.4.4. **Deficiencies and Resolutions List:** Includes a list of noted deficiencies discovered as a result of the commissioning process. This list also includes the current disposition of issues, and the date of final resolution as confirmed by the Construction Manager and Inspector. Deficiencies are defined as those issues where products execution or performance does not satisfy the Project Contract Documents and/or the design intent.

1.5. COMMISSIONING SCHEDULE

- 1.5.1. Provide schedules for Contractor Start-Up work.
- 1.5.2. Incorporate in overall construction schedule.
- 1.5.3. Contractor's activities, which will be performed as specified under Fine Tuning, shall be completed within one (1) year from date of occupancy by the District.

1.6. CONTRACTOR RESPONSIBILITIES

- 1.6.1. Provide utility services required for the commissioning process.
- 1.6.2. Contractor is responsible for construction means, methods, job safety, and/or management function related to commissioning on the Project Site.
- 1.6.3. Contractor shall assign representatives with expertise and authority to act on behalf of Contractor and schedule the representatives to participate in and perform commissioning team activities including, but not limited to, the following:
 - 1.6.3.1. Participate in design and construction-phase coordination meetings.
 - 1.6.3.2. Participate in maintenance orientation and inspection.
 - 1.6.3.3. Participate in operation and maintenance training sessions.
 - 1.6.3.4. Participate in final review.
 - 1.6.3.5. Certify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
 - 1.6.3.6. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
 - 1.6.3.7. Review and comment on final commissioning documentation.
- 1.6.4. Contractor shall integrate all commissioning activities into Contractor's Construction Schedule.
- 1.6.5. Contractor's Subcontractors shall assign representatives with expertise and authority to act on behalf of subcontractors and schedule the representatives to participate in and perform commissioning team activities including, but not limited to, the following:

- 1.6.5.1. Participate in design and construction-phase coordination meetings.
- 1.6.5.2. Participate in maintenance orientation and inspection.
- 1.6.5.3. Participate in procedures meeting for testing.
- 1.6.5.4. Participate in final review.
- 1.6.5.5. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to Commissioning Authority for incorporation into the commissioning plan. Update schedule on a weekly basis throughout the construction period.
- 1.6.5.6. Provide information to the Commissioning Authority for developing construction phase commissioning plan.
- 1.6.5.7. Participate in training sessions for District's operation and maintenance personnel.
- 1.6.5.8. Provide updated Project Record Documents to Commissioning Authority on a daily basis.
- 1.6.5.9. Gather and submit operation and maintenance data for systems, subsystems, and equipment to the Commissioning Authority, as specified in Division 01 Document "Operation and Maintenance Data."
- 1.6.5.10. Provide technicians who are familiar with the construction and operation of installed systems, who shall execute the test procedures developed by the Commissioning Authority, and who shall participate in testing of installed systems, subsystems, and equipment.

1.7. SUBMITTALS

- 1.7.1. Submit Draft and Final Contractor Start-up Forms as described in this Document. Submit Draft Report for Construction Manager and Architect's review and comment prior to Final Submission. Submit Final Report not later than twenty weeks before scheduled date of Acceptance of Work.
- 1.7.2. Prepare and submit one copy of report form to be used in preparation of system reports for:
 - 1.7.2.1. Each Mechanical system specified in Division 23.
 - 1.7.2.2. Each Electrical system specified in Division 26.
- 1.7.3. Each System Report shall be submitted including the following:
 - 1.7.3.1. Project Name

- 1.7.3.2. Name of System
- 1.7.3.3. Index of report's content
- 1.7.3.4. Adjacent to list of equipment, columns to indicate status of equipment operation, to date and to sign off equipment start-up.
- 1.7.3.5. Space to record equipment and operational problems which cannot be corrected with scheduled Contractor Start-Up program and which may delay Acceptance of Work.
- 1.7.3.6. Manufacturer's equipment start-up reports.
- 1.7.3.7. Systems' testing, balancing, and adjusting reports.
- 1.7.3.8. Equipment Report Forms shall include the following: Project name, name of equipment, starting and testing procedures to be performed and observations and test results to be recorded.

1.8. QUALITY ASSURANCE

- 1.8.1. Training Instructor Qualifications: Contractor shall provide factory-authorized service representatives, experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.
- 1.8.2. Test Equipment Calibration: Comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments (per NIST requirements if applicable) immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

1.9. EQUIPMENT & SYSTEM SCHEDULE

- 1.9.1. The following equipment, if installed, shall be commissioned in this Project:

System	Equipment	Note	
HVAC System	Chillers		
	Boilers		
	Pumps		
	Cooling towers		
	Variable frequency drives		
	Air handlers		
	Packaged AC units		
	Terminal units for Office areas		
	Unit heaters		
	Heat exchangers		
	Exhaust fans		
	Supply fans		

	Return fans		
Building Management System	Sequences of Operation, Monitored Points, and Alarms		
	Metering/Monitoring Devices and Equipment		
	Software Commissioning, GUI presentation commissioning, system access performance criteria, software tools/source code commissioning, instrument data sheets, middleware commissioning, Internet Protocol commissioning		
Electrical System	Sweep or scheduled lighting controls		
	Daylight dimming controls		
	Lighting occupancy sensors		
	Electrical grounding		
Plumbing System	Domestic water heaters		
Security Alarm Systems	Security cameras and monitoring system personal duress alarm system; Intercom system; Paging System.		
System	Equipment		
Security Electronics	Security plumbing fixture water management system.		
	Door Controls.		
	Fire alarm system.		
	Distributed radio antenna system.		
	Access control system.		
Fire/Life Safety Systems	All devices		
	Alarm drivers		
	HVAC/Fire System Integration		
	Event Notifying and Reporting Systems		
Communication System			

1.10. SYSTEM FAILURES

After a second failure of a system to successfully meet the criteria as set for in the functional performance testing process, the Contractor shall reimburse the District for cost associated with any additional retesting required due to uncorrected deficiencies. Costs shall include salary, benefits, overhead, travel costs and per diem lodging costs if applicable.

END OF DOCUMENT

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Formwork for cast-in-place concrete with shoring, bracing, and anchorage.
2. Openings for other Work.
3. Form accessories, sealers, and release agents.
4. Form stripping.

B. Related Sections

1. Section 03 15 00 - Concrete Accessories.
2. Section 03 20 00 - Concrete Reinforcing.
3. Section 03 30 00 - Cast-in-Place Concrete.
4. Section 03 30 50 - Concrete Testing and Inspection.
5. Section 03 60 00 - Grouting
6. Section 07 26 00 - Vapor Retarders.
7. Section 07 90 00 - Joint Protection.
8. Section 09 61 00 - Flooring Treatment

1.2 REFERENCE

- A. ACI 318 - Building Code Requirements for Structural Concrete.
- B. ACI 347 - Guide to Formwork for Concrete.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data
 1. Product data for products and materials indicated.
 2. Manufacturer's technical bulletins and installation/application instructions.
 3. Material Safety Data Sheets (MSDS).

1.4 COORDINATION

- A. Coordinate the design, construction and installation of concrete formwork with the requirements for openings, sleeves, chases, pipes, recesses, nailers, anchors, ties, inserts and other embedded items required by other Sections.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store products subject to damage by dirt and moisture in a clean, dry location, off the ground and suitably protected.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Form materials shall be salvageable, reusable and recyclable.
- B. Use flexible spring-steel forms or laminated boards to form radius bends.
- C. Form Lumber: Douglas Fir, Construction Grade, No. 2 or better, S1S2E.
- D. Plywood: Five-ply, 3/4 inch thick, APA B-B Plyform, Class I, Exterior Type with mill-oiling treatment omitted.

2.2 EARTH FORMS

- A. Where approved, vertical excavated surfaces may be used for forms for slabs on grade and grade beams, provided that the earth will stand without caving and that suitable provisions are taken to prevent raveling of top edges or sloughing of loose materials from the walls of the excavation.
- B. Where earth forms are permitted, clear dimensions as indicated shall be maintained and any over-excavation shall be filled monolithically with concrete.
- C. Construct wood edge strips at top sides of excavations.

2.3 ACCESSORIES

- A. Accessories which will be wholly or partially embedded in concrete, such as ties and hangers, shall be a commercially manufactured type, of metal; wire will not be acceptable.
- B. The portion remaining in the concrete shall leave no metal within 1 inch of concrete face and no fractures, spalls, depressions, or other surface disfigurements greater than 3/4 inch in diameter.
- C. Spreader cones on ties shall not exceed 1 inch in diameter.

2.4 FINISHES

- A. Form Sealer: Type to eliminate grain raise as a result of moisture and shall not interfere with color, bond, or subsequent treatment of concrete surface.
 - 1. Manufacturers
 - a. W.R. Meadows; Duogard II = Water-based form release agent.
 - b. BASF Construction Chemicals.; Cast-off: Nonstaining form-release agent.
 - c. EDOCO/Burke; "Form Sealer" (also known as "Kwik Koat Form Coating").
- B. Form Release Agent
 - 1. For Exposed Concrete to Receive Paint or Other Coatings: Chemically active type producing water-insoluble soaps. Release agents shall contain no petroleum solvents such as creosote, paraffin, wax or diesel oils.
 - 2. Unexposed Concrete: Any type that will not interfere with bond of applied finishes.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive the Work. Notify the Owner's Representative, in writing, of any conditions requiring corrective action.
- B. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Whenever concrete bases or foundations are to be provided for equipment provided as part of the Work of other Sections, verify dimensions for the equipment to be provided before concrete is placed.
- B. Coordinate locations of openings, sleeves, chases, pipes, recesses, nailers, anchors, ties, inserts and other embedded items.

3.3 INSTALLATION

- A. All cast-in-place concrete shall be contained by constructed forms or stable earth forms.
- B. Design, construct, and brace formwork and temporary falsework to safely support concrete and safely hold personnel during construction operations.
- C. Construct forms of sufficient strength and rigidity to produce finished concrete of the precise size, shape, and location indicated, within the specified tolerances. Form assembly shall permit removal in proper sequence without damage to concrete.
- D. Arrange forms to permit single placement of exposed areas and panels without joints between adjacent forming materials in the same plane.
- E. Construct forms for architectural concrete full height and width between construction joints in concrete surface.
- F. Construct forms no higher than 12 inches above the top of a placement or construction joint.
- G. Construction Joints
 1. Form in accordance with requirements of Section 03 30 00.
 2. Provide a surfaced strip where construction joints intersect exposed surfaces; faces to provide straight lines at joints. Prior to subsequent placement, remove strip and tighten forms.
 3. Construction joints shall show no overlapping or offsetting of concrete surfaces and shall, as closely as possible, present the same appearance as butted plywood joints.
 4. Joints in a continuous line shall be straight and true.
- H. Provide cleanouts as required to permit inspection and thorough cleaning of loose dirt, debris, and waste material. Cleanouts shall not be apparent on concrete surfaces exposed to view in the finished Work.

- I. Chamfered Corners
 - 1. Chamfer exposed corners unless otherwise indicated.
 - 2. Obtain chamfers by placing 3/4 x 3/4-inch non-staining moldings in forms. Provide pieces in longest lengths possible and miter joints.
 - J. For surfaces exposed to view in the finished Work, forms shall be constructed of plywood.
 - K. For surfaces not exposed to view in the finished Work, forms shall be lumber, form plywood, or any other suitable material.
 - L. Formwork shall be clean and free of debris when concrete is placed.
 - M. Forms shall be sufficiently tight to prevent leakage of water and mortar.
 - N. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only.
 - O. Locate temporary openings on forms at inconspicuous locations.
 - P. Provide openings in formwork to accommodate the Work of other Sections. Accurately place and securely support items built into forms.
- 3.4 FINISHES
- A. Treat contact surface of plywood and lumber forms with a form sealer in accordance with the manufacturer's printed instructions.
 - B. Clean surfaces and reseal before each use to ensure undamaged concrete.
 - C. Do not use form oil.
- 3.5 TOLERANCES
- A. Construct formwork to tolerances specified in ACI 347, except that anchor bolt setting tolerances shall be in accordance with AISC Code of Standard Practice, Section 7.5.
 - B. Where tighter tolerances are required to accommodate detention equipment or other items specified in other Sections, construct formwork to the most restrictive tolerance.
- 3.6 STRIPPING OF FORMS
- A. Strip forms using methods which will not damage concrete.
 - B. Do not remove forms until concrete has attained sufficient strength to support its own weight and construction live loads to be placed thereon without damage to the structure, but not before minimum time as follows:
 - 1. Side Forms of Footings, Curbs, Walks, and Paving: 24 hours.

3.7 RESHORING

- A. Submit re-shoring plan to the Owner's Representative if forms are to be stripped earlier than specified above.

3.8 RE-USE OF FORMS

- A. Re-use of forming materials shall be subject to the approval of the Owner's Representative, provided the material is structurally sound, free of defects and blemishes. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. In no case shall forming materials be used more than four times.
- B. Clean and repair surfaces of forms to be reused in the Work. Apply new form coating compound as specified for new formwork.
- C. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces.

END OF SECTION

SECTION 03 15 00
CONCRETE ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Locating and furnishing construction joints.
- B. Related Sections
 - 1. Section 03 10 00 - Concrete Forming and Accessories.
 - 2. Section 03 20 00 - Concrete Reinforcing.
 - 3. Section 03 30 00 - Cast-in-Place Concrete.
 - 4. Section 03 60 00 – Grouting.
 - 5. Section 07 26 00 - Vapor Retarders.
 - 6. Section 07 90 00 - Joint Protection.

1.2 REFERENCES

- A. ACI 318-- Building Code Requirements for Structural Concrete.
- B. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- C. ASTM D545 - Test Methods for Preformed Expansion Joint Fillers for Concrete Construction (Nonextruding and Resilient Types).
- D. Corps of Engineers CRD-C 508 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings
 - 1. Construction and Control Joints: Indicate layout and location; joint types and details.
- C. Product data
 - 1. Product data for products and materials indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

- C. Protect materials during handling and application to prevent damage.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Expansion-Contraction (Isolation) Joints:
 - 1. Preformed Expansion Joint Filler: Resilient, flexible, non-extruding, expansion-contraction joint filler. Cellular fibers securely bonded together, uniformly saturated with asphalt. Joint filler shall conform to the following standards and meet the following requirements:
 - a. ASTM D1751
 - b. Resilience: When compressed to half of original thickness, recover to a minimum of 70 percent of original thickness.
 - 2. Manufacturers:
 - a. W.R.Meadows: Fibre Expansion Joint; 3/8-inch thickness unless otherwise indicated on the drawings.
 - b. Or equal.
- B. Construction Joints (Keyed):
 - 1. Preformed Keyed Construction Joint: 24 gauge galvanized steel with dowel knockouts 6" on centers, formed to tongue and groove profile. When drawings indicate that construction joints are to receive joint sealant, furnish the preformed keyed construction joints with a removable top strip to form a sealant trough at the locations indicated on the drawings.
 - 2. Manufacturers:
 - a. Form-A-Key Products, a division of Cardinal Manufacturing Company: Key-Loc Joint System. (with #0658 removable plastic cap at sealant trough locations).
 - b. Dayton Superior Corporation: G33 Screed Key Joint.
 - c. OCM, a subsidiary of OKABE Co., Ltd: Metal Keyway.
 - d. Or equal.
- C. Control Joints:
 - 1. Preformed Control Joint; Rigid plastic extrusion intended to create a straight line, controlled crack on the surface of on-grade concrete slabs, sidewalks, and flatwork; minimum 1-inch in depth, or greater depth as otherwise specified in this section or indicated on the drawings.
 - 2. Manufacturers:
 - a. W.R.Meadows: Speed-E-Joint.
 - b. Superior Profiles: Zipstrip.
 - c. Greenstreak: Zipcap.
 - d. Or equal
 - 3. Saw-cut control joint systems as specified in this section may be used in lieu of preformed control joints at specifically designated portions of the concrete Work when approved by the Owner's Representative.

2.2 ACCESSORIES

- A. Expansion Joint Cap:
 - 1. Rigid plastic cap intended to be temporarily placed over expansion-contraction (isolation) joints to form straight, uniform and debris-free joints of the proper size and configuration specified in this section, ready to accept joint sealant.
 - 2. Size: 1/2 inch (12.7mm) depth and having the same width (thickness) as the expansion joint filler the cap is covering.
 - 3. Manufacturers:
 - a. W.R.Meadows: Snap-Cap.
 - b. Superior Profiles: Voidcap.
 - c. Greenstreak: Expansion Board Cap.
 - d. Or equal.
- B. Joint Sealant: In accordance with Section 07 90 00.
- C. Bond Breaker: In accordance with Section 03 30 00.
- D. Nonshrink Grout: In accordance with Section 03 30 00. Compatible with joint sealant.
- E. Reinforcing Steel: In accordance with Section 03 20 00.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive the Work. Notify the Owner's Representative, in writing, of any conditions requiring corrective action.
- B. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Verify location and conformance of each joint with the typical details and approved shop drawings. Provide joints only where designated or accepted by the Owner's Representative.
- B. Construct straight joints; make vertical or horizontal, except where walls intersect sloping floors.
- C. Vibrate concrete minimum amount required for consolidation of concrete in the vicinity of joints.
- D. Expansion-Contraction (Isolation) Joints
 - 1. Install expansion-contraction joint filler in accordance with manufacturer's instructions.
 - 2. All isolation and expansion joint materials in concrete floors, sidewalks, and flatwork shall terminate a minimum of 1/2 inch below the surface. After set, joints shall be trimmed and filled with joint filler.

3. Expansion and contraction joints shall be not less than 3/8 inch, and not more than 3/4 inch in width (joint filler thickness).
 4. Install temporary expansion joint cap over joint in accordance with manufacturer's instructions to keep joint free of debris prior to sealing the top of the joint. The top of the expansion joint cap shall remain in place until immediately prior to sealing the joint, at which time the temporary cap shall be pulled free and properly dispose of material in accordance with the provisions of Division 01.
 5. Install joint sealant in accordance with the provisions of Section 07 90 00.
- E. Construction Joints (Keyed)
1. Verify location and conformance with typical details and approved shop drawings. Provide joints only where designated or accepted by the Owner's Representative.
 2. Construction joints shall be in accordance with ACI 318 Section 26.5.6.
 3. Place dowels across the joints as indicated on the drawings.
 4. Install preformed keyed construction joints in accordance with manufacturer's instructions.
- F. Construction Joints (Flush / Not-Keyed)
1. Specified in Section 03 30 00 - Cast-in-Place Concrete.
- G. Control Joints
1. Unless otherwise indicated on the drawings, control joints shall be located between construction joints at intervals not exceeding 8 feet on center each way for concrete slabs having a maximum aggregate size of 3/4-inch, and 10 feet on center each way for concrete slabs having an aggregate size greater than 3/4-inch.
 2. Depth of control joints shall be 25-percent (25%) of the depth of the slab.
 3. Locate control joints to avoid or eliminate re-entrant corners.
 4. Saw-Cut Control Joints:
 - a. Saw-cut control joints after concrete finishing, using Husqvarna Soff-Cut Systems or approved equivalent. Take necessary measures to prevent cracking.
 - b. Where joint abuts a wall or other obstruction that prevents the saw-cut joint from extending to the wall or obstruction, neatly complete the joint by hand tooling.
 5. Pre-formed Control Joints
 - a. Install in accordance with manufacturer's instructions. Take necessary measures to prevent cracking.
 - b. Remove the top of the pre-formed control joint in accordance with manufacturer's instructions after concrete has sufficiently cured and properly dispose of material in accordance with the provisions of Division 01.

3.3 INSTALLATION

- A. Construct straight joints; make vertical or horizontal, except where walls intersect sloping floors and sidewalks.
- B. General
1. Vibrate concrete minimum amount required for consolidation Vibrate concrete to obtain impervious concrete in the vicinity of all joints.

3.4 TESTING AND INSPECTION

- A. The Owner's Representative will inspect the installation of the Work

3.5 DEFECTIVE WORK

- A. Work not conforming to required lines, details, dimensions, tolerances, or other specified requirements shall be considered defective. Notify the Owner's Representative upon discovery of these conditions.
- B. Required repair or replacement of defective Work will be determined by the Owner's Representative.
- C. Do not patch, fill, touch-up, repair, or replace Work except upon express direction of the Owner's Representative for each individual area.
- D. Defective Work shall be repaired or replaced as recommended by the Owner's Representative at no additional expense to the Owner.

3.6 PROTECTION

- A. Protect the Work from damage from subsequent construction operations.
- B. Provide protection in accordance with manufacturer's instructions.

END OF SECTION

SECTION 03 20 00

CONCRETE AND MASONRY REINFORCING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Reinforcing steel bars, wire fabric, and accessories for concrete.

B. Related Sections

1. Section 03 10 00 - Concrete Forming and Accessories.
2. Section 03 15 00 - Concrete Accessories.
3. Section 03 30 00 - Cast-in-Place Concrete.
4. Section 03 30 50 - Concrete Testing and Inspection.
5. Section 03 60 00 - Grouting.
6. Section 07 26 00 - Vapor Retarders.

1.2 REFERENCES

- A. ACI 301 - Specifications for Structural Concrete.
- B. ACI 315 - Details and Detailing of Concrete Reinforcement.
- C. ACI 318 - Building Code Requirements for Structural Concrete.
- D. ASTM A82 - Steel Wire, Plain, for Concrete Reinforcement.
- E. ASTM A185 - Steel Welded Wire Reinforcement, Plain, for Concrete.
- F. ASTM A497 - Steel Welded Wire Reinforcement, Deformed, for Concrete
- G. ASTM A615 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- H. ASTM A706 - Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
- I. AWS D1.4 - Structural Welding Code - Reinforcing Steel.
- J. CRSI - Manual of Standard Practice, Latest Edition.
- K. CRSI - Placing Reinforcing Bars, Latest Edition.
- L. WWR-500 Latest Edition - Structural Welded Wire Reinforcement Manual of Standard Practice.
- M. CCR - California Code of Regulations: Title 24, 2016 - California Building Code (CBC).

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings
 - 1. Detail reinforcement in accordance with ACI 315.
 - 2. Indicate bending and placing details of reinforcement; bar sizes, spacing, locations, and quantities of reinforcing steel and wire fabric; bending and cutting schedules; supporting and spacing devices.
- C. Product Data
 - 1. Product data for products and materials indicated.
 - 2. Manufacturer's technical bulletins and installation/application instructions.
 - 3. Material Safety Data Sheets (MSDS).
 - 4. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
- D. Certificates
 - 1. Welding Certificates: In conformance with AWS D1.4.
 - 2. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
 - 3. Mill Test Report: Certified copies of reinforcement materials analysis.

1.4 COORDINATION

- A. Coordinate reinforcement with placement of formwork, anchor bolt locations, anchors, inserts, conduit, sleeves, and other items required to be cast in concrete. Ensure reinforcement will not interfere with the placement of such items, formed openings, and other Work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Reinforcing steel shall be delivered from the mill in securely tied bundles, each bundle limited to one size and grade of material. Plastic or metal tags in an exposed position on each bundle shall identify the mill, the melt or heat number, and the grade and size of material. Identification of steel shall be maintained after bundles are broken.
- B. After fabrication, reinforcing steel shall be bundled and tagged for identification at the site. Tags shall identify the steel by the reinforcement item marking indicated on the approved shop drawings and the quantity of such item contained in the bundle.
- C. Segregate to maintain identification after bundles are broken.
- D. Store off the ground, protected from the elements and contaminants which could adversely affect bond.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.
- B. Reinforcing Steel
 - 1. #3 Bars: ASTM A615, Grade 40 deformed low alloy steel bars, plain.
 - 2. #4 Bars and larger: ASTM A615, Grade 60 deformed billet steel bars, plain finish, unless otherwise indicated.
 - 3. Reinforcing Steel to be Welded: ASTM A706, Grade 60 deformed low alloy steel bars, plain finish.
- C. Welded Wire Reinforcement: ASTM A185 Plain Type. Provide in flat mats, rolls are not acceptable.
- D. Welded Deformed Steel Reinforcement: ASTM A497.

2.2 ACCESSORIES

- A. Wire for Ties, Stirrups, and Spiral Reinforcement: ASTM A82, minimum 16 gauge.
- B. Splice Sleeves: Steel splice sleeves conforming to requirements of ACI 318 and CBC, Chapter 19A for mechanically spliced reinforcing. Each splice sleeve shall be identified with the size, type, and manufacturer's identification imprinted on the sleeve.
 - 1. Manufacturers
 - a. Splice Sleeve North America; NMB Splice Sleeve.
 - b. Erico Products, Inc.; Lenton Interlock Rebar Splicing System.
 - c. Dayton/Richmond; US/MC - SAE Coupler Splice System.
- C. Chairs, Bolsters, Spacers, Bar Supports, and Other Accessories
 - 1. Conform to requirements of ACI 315; size and shape for strength and support of reinforcement during concrete placement conditions.
 - 2. Where portion of accessories will be within 1/2 inch of concrete surfaces exposed to the weather in the finished Work, such accessories shall be made of stainless steel.
 - 3. Use wire bar type support complying with CRSI recommendations, unless otherwise indicated.
 - 4. For slabs on grade, use supports with sand plates or horizontal runners where wetted base materials will not support chair legs.
 - 5. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are hot-dip galvanized, or plastic or stainless steel protected.
 - 6. Over vapor barriers or waterproof membranes use load-bearing bottom pads or precast concrete chairs to prevent penetration of the membrane.

- D. Welding Filler Metal
 - 1. E70XX for Grade 40 bars, low hydrogen electrodes.
 - 2. E90XX for Grade 60 bars, low hydrogen electrodes.

2.3 FABRICATION

- A. Fabrication of reinforcement items shall proceed only after approval of bar lists and shop drawings. Each unit of reinforcement shall be fabricated in accordance with the approved bar lists and shop drawings.
- B. Reinforcing steel shall be bent cold and shall not be straightened or rebent in a manner that will damage the material.
- C. Fabricate reinforcing in accordance with ACI 318 and CBC, Chapter 19A.
- D. Locate reinforcing splices in accordance with approved shop drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive the Work. Notify the Owner's Representative, in writing, of any conditions requiring corrective action.
- B. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Reinforcement shall be supported and fastened together to prevent displacement by construction loads or by the placement of concrete, beyond the tolerances specified in ACI 301. Sizes and dimensions of supports shall be as required to position the steel as indicated on the Drawings, the approved shop drawings, and in accordance with the minimum concrete protective covering requirements of ACI 301.
- B. Provide reinforcing bars full length, to the extent practicable.
- C. Splices in Reinforcing Bars
 - 1. Splices will be permitted only where indicated on the Contract Documents, the approved shop drawings, or as otherwise approved by the Owner's Representative.
 - 2. Lapped ends of bars may be placed in contact and securely wired or may be separated sufficiently to permit the embedment of the entire surface of each bar in concrete.
 - 3. Lap bars as indicated, but no less than 48 bar diameters.
 - 4. Stagger splices in adjacent bars.
 - 5. Sleeved Splices: Install splice sleeves in accordance with manufacturer's instructions; permitted only where indicated.
- D. Lap welded wire fabric reinforcement 12 inches at edges, unless otherwise indicated, and wire together.

- E. Obstructions: Should conduit, pipes, inserts, sleeves, or other items interfere with the placement of reinforcement, notify the Owner's Representative and obtain approval of procedure before placement of concrete is started.
- F. Welding
 - 1. Do not weld reinforcement unless specifically indicated on the Drawings or directed by the Owner's Representative.
 - 2. Conform to the requirements of AWS D1.4 with welding performed by AWS certified welders.
- G. Do not displace or damage vapor barrier.
- H. Accommodate placement of formed openings.
- I. Dowels shall be tied securely in place before concrete is deposited. Bending of dowels subsequent to concrete placement is not permitted.

3.3 TOLERANCES

- A. Reinforcement shall be placed within tolerances specified in ACI 301.

3.4 TESTING AND INSPECTION

- A. Testing and inspection shall be in accordance with the provisions of Division 01.
- B. Obtain inspection and approval of reinforcing before concrete is placed.

3.5 CLEANING

- A. At time of concrete placement, reinforcement shall be free of coatings that could adversely affect the bond with concrete.

3.6 REPAIR AND ADJUSTMENT

- A. Misplaced bars shall not be bent.

3.7 DEFECTIVE WORK

- A. If reinforcing bars are found to be misplaced after concrete has been placed, immediately notify the Owner's Representative and make no correction or cutting without the Owner's Representative review and recommendations.
- B. Required repair or replacement of misplaced reinforcement will be determined by the Owner's Representative.
- C. Misplaced reinforcement shall be repaired or replaced as recommended by the Owner's Representative at no additional expense to the Owner.

3.8 PROTECTION

- A. Continuously inspect and maintain reinforcement in proper position during concrete operations.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Structural concrete for building and structural elements, concrete floors, and exterior concrete flatwork.
2. Construction joints (flush / not-keyed) associated with concrete Work.
 - a. Keyed construction joints, control joints, and expansion-contraction (isolation) joints are specified in Section 03 15 00 - Concrete Accessories.

B. Related Sections

1. Section 03 10 00 - Concrete Forming and Accessories.
2. Section 03 15 00 - Concrete Accessories.
3. Section 03 20 00 - Concrete Reinforcing.
4. Section 03 30 50 - Concrete Testing and Inspection.
5. Section 03 60 00 - Grouting.
6. Section 07 26 00 - Vapor Retarders.
7. Section 07 90 00 - Joint Protection.
8. Section 09 61 00 - Flooring Treatment.

1.2 REFERENCES

- A. ACI 117 - Tolerances for Concrete Construction and Materials.
- B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
- C. ACI 301 - Specifications for Structural Concrete.
- D. ACI 302.1R - Guide for Concrete Floor and Slab Construction.
- E. ACI 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete.
- F. ACI 305R - Hot Weather Concreting.
- G. ACI 306.1 - Cold Weather Concreting.
- H. ACI 308.1 - Curing Concrete.
- I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
- J. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures.
- K. ACI SP-66 - ACI Detailing Manual.

- L. AISC - Manual of Steel Construction , Latest Edition.
- M. ASTM C33 - Concrete Aggregates.
- N. ASTM C39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- O. ASTM C94 - Ready-Mixed Concrete.
- P. ASTM C150 - Portland Cement.
- Q. ASTM C171 - Sheet Materials for Curing Concrete.
- R. ASTM C192 - Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
- S. ASTM C260 - Air-Entraining Admixtures for Concrete.
- T. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- U. ASTM C330 - Lightweight Aggregates for Structural Concrete.
- V. ASTM C494 - Chemical Admixtures for Concrete.
- W. ASTM C618 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- X. ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous Type). Filler Not Exposed to Traffic or Weather.
- Y. ASTM C1107 - Packaged Dry, Hydraulic-Cement Grout (Nonshrink0.
- Z. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- AA. ASTM D1752 - Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- BB. ASTM D6690 - Joint and Crack Sealants, Hot Applied, for Concrete and Pavements.
- CC. CCR - California Code of Regulations: Title 24, 2016 - California Building Code (CBC).

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings: Indicate locations and details of proposed construction and control joints.
- C. Product Data
 - 1. Product data for products and materials indicated.
 - 2. Manufacturer's technical bulletins and installation/application instructions.
 - 3. Material Safety Data Sheets (MSDS).
 - 4. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

- D. Samples
 - 1. Submit two, 6-inch long samples of expansion/contraction joint and control joint.
- E. Certificates
 - 1. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Mix Designs
 - 1. Submit separate mix design for each type of concrete specified.
 - 2. Submit certified mix designs with and without fly ash for comparison.
 - a. For further Mix Design criteria, refer to Part 2, "Mix Designs" article.
 - 3. Submit for each concrete mixture containing fly ash, 15 percent maximum, as a replacement for Portland cement or 40 percent other Portland cement replacements, and for equivalent concrete mixtures that do not contain Portland cement replacements.
 - 4. Submit test results on three cylinders for each mix design.
 - 5. Prepare, age, and cure in accordance with ASTM C192.
 - b. Test at seven and 28 days in accordance with ASTM C39.
 - c. The test cylinders shall have been prepared from a batch of the proposed mix design with fly ash.
 - d. Where the 28-day tests do not meet specified strength requirements, the mix design will not be acceptable.

1.4 COORDINATION

- A. Coordinate the installation of items to be embedded in concrete and provide openings in the concrete necessary for performance of Work of other Sections.
- B. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.
- C. Request schedules of items specified under other Sections, but installed under this Section, in addition to templates, template dimensions, and shop drawings required for the installation of those items.
- D. Coordinate finish characteristics required by Work of other Sections with curing methods and finishing of concrete surfaces.
- E. Concrete which is to receive application of other Work shall be water-cured only, and maintained free from other formwork and curing materials, unless otherwise accepted by the Owner's Representative.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle packaged materials in the manufacturer's original, sealed containers, each clearly identified with the manufacturer's name, and name and type of product.
- B. Store materials subject to damage by dirt and moisture in a clean, dry location, off the ground, and suitably protected.
- C. Store coarse and fine aggregates in separate, covered bins.

- D. Store bulk cement in covered bins.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Concrete: Ready-mixed, ASTM C94.
- B. Cement: ASTM C150.
 - 1. Type I or Type II may be used if type is not otherwise indicated on Drawings.
- C. Fly Ash: ASTM C618
- D. Aggregate: ASTM C33.
 - 1. Aggregate size for footings, grade beams and pile caps, and filling of steel piles shall be 1-1/2 inch maximum, if not otherwise indicated on Drawings.
 - 2. Aggregate for walls, support slabs, beams, pilasters, columns, and slabs on grade shall be 1 inch maximum, and be mixed with pea gravel (minimum of 10 percent by weight, maximum of 15 percent by weight).
 - 3. All aggregate shall be of a type producing low shrinkage.
 - 4. Coarse Aggregate: Granite, limestone, or Clayton blue rock.
 - 5. Fines: Clean and well graded sands.
- E. Acquire cement, fly ash, and aggregate from same source for all Work.
- F. Water: Potable, clean, not detrimental to concrete, containing less than 500 ppm of chlorides.

2.2 ADMIXTURES

- A. Water-Reducing Admixture: ASTM C494.
 - 1. Manufacturers
 - 2. Euclid Chemical Company; Eucon WR.
 - 3. Master Builders/BASF; Pozzoloth 200N.
 - 4. Sika Chemical Corp; Plastocrete 161.
- B. Water-Reducing and Retarding Admixture: ASTM C494.
 - 1. Manufacturers
 - 2. Euclid Chemical Company; Eucon Retarder-75.
 - 3. Master Builders/BASF; Pozzoloth 80N.
 - 4. Sika Chemical Corp; Plastiment.
 - 5. W.R. Grace; #WRDA-64.
- C. High Range Water-Reducing Admixture (Superplasticizer): ASTM C494.
 - 1. Manufacturers
 - 2. Euclid Chemical Company; Eucon 37.
 - 3. Nox-crete Products Group; Plastiflow R.
 - 4. W.R. Grace; # ADVA 360, Superplasticizer.

- D. Air-Entraining Admixture: ASTM C260.
 - 1. Manufacturers
 - 2. W. R. Grace; DARAVAIR AT 60.
 - 3. Cemix Products, Ltd; Cemix A.E.A.
 - 4. Master Builders/BASF; MBAE90.

- E. Accelerator: ASTM C494, Type C or E; Noncorrosive, nonchloride.
 - 1. Manufacturers
 - 2. Euclid Chemical Company; Accelguard 80.
 - 3. Master Builders/BASF; Pozzutec 20.
 - 4. W.R. Grace; Doraset 400.
 - 5. Submit test report from independent testing laboratory of results of an acceptable accelerated corrosion test method such as that using electrical potential measures, of minimum one year duration, demonstrating noncorrosive nature of product.

- F. Bonding Admixture: Acrylic latex, nonrewettable type.
 - 1. Manufacturers
 - 2. Euclid Chemical Company; Flex-Con.
 - 3. Dayon(Burke), Conspec; Strong Bond.
 - 4. Master Builders/BASF; Thoro System Products, Acryl 60.
 - 5. W. R. Grace; Daraweld C.

- G. Mineral Admixture: Fly Ash Pozzolan; ASTM C618, Class F supplementary optional chemical and physical requirements of Tables 1A and 2A, except that the maximum sulfur trioxide shall be 4 percent and the maximum loss on ignition shall be 1.5 percent.
 - 1. Manufacturers
 - 2. Headwaters Resources; Fly Ash.
 - 3. Boral Material Technologies.
 - 4. The SEFA Group.

- H. Corrosion Inhibitor: ASTM C494 Type C, All reinforced (including clips and ties) concrete in contact with soil shall have a corrosion inhibitor added. The dosage rate for the corrosion inhibiting admixture shall protect the reinforcing bars in concrete from chloride concentrations as high as 7,000 ppm. If a calcium nitrite inhibitor is used, the dosage rate shall not be less than two gallons per cubic yard of concrete. The calcium nitrite inhibitor solution shall contain a minimum of 30 percent calcium nitrite. A corrosion inhibitor is not necessary in any concrete placed without embedded steel.
 - 1. Manufacturers
 - 2. W.R. Grace, DCI.
 - 3. Sika, CNI.
 - 4. Euclid Chemical Company, Arrmatect.

- I. Water Vapor Reducing Admixture: All slab on grade construction that will receive finish flooring shall have water vapor reducing admixture.
 - 1. Manufactures
 - 2. Moxie; 1800 SUPER-ADMIX.

2.3 ACCESSORIES

- A. Curing Compound: Liquid membrane, ASTM C309, type I; conforming to volatile organic compound (VOC) limits that may be established by the Great Basin Unified Air Pollution Control District (GBUAPCD).
 - 1. Manufacturers
 - 2. Creteseal.
 - 3. Or equal.
- B. Sheet Curing Material: ASTM C171.
- C. Hardeners: Clear, nonmetallic dust-on type.
 - 1. Manufacturers
 - 2. Basalite Concrete; Floor Hardener.
 - 3. Dayton Superior; Emery Tuff.
 - 4. Lambert Corp.; "Colorhard."
- D. Bonding Agent: Polyvinyl acetate, rewettable type, with visible tinted pigment to verify coverage.
 - 1. Manufacturers
 - 2. Euclid Chemical Company; Euco-Weld.
 - 3. Larsen Products Corp.; Weld-Crete.
 - 4. Dayton-Superior; Concrete Bonder J41.
 - 5. CGM Incorporated, Perma Weld.
- E. Bond Breaker: Nonstaining type, providing positive bond prevention.
 - 1. Manufacturers
 - 2. Nox-Crete; Silcoseal 2000F.
 - 3. EDOCO Construction Chemical; Clean Lift 90 Bond Breaker WB.
 - 4. Dayton Superior Chemical; Maxi-Tilt "E" WB Bond Breaker.
- F. Structural Epoxy Bonding Adhesive: Two component, 100 percent solids compound suitable for use on dry or damp surfaces.
 - 1. Manufacturers
 - 2. Euclid Chemical Company; Eucopoxy LPL, MV or Euco#452 Eprox System, MV.
 - 3. Sika Chemical Corporation; Sikadur 32 Hi-Mod.
 - 4. EDOCO Construction Chemicals; Burkepoxy MV.
 - 5. Dayton-Superior; Resi-Bond J58.
- G. Nonshrink Grout: ASTM C1107; nonmetallic; capable of achieving a 95 percent bearing under a 4 by 4-foot baseplate when grout is placed at a fluid consistency.
 - 1. Manufacturers
 - 2. Euclid Chemical Company; Euco N-S Grout, or Hi-Flow Grout.
 - 3. Master Builders/BASF; Masterflow 713 plus, Masterflow 928.
 - 4. EDOCO Construction; EDOCO Nonferrous Nonshrink Grout.
 - 5. W.R. Meadows; "Sealtight 588" Precision Grout.
 - 6. Dayton-Superior; Sure-Grip High Performance Grout.
 - 7. Sika Chemical Corporation; Sika Grout 212.

- H. Injection Grout for Splice Sleeves
 - 1. Early Strength: 3,000 psi or greater in 24 hours.
 - 2. Ultimate Strength: 9,500 psi or greater in 28 days.
 - 3. Nonshrink; capable of completely filling voids within sleeves.
 - 4. Manufacturers
 - 5. Erico In., Lenton Interlock; Erico Hy10L Grout.
 - 6. Splice Sleeve North America, Inc.; SS Mortar.
 - 7. Dayton Superior, Richmond DB Grout Sleeve Splice System; DBGS Splice Grout.

- I. Patching Mortar: Epoxy type, 100 percent solids, suitable for use on damp or dry surfaces.
 - 1. Manufacturers
 - 2. Euclid Chemical Company; Euco 456 Mortar.
 - 3. Sika Chemical Corporation; Sikadur 43 Patch-Pak.
 - 4. EDOCO Construction Chemicals; Burkepoxy Mortar.

- J. Patching Compound for Vertical or Overhead Applications: Free flowing, polymer modified, cementitious topping.
 - 1. Manufacturers
 - 2. Euclid Chemical Company; Verticoat.
 - 3. Dayton-Superior; Poly-Fast FS.
 - 4. ARDEX Engineered Cement; ARDEX Poly-top.
 - 5. Sika Chemical Corporation; Sikatop 121 Plus.

- K. Abrasive Aggregate for Nonslip Finish
 - 1. Manufacturers
 - 2. Euclid Chemical Company; Nonslip Aggregate.
 - 3. Lambert Corp; EMAG 20.
 - 4. BASF Construction Chemicals; Frictex-NS.
 - 5. Dayton-Superior; Emery Nonslip.

- L. Evaporation Retardant
 - 1. Manufacturers
 - 2. Euclid Chemical Company; Eucobar.
 - 3. Master Builders/BASF; Confilm.
 - 4. W.R. Meadows Inc; Evapre.
 - 5. Dayton-Superior; SureFilm (J-74)
 - 6. Creteseal, CS2000.

- M. Clear Sealer:
 - 1. Manufacturers
 - 2. Euclid Chemical Company; Euco #512 Epoxy Sealer.
 - 3. Sonneborn; Kure-N-Seal.
 - 4. Synthetics International; Synthetic10.
 - 5. L+M Construction Chemical; Seal Hard.
 - 6. Creteseal: CS2000.

2.4 JOINT DEVICES AND FILLER MATERIALS

- A. Joint Filler Type A: ASTM D1751; Asphalt impregnated fiberboard or felt, 1/4 inch thick; tongue and groove profile.

- B. Joint Filler Type B: ASTM D1752; Closed cell polyvinyl chloride foam, resiliency recovery of 90 percent if not compressed more than 50 percent of original thickness.
- C. Joint Filler Type C: ASTM D1752; Premolded sponge rubber, fully compressible with recovery rate of minimum 95 percent.
- D. Epoxy Joint Filler: Two component, 100 percent solids compound; minimum 50 Shore D Hardness.
 - 1. Manufacturers
 - 2. Euclid Chemical Company; Euco 700.
 - 3. Metzger/McGuire Co.; MM-80.
 - 4. EDOCO Construction Chemicals; Burke Reflex Joint Filler.
- E. Construction Joint Devices: Integral galvanized steel formed to tongue and groove profile, with removable top strip exposing sealant trough where indicated.

2.5 MIX DESIGNS

- A. Cast-In-Place Concrete
 - 1. Mix Designs shall be in accordance with ACI 318, Section 26.4.3.
 - 2. Instruct Testing Agency to base mix designs on use of materials tested and approved.
 - 3. Concrete mixes shall be designed to meet strengths specified and be of uniform density without segregation when placed.
 - 4. Water-cement ratio which shall control the amount of total water added to concrete shall be per the Concrete Notes on the structural drawings.
 - 5. Air Content: 4 to 6 percent for severe exposure such as concrete in exterior or freezing conditions. 1.5 to 3.5 percent for mild exposure of interior condition.
 - 6. Fly Ash: Fly ash shall be used only in mix designs with Portland cement Type I and II. Reduction of Portland cement, by weight, is acceptable with addition of 15 percent maximum fly ash in the mix design.
 - 7. Water Reducers: Use water-reducing admixtures in all concrete without superplasticizers. Use water-reducing admixtures in all concrete with superplasticizers to allow proper mixing prior to adding superplasticizer.
 - 8. Accomplish variations in slump, working time, and air content for flowable mixes by increasing or reducing superplasticizer dose or air-entraining admixture dose at the ready-mix plant only. Adjust the slump or air content at the jobsite by adding admixtures for a particular load when approved by the Owner's Representative, then the plant dose shall be adjusted to meet the specifications for the rest of the placement. This additional dosage at the jobsite shall be through an approved dispenser, supplied by the admixture manufacturer and otherwise at the Contractor's option.
 - 9. Effect on Slump: Maintain required slump throughout time of concrete placement and consolidation. Discontinue use of superplasticizer if it fails to maintain slump in required range.
 - 10. Meet design strengths, slumps, water-cement ratio, and other requirements as specified at slump required for placement.
 - 11. Use water reducers in combination with superplasticizers as required for mixing.
 - 12. Specifically Prohibited Admixtures: Admixtures containing hydrogen chloride, calcium chloride, or thiocyanates. Admixtures containing more than 0.05 percent chloride ions.

13. Unspecified admixtures will not be permitted, unless accepted by the Owner's Representative, and under condition that the Independent Testing Agency modifies mix design as necessary, and each such modification is approved by the Structural Engineer.
 14. Concrete may be designed for either pump or conventional placement. If pumping will be used, the mix shall be specifically designed for pumping and shall be so designated.
 15. Mix designs are subject to review. Final acceptance of materials will depend upon strength testing after placement.
 16. Use water vapor reducing admixture at all interior slab on grade conditions.
- B. Nonshrink Grout: Mix in accordance with the manufacturer's printed instructions, using potable water from a domestic source.
- C. Dry Pack: Mix in proportions, by volume, one part cement to two and one half parts fine aggregate, screening out materials retained on a No. 4 sieve. Mix with water to a consistency such that, when a ball of mixture is compressed in the hand, it will maintain its shape, showing finger marks, but not showing any surface water.
- D. Patching Mortar: Mix in proportions, by volume, one part cement to two parts fine aggregate.
1. Design Requirements: As indicated in the Schedule in Part 3.

2.6 MIXING

- A. Batch Plant Conditions
1. Equipment and plant shall be capable of weighing, proper segregation and efficient handling, and shall be subject to approval. Equipment and plant processes not approved shall not be used in Work.
 2. Use approved automatic metering capable of determining moisture content of sand.
- B. General Requirements
1. Concrete mixing shall comply with ACI 318.
 2. Mix cement, fine and coarse aggregates, admixtures, and water to exact proportions of mix designs.
 3. Measure fine and coarse aggregates separately in accordance with approved method which provides accurate control and easy checking.
 4. Adjust grading to improve workability; do not add water, unless otherwise recommended by the Owner's Representative.
 5. Maintain proportions, values, and factors of approved mixes throughout Work.
- C. Admixtures: Use automatic metering dispenser to introduce admixture into mix.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive the Work. Notify the Owner's Representative, in writing, of any conditions requiring corrective action.
- B. Verify requirements for concrete cover over reinforcement.
- C. Verify that anchors, seats, plates, embeds, reinforcement, and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.
- D. Verify all controlling dimensions, for the Work of this Section and related Work, by field measurement prior to start of construction.
- E. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's written instructions.
- B. In locations where new concrete is dowelled to existing work, install dowels as indicated on Contract Documents.
- C. Remove loose dirt and foreign matter from excavations and forms; remove standing water and saturated soil from excavations and from cavities. Placing concrete in standing water shall not be permitted. Hardened concrete and foreign materials shall be removed from the inner surfaces of conveying equipment.
- D. Thoroughly clean reinforcement and other embedded items free from loose rust and other objectionable matter.
- E. Thoroughly wet wood forms, except coated plywood, and adjacent concrete at least one hour in advance of placing concrete; securely close cleanout and inspection ports; repeat wetting as necessary to keep forms damp.
- F. Moisten subgrade or sand associated with under-slab vapor barrier system one day prior to placing concrete; maintain moisture until concrete placement.
- G. Maintain equipment clean and of sufficient quantity and capacity to efficiently execute the Work.
- H. Verify subgrade and forms have been checked for line and grade, and the Work areas have been observed and approved by the Owner's Representative.

- I. Before depositing new concrete on or against hardened concrete, retighten forms and prepare surface of hardened concrete as follows:
 1. Concrete which has been placed longer than 6-1/2 hours: Sandblast to roughen surfaces. Thoroughly clean of foreign matter and laitance, and moisten with water.
 2. Concrete which has been placed longer than 3-1/2 hours but less than 6-1/2 hours: Remove all laitance from concrete by wire brushing.
 3. Apply bonding agent as required in accordance with manufacturer's instructions.

3.3 CONCRETE PLACEMENT

A. Transporting

1. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which prevent the separation or loss of the ingredients, in accordance with ASTM C94.
2. Concrete shall not be dropped freely where reinforcing bars will cause segregation, nor shall it be dropped more than 4 feet.
3. Spouts, elephant trunks, or other approved means shall be used to prevent segregation.
4. Concrete may be pumped from the transit mixer to places of deposit, provided that information on mix design adjustments, equipment data, procedures, and the entire operation are submitted for the Owner's Representative's prior review.
5. Pumps shall be suitable for the mix, aggregate size, and slump required.
6. Pump operators shall be experienced in the operation of the equipment to be used.
7. Use of aluminum equipment to transport concrete is not permitted.

B. Depositing

1. Place concrete in accordance with CBC Chapter 19A and ACI 318 Section 26.6.2.
2. Maintain during placement or until the completion of the section, a plastic surface approximately horizontal.
3. Prevent displacement of reinforcement, anchor bolts, welding plates, and other items required to be embedded in concrete.
4. Before concrete sets, completely remove concrete spilled on forms or reinforcing steel in portions of structure not to be immediately concreted.
5. Place concrete continuously between predetermined expansion, control, and construction joints. An interruption in placing of more than 60 minutes will be cause for shutting down concrete placement operations and the wasting of remaining mixed concrete, concrete in hoppers, and concrete in mixers. In case such interruption occurs, provide construction joints where and as directed, and cut concrete back to such line, cleaning forms and reinforcing as specified herein.
6. Keep a record of the time and data of placing the concrete in each portion of the structure. Keep reports until the completion of the structure, and keep reports open to the review of the Owner's Representative.

C. Consolidation

1. Thoroughly consolidate concrete by puddling with suitable tools during placement and thoroughly working around reinforcement, embedded fixtures, and into the corners of forms.
2. In addition to manual spading and tamping, internally vibrate concrete with high-speed mechanical vibrators of sufficient amplitude for adequate consolidation.
3. Vertically insert and remove hand-held vibrators at points 18 to 30 inches apart.

4. Do not use vibrators to transport concrete in forms.
 5. Vibrate concrete minimum amount required for consolidation.
 6. Do not vibrate concrete placed for slab on grade except at slab edges adjacent to edge forms and at items embedded in the slab.
- D. Construction Joints (Flush / Not-Keyed)
1. Verify location and conformance of each joint with the typical details and approved shop drawings. Provide joints only where designated or accepted by the Owner's Representative.
 2. Construction joints shall be in accordance with CBC Chapter 19A and ACI 318.
 3. Contact surface of construction joints shall be cleaned and roughened by removing the entire surface and exposing clean aggregate solidly embedded in mortar matrix in accordance with the following procedures:
 4. Thoroughly clean surface by sandblasting or chipping the entire surface not earlier than five days after the initial placement.
 5. Thoroughly hose wash surface not less than two or more than four hours after concrete is placed. Wash water and chalk-like material to be removed entirely from the contact surface.
 6. Contact surfaces of vertical construction joints in suspended slabs shall be sandblasted.
 7. Prevent formation of shoulders and ledges.
 8. Place dowels across the joints as indicated on the drawings.
 9. Construction joints are required as follows:
 10. Slabs on grade.
 11. Construct in checkerboard fashion or in alternate strips with keyed joints.
 12. Cast in areas small enough to prevent uncontrolled shrinkage cracking.
 13. Slab shall be without re-entrant corners.
 14. Sections shall have length to width ratios not exceeding 1.5 to 1.
 15. Locate construction joints under partitions whenever possible.
 16. Foundations, beams, walls, and framed slabs shall be placed with maximum continuous length not to exceed 60 feet.
- E. Construction Joints (Keyed)
1. In addition to the applicable provisions of this Section, provide in accordance with the provisions of Section 03 15 00 - Concrete Accessories.
- F. Expansion-Contraction (Isolation) Joints
1. In addition to the applicable provisions of this Section, provide in accordance with the provisions of Section 03 15 00 - Concrete Accessories.
- 3.4 SEPARATE FLOOR TOPPINGS
- A. Prior to placing floor topping, remove deleterious material. Broom and vacuum clean.
 - B. Place required reinforcing and other items to be cast in.
 - C. Apply bonding agent to substrate in accordance with manufacturer's instructions.
 - D. Place concrete floor toppings to required lines and levels.

3.5 FINISHES

A. Formed Surfaces

1. Smooth Finish: Obtain by the use of plywood, sheet metal, or lined wood forms; no fins, pockmarks, and other irregularities shall be present in the exposed surfaces of concrete.
2. Scored Finish: Roughen surface in an approved manner, or etch with sharp-pointed steel tools to key or otherwise improve the mechanical bond of the surface. Such scoring or roughening shall disturb or otherwise roughen at least 10 percent of the area so scored.
3. Grout-Cleaned Finish
4. Prepare grout of two parts normal Portland cement, one part white cement, and 4-1/2 parts fine aggregate mixed with water to consistency of thick paint.
5. Wet surfaces and rub grout on surfaces using rubber or cork float so that small voids and imperfections are filled.
6. Allow surfaces to dry for approximately one hour, scrape off excess grout with trowel, and then rub surfaces with burlap sacks.
7. Keep surfaces continuously damp for 24 hours.
8. Provide on exposed wall surfaces, vertical surfaces of equipment foundations, and other vertical surfaces for unless otherwise indicated or specified.

B. Unformed Surfaces

1. Floating
2. Provide as first stage for flatwork finishes, unless otherwise specified.
3. Thoroughly consolidate areas, strike off to screeds tamp to recess large aggregate below surface level.
4. Fill voids, reconsolidate, and re-level surfaces as necessary.
5. Do not proceed with subsequent finishes until surface water has absorbed or dried off and surface sheen has become dull.
6. Wood Float Finish
7. Provide as second stage for other finishes, unless otherwise specified.
8. Using approved floating machines or hardwood trowels, float surfaces to required planes and shapes, working just sufficiently to bring surfaces to uniform condition.
9. Work no more than necessary to achieve uniform texture free from irregularities and screed marks; except where receiving fills or mortar beds, leave surfaces in roughened, granular condition for good mechanical bond.
10. Cut and fill surfaces as necessary to true up.
11. When followed by other finishes, floating shall leave small amount of mortar on surfaces without excess of water.
12. Do not proceed with subsequent finishes until surface water has absorbed or dried off and concrete has set sufficiently to prevent fines or water from being worked to the surface.
13. Finish texture shall be fine-grained and granular to provide good slip resistance and shall be reasonably free from directional trowel marks.
14. Provide for exterior and interior surfaces of buildings, unless otherwise indicated or specified.
15. Steel Trowel Finish
16. Using finishing machines or steel trowels, trowel surfaces to produce a dense, hard, smooth steel trowel finish.
17. Commence troweling in one pass just sufficiently to flatten floated surface.

18. Wait until concrete has set sufficiently; then resume steel troweling; continue and repeat as required to obtain a hard steel trowel finish, free of blemishes, ripples, and trowel marks.
 19. Do not
 - 1) Use cement or sand dusting to absorb or otherwise remove surface water.
 - 2) Commence troweling too soon on freshly placed concrete.
 - 3) Overwork surfaces by excessive troweling in an area in one pass.
 - b. Work out lips, uneven levels, and other irregularities prior to final troweling.
 - c. Neatly tool exposed edges, expansion joints, curbs, arises, and other details.
 - d. Surface across joints shall be level and free from offsets.
 - e. Provide for interior surface not otherwise indicated or specified.
 20. Broom Finish
 21. Draw a soft-bristled push broom over an initially trowel-finished surface.
 22. When coarser surfaces are desired, use a stiffer-bristled broom.
 23. Broom finish shall provide a nonslip surface, even if exposed to rain.
 24. Provide for exterior flatwork and as indicated or specified.
- C. Concrete Hardeners and Sealers
1. Apply in accordance with the manufacturer's printed instructions.
 2. Apply hardener at the rate consistent with the manufacturer's definition of light traffic areas.
- 3.6 CURING
- A. Curing shall immediately follow finishing and shall be accomplished for each portion of the Work.
- B. Wall Surfaces
1. Cure for a minimum of seven days by form-curing with forms wetted down thoroughly at least four times daily until forms are removed.
 2. If forms removed in less than seven days, follow immediately with membrane curing if outside of building, and with fog spray to maintain moist condition inside of building.
- C. Flatwork Surfaces
1. Water cure all concrete work, unless noted otherwise.
 2. Membrane cure exterior pavement and slab surfaces.
 3. Where hardener is approved to be used, cure in accordance with hardener manufacturer's printed instructions.
 4. Do not use liquid membrane curing compounds on surfaces to receive other finishes.
- D. Maintain concrete temperature above 50 degrees F during curing.
- E. Protect concrete from damage during the curing period.
- 3.7 TOLERANCES
- A. Tolerances shall be in accordance with ACI 117.
- B. Deviation from plumb or level shall not exceed 1/8 inch within 10 feet in any direction, as determined with a 10 foot straight edge.

- C. Anchor Bolts: Setting Tolerances shall be in accordance with AISC Code of Standard Practice, Section 7.5.

3.8 FIELD QUALITY CONTROL

- A. Place concrete during hot weather in accordance with ACI 305R.
- B. Place concrete during cold weather in accordance with ACI 306R.
- C. Do not place concrete during precipitation, unless adequate protection is provided.

3.9 TESTING AND INSPECTIONS

- A. Testing and inspection shall be in accordance with Section 03 30 50 and the provisions of Division 01.
- B. Do not place concrete until reinforcing and embeds have been inspected and approved by the Owner's Representative.

3.10 REPAIR AND ADJUSTMENT

- A. Immediately after removing formwork, concrete surfaces shall be examined by the Owner's Representative, and pour joints, voids, rock pockets, tie holes, and similar defects shall be patched at once as directed by the Owner's Representative.
- B. Submit information on patching mixture and method proposed for use to the Owner's Representative for review prior to commencing repair work.
- C. Patch honeycomb, aggregate pockets, voids, and holes as follows, unless otherwise directed by the Owner's Representative
 1. Chip out until sound concrete is exposed to minimum depth of one inch.
 2. Prepare patching mortar with approximately two parts normal Portland cement, one part white cement, and nine parts fine aggregate; vary proportions of cement as necessary to match color of adjacent concrete.
 3. Saturate surfaces with water and fill cavities with patching mortar.
 4. Cure patches as specified for concrete.
- D. Patching Tie Holes
 1. Cut nails and tie wires for form ties flush with the face of the concrete, and leave surfaces smooth and clean.
 2. Remove metal spreader ties on exposed concrete Work, or snap off inside the wall surface.
 3. Patch resulting cone pockets on exposed surfaces as described above.

3.11 DEFECTIVE CONCRETE

- A. Concrete not conforming to required lines, details, dimensions, tolerances, finishes, strength, or other specified requirements shall be considered defective. Concrete with excessive honeycomb or embedded debris. Notify the Owner's Representative upon discovery of these conditions.

- B. With the prior acceptance of the Owner's Representative, some minor defective Work may be repaired by use of cement mortar; however, if the defects are serious or affect the strength of the structure or its appearance, the Owner's Representative may require the removal and replacement of that portion of the structure affected.
- C. Required repair or replacement of defective concrete will be determined by the Owner's Representative.
- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of the Owner's Representative for each individual area.
- E. Defective concrete shall be repaired or replaced as recommended by the Owner's Representative at no additional expense to the Owner.

3.12 PROTECTION

- A. Provide protection in accordance with manufacturers instructions.
- B. Protect concrete from elements including sun and rain.
- C. Do not subject concrete to any loads until it is completely cured and has attained its minimum 28-day strength.
- D. Protect concrete during and after curing from damage from subsequent construction operations.
- E. Cover traffic areas with plywood sheets; maintain paper and plywood in place and in good repair for as long as necessary to protect against damage from construction operations.
- F. Keep finished areas free from traffic for a minimum of four days or as necessary until surfaces have set sufficiently to prevent damage.

3.13 SCHEDULE

- A. Refer to Concrete Schedule provided on the Structural Drawings.

END OF SECTION

SECTION 03 30 50

CONCRETE TESTING AND INSPECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Concrete Testing and Inspection required by other Sections.

B. Related Sections

1. Section 03 20 00 - Concrete Reinforcing.
2. Section 03 10 00 - Concrete Forming and Accessories.
3. Section 03 15 00 - Concrete Accessories.
4. Section 03 20 00 - Concrete Reinforcing.
5. Section 03 30 00 - Cast-in-Place Concrete.
6. Section 03 60 00 - Grouting
7. Section 07 26 00 - Vapor Retarders.
8. Section 07 90 00 - Joint Protection.

1.2 REFERENCES

- A. ACI 221R - Guide for Use of Normal Weight and Heavyweight Aggregates in Concrete.
- B. ACI 301 - Specifications for Structural Concrete.
- C. ACI 305R - Hot Weather Concreting.
- D. ACI 306.1 - Cold Weather Concreting.
- E. ACI 318 - Building Code Requirements for Structural Concrete.
- F. ASTM C31 - Practice for Making and Curing Concrete Test Specimens in the Field.
- G. ASTM C39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- H. ASTM C40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
- I. ASTM C42 - Test Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- J. ASTM C88 - Standard Test for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
- K. ASTM C94 - Ready-Mixed Concrete.
- L. ASTM C117 - Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing.

- M. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- N. ASTM C138 - Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
- O. ASTM C143 - Test Method for Slump of Hydraulic-Cement Concrete.
- P. ASTM C172 - Practice for Sampling Freshly Mixed Concrete.
- Q. ASTM C173 - Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- R. ASTM C192 - Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
- S. ASTM C289 - Standard Test for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
- T. ASTM C1077 - Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- U. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
- V. ASTM F1869 - Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- W. AWS D1.4 - Structural Welding Code - Reinforcing Steel.
- X. Caltest 217 - Method of Test for Sand Equivalent.
- Y. ICRI Guideline No. 03739 - Guide to Using In-Situ Tensile Pull-Off Tests to evaluate Bond of Concrete.
- Z. CCR - California Code of Regulations: Title 24, 2016 - California Building Code (CBC).

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Independent Testing Laboratory shall submit the following:
 - 1. Testing and Inspection Reports in accordance with Section 01 45 29.
 - 2. Product Data
 - a. Certified copies of mix designs for each concrete class specified.
 - b. Ready mix delivery tickets, ASTM C94.
 - c. Certified copies of concrete reinforcement test results for tensile and bending strength.
 - d. Certified copies of concrete cylinder compressive strength test results at time intervals specified.
 - e. Certification that aggregate and gravel are asbestos-free and conform to specified gradations and characteristics.

- f. Certification from vendor that samples originate from and are representative of each lot proposed for use.
 - g. Certification that materials meet requirements specified.
 - 3. Certificates
 - a. Batch plant certification.
 - C. Owner's Representative will collect the following:
 - 1. Product Data
 - a. Mill test reports for reinforcing.
 - b. Ready mix delivery tickets, ASTM C94.
- 1.4 COORDINATION
 - A. Contractor shall allow the Independent Testing Laboratory and the Owner's Representative free access to places, whether on or off the job site, where materials are stored, proportioned, mixed, or fabricated; to places where equipment is stored or serviced; and to the job site during times of preparation, installation, erection, placement, curing and patching.
 - B. Contractor shall supply labor, transportation, and on-site storage facilities required by the Independent Testing Laboratory and the Owner's Representative for taking and preparing samples for testing.
 - C. Contractor shall notify the Independent Testing Laboratory and the Owner's Representative in sufficient time prior to fabrication, field welding, mixing, and placement to permit testing and inspecting without delaying the Work; minimum 48 hour notice required, unless otherwise noted.
 - D. Concrete placed without inspection by Owner's Representative is not allowed.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. The Independent Testing Laboratory shall inspect concrete plant prior to Work to verify following:
 - 1. Plant is equipped with approved metering devices for determining moisture content of fine aggregate.
 - 2. Plant quality controls are adequate.
- 3.2 GENERAL
 - A. Materials and testing thereof shall comply with ACI 318.
 - B. Test and inspect in accordance with CBC Chapter 17A and 19A and as specifically outlined in Sections 1705A.3, and 1910A.
- 3.3 CONCRETE REINFORCING
 - A. Independent Testing Laboratory shall provide the following testing:

1. Material Samples
 - a. Where positive identification of the heat number and mill certificates cannot be made, two specimens from each 2-1/2 tons, or fraction thereof, of each size and grade shall be tested for tensile and bending strength.
 2. Welded Reinforcement
 - a. Perform chemical analysis of reinforcing to be welded if mill certificates not available. Carbon equivalent shall be below 0.75 for reinforcing to be welded.
 - b. Perform field test on minimum one weld within each 25 welds. Conduct nondestructive field test (radiographic or ultrasonic for butt welds, magnetic particle for fillet welds) for welds indicated.
- B. Owner's Representative will provide the following inspections:
1. Inspect materials tags and mill certifications.
 2. Inspect placement of all reinforcement for conformance with Drawings and approved shop drawings to confirm size, spacing, and installation.
 3. Welded Reinforcement
 - a. Verify welder's certification, materials, and equipment.
 - b. Perform visual inspection of welding.
- 3.4 CONCRETE AGGREGATE
- A. Independent Testing Laboratory shall provide testing and inspection per Table 5.1 of ACI 221R.
- 3.5 CONCRETE
- A. Independent Testing Laboratory shall provide the following testing:
1. Perform testing in accordance with ACI 318.
 2. Test slump of concrete in accordance with ASTM C143.
 3. Test compressive strength in accordance with ACI 318 and as follows:
 - a. Make and cure specimen cylinders in accordance with ASTM C31 for each class placed at site as directed by the Owner's Representative.
 - b. Frequency of testing shall be in accordance with ACI 310.
 - c. Retain one cylinder for 7 day test, and two for 28 day test. Hold one cylinder for subsequent testing, if necessary.
 - d. Number each cylinder 1A, 1B, 1C, 1D, 1E, 2A, 2B, 2C, etc.; date each set; and keep an accurate record of placement on what each set represents.
 - e. Transport specimen cylinders from job to laboratory.
 - f. Test specimen cylinders at age 7, and 28 days for specified strength in accordance with ASTM C39.
 4. Take core specimens of hardened structure and test specimen in accordance with ASTM C42 when laboratory tests of specimen cylinders show compressive strengths below specified minimum.
 5. Test for air entrainment as specified in design mix in accordance with ASTM C173.
- B. Owner's Representative will provide the following inspections:
1. Review mix designs, certificates of compliance, and samples of materials proposed for use.
 2. Verify hot weather concrete placement in accordance with ACI 305R.

3. Verify cold weather concrete placement in accordance with ACI 306R.
 4. Concrete placement, sampling, and testing procedures.
 5. Inspect concrete surfaces upon removal of formwork to determine acceptance of concrete surfaces and any required repair or replacement.
- C. The Contractor shall submit ticket for each batch of concrete delivered to jobsite. Ticket shall bear following information:
1. Design Mix Number.
 2. Time of batching.
 3. Weight of cement, aggregates, water, and admixtures with maximum aggregate size.
 4. Total volume of concrete.

3.6 GROUTING

- A. Independent Testing Laboratory shall provide the following testing:
1. Fine Aggregates.
 - a. Gradation
 - 1) Test in accordance with ASTM C136. 100 percent shall pass No. 8 mesh sieve, no less than 45 percent by weight shall pass No. 4 mesh sieve.
 - 2) Variations from the specified gradations in individual tests will be acceptable if the average of three consecutive tests is within the specified limits and the variation is within the following permissible variations:

<u>U.S. Standard Sieve Size</u>	<u>Permissible Variation in Individual Tests, Percent</u>
30 or Coarser	2
50 or Finer	0.5
 - 3) Test in accordance with ASTM C117: 3 percent maximum by weight passing No. 200 Sieve.
 - b. Organic Impurities: ASTM C40; color lighter than Standard.
 - c. Soundness: ASTM C88; 10 percent maximum loss with sodium sulfate.
 - d. Reactivity: ASTM C289; Innocuous aggregate.
 - e. Sand Equivalent: CALTEST No. 217; minimum 80.
- B. Owner's Representative will provide the following inspections:
1. Inspect materials tags and mill certifications.
 2. Inspect placement of all reinforcement, plates, and embeds for conformance with Drawings and approved shop drawings to confirm size, spacing, and installation.
 3. Verify conformance to manufacturer's written installation instructions.

3.7 RETESTING

- A. When tests or inspections reveal failure of materials to meet the Contract requirements, Independent Laboratory shall provide additional tests in accordance with specified requirements as necessary until acceptance. Retesting shall be performed at no additional expense to the Owner.

END OF SECTION

SECTION 03 60 00

GROUTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Drypack, Epoxy, Nonshrink, and Cement Grout.
- B. Related Sections
 - 1. Section 05 12 00 - Structural Steel Framing
 - 2. Section 07 90 00 - Joint Protection.

1.2 REFERENCES

- A. ACI 318 - Building Code Requirements for Structural Concrete.
- B. ASTM C33 - Concrete Aggregates.
- C. ASTM C150 - Portland Cement.
- D. ASTM C494 - Chemical Admixture for Concrete.
- E. CRD-C621 Corps of Engineers - Specification for Nonshrink Grout.
- F. CCR - California Code of Regulations: Title 24, 2016 - California Building Code (CBC).

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data
 - 1. Product data for products and materials indicated.
 - 2. Manufacturer's technical bulletins and installation/application instructions.
 - 3. Material Safety Data Sheets (MSDS).
- C. Certificates
 - 1. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Mix Designs: Submit separate mix design for each type of grout specified.

1.4 COORDINATION

- A. Coordinate the installation of grout with the requirements of the Work of other Sections.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle packaged materials in the manufacturer's original, sealed containers, each clearly identified with the manufacturer's name, and name and type of product.
- B. Store products subject to damage by dirt and moisture in a clean, dry location, off the ground, and suitably protected.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Cement: ASTM C150, Type II Portland cement; low alkali, containing less than 0.60 percent alkalies.
- B. Fine Aggregate: ASTM C33, except as modified below; nonreactive; hard, dense, durable particles of either sand or crushed stone, regularly graded from coarse to fine; washed before use.
- C. Water
 - 1. Free from oil and deleterious amounts of acids, alkalies, and organic materials.
 - 2. Containing not more than 1,000 mg/l of chlorides as Cl.
 - 3. Containing not more than 1,300 mg/l of sulfates as SO₄.
 - 4. Not containing impurities that may cause a change of more than 25 percent in the setting time of the cement, nor a reduction of more than 5 percent in the compressive strength of the grout at 14 days when compared with the result obtained with distilled water.
 - 5. Water used for curing shall not contain impurities sufficient to cause discoloration.
- D. Acquire cement and aggregate from same source for all the Work.

2.2 ADMIXTURES

- A. Admixtures shall be compatible with the grout.
- B. Calcium chloride or admixtures containing calcium chloride are prohibited.
- C. Water Reducing Retarder: ASTM C494, Type D.
 - 1. Manufacturers
 - a. BASF/Master Builders; Pozzolith 300-R.
 - b. Sika Chemical Corp; Plastiment.
 - c. Euclid Chemical Company; Eucon Retarder 75.
- D. Lubricant Additive for Cement Pressure Grouting
 - 1. Manufacturers
 - a. Spcrete; Prepakt Intrusion Aid.
 - b. Sika Chemical Corp; Intraplast N.

2.3 DRYPACK GROUT

- A. Mix: One part cement, 1-1/2 to two parts sand, water reducing retarder, and water to make a stiff workable mix.

2.4 CEMENT GROUT

- A. Mix: One part cement and two parts sand, proportioned by volume, admixtures for pressure grouting, water to make a workable mix.

2.5 NONSHRINK GROUT

- A. Corps of Engineers CRD C621; Nonshrink type, pre-mixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days, unless otherwise indicated.
- B. Manufacturers
 1. Master Builders/ BASF; Masterflow 713.
 2. Five Star products, Inc; Precision Nonshrink Cement Grout.
 3. Euclid Chemical; Euco Nonshrink Grout.
 4. Five Star Products, Inc.; Five Star Grout.
 5. W.R.Meadows; Sealtight 588.

2.6 EPOXY GROUT

- A. Manufacturers
 1. Master Builders/BASF; Coneresive 1380.
 2. Sika Chemical Corporation; Sikadur -42.
 3. Euclid Chemical; E3-F.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive the Work. Notify the Owner's Representative, in writing, of any conditions requiring corrective action.
- B. Verify that anchors, seats, plates, embeds, reinforcement, and other items to be grouted are accurately placed, positioned securely, and will not cause hardship during grouting.
- C. Ensure bolts and reinforcing to be installed in horizontal grout holes is slightly bent to accommodate angle of hole.
- D. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Holes required for grouting
 - 1. Drill horizontal holes at a slight downward angle to facilitate holding the grout until setting is complete.
 - 2. Blow holes clean prior to installation of grout.
- B. Thoroughly clean reinforcement and other embedded items free from loose rust and other objectionable matter.
- C. Protect elements surrounding Work of this Section from damage or disfiguration.

3.3 INSTALLATION

- A. Drypack Grout
 - 1. Roughen surfaces to be built-up with drypack grout by brushing; clean, and coat with bonding compound immediately prior to grout application.
 - 2. Apply drypack grout immediately following application of bonding compound.
 - 3. Apply in bands or strips to form a smooth covering of the required thickness.
 - 4. Completely fill voids; thoroughly compact in place.
 - 5. Slope construction joints; clean and wet surface before application is resumed.
 - 6. Membrane cure drypack grout.
 - 7. Bolts or inserts which have been dry packed or grouted in place shall not be tensioned sooner than seven days after packing.
- B. Cement Grout
 - 1. Place using pressure grouting equipment or mixing and placement apparatus of type used for cast-in-place concrete.
 - 2. Agitate diluted grout to keep ingredients mixed.
- C. Nonshrink Grout
 - 1. Install in accordance with manufacturer's instructions.
- D. Epoxy Grout
 - 1. Install in accordance with manufacturer's instructions.
 - 2. Prime surface of concrete when required by manufacturer's instructions.
- E. Pressure Grout
 - 1. Equipment
 - a. Designed to place grout at pressures up to 50 psi. Include mixer and holdover agitator tanks.
 - b. Gauges: Indicate pressure used for grout placement, up to 50 psi.
 - c. Meter: Capable of indicating the volume of grout used, to within 1/10 cubic foot.
 - 2. Prior to grouting, wash clean systems and holes to be grouted.
 - 3. Once begun, complete grouting without stopping. Maintain grout pressure until grout has set.
 - 4. In case of equipment failure, wash out the grouting system sufficiently to ensure fresh grout and adequate bond and penetration will occur upon restarting the grouting operation.

3.4 FIELD QUALITY CONTROL

- A. Do not apply drypack grout when ambient temperature is below 40 degrees F. Maintain ambient temperature above 40 degrees F for 48 hours after application.

3.5 TESTING AND INSPECTION

- A. Testing and inspection shall be in accordance with the provisions of Division 01.
- B. Do not place grout until reinforcing and embeds have been inspected and approved by the Owner's Representative.
- C. Notify the Owner's Representative 48 hours before each grouting operation.

3.6 CLEANING

- A. Clean, leaving exposed surfaces free from damage, tool marks, stains, discoloration, and other defects and damage.

3.7 DEFECTIVE WORK

- A. Grout not conforming to required details, dimensions, tolerances, finishes, strength, or other specified requirements shall be considered defective. Notify the Owner's Representative upon discovery of these conditions.
- B. Required repair or replacement of defective grout will be determined by the Owner's Representative.
- C. Do not patch, fill, touch-up, repair, or replace grout except upon express direction of the Owner's Representative for each individual area.
- D. Defective grout shall be repaired or replaced as recommended by the Owner's Representative at no additional expense to the Owner.

3.8 PROTECTION

- A. Protect grout from damage from subsequent construction operations.

3.9 SCHEDULE

- A. Drypack Grout: Used for built-up surfaces, setting miscellaneous metal items, and minor repairs.
- B. Epoxy Grout: Used for repairing cracks by pressure grouting, repairing structural concrete, setting reinforcing dowels into holes for grouting.
- C. Nonshrink Grout: Used for bearing surfaces of machinery and equipment bases, column baseplates and bearing plates, setting bolts and reinforcing steel in holes for grouting.
- D. Cement Grout: Used for filling nonbearing portions of equipment pads and pressure grouting.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Fabrication and erection of structural steel framing members.
- B. Related Sections
 - 1. Section 05 50 00 - Metal Fabrications
 - 2. Section 03 60 00 - Grouting.
 - 3. Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

- A. AISC - Manual of Steel Construction - Latest Edition.
- B. ANSI B18.22.1 - Plain Washers.
- C. ANSI B18.23.1 - Beveled Washers.
- D. ASTM A36 - Carbon Structural Steel.
- E. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless.
- F. ASTM A108 - Steel Bar, Carbon and Alloy, Cold-Finished.
- G. ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
- H. ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.
- I. ASTM A307 - Carbon Steel Bolts and Studs, 60,000-psi Tensile Strength.
- J. ASTM A325 - Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength.
- K. ASTM A449 - Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.
- L. ASTM A490 - Structural Bolts, Alloy Steel, Heat Treated, 150 KSI Minimum Tensile Strength.
- M. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- N. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- O. ASTM A572 - High Strength Low Alloy Columbium-Vanadium Structural Steel.

- P. ASTM A992 - Structural Steel Shapes.
- Q. ASTM F1554 - Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- R. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
- S. AWS D1.1 - Structural Welding Code - Steel.
- T. SSPC PM-SET B/PM-SET C - Society for Protective Coatings: Painting Manuals Volume 1 and 2.
- U. CCR - California Code of Regulations: Title 24, 2016 - California Building Code (CBC).

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings
 - 1. Indicate markings, quantities, materials, and shapes.
 - 2. Indicate profiles, cambers, dimensions, spacing, and locations.
 - 3. Indicate openings, cuts, and holes
 - 4. Indicate attachments, connections, threaded fasteners, rivets, and welds, including methods of connecting, anchoring, fastening, bracing, and attachment to the Work of other Sections.
 - 5. Indicate shop and erection details.
 - 6. Indicate shop and field welds by welding symbols in accordance with AWS A2.4. Indicate net weld lengths.
- C. Written Welding Procedures
- D. Product Data
 - 1. Product data for products and materials indicated.
 - 2. Manufacturer's technical bulletins and installation/application instructions.
 - 3. Material Safety Data Sheets (MSDS).
 - 4. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content, the manufacturer, and the source of the recycled content data.
 - 5. For materials harvested or extracted within 500 miles of the site, provide a statement indicating the location of extraction and manufacture. Include a statement of costs for each product.
- E. Certificates
 - 1. Manufacturer's Mill Certificate: Submit certificate that products meet or exceed specified requirements.
 - 2. Mill Test Reports: Submit manufacturer's certificates, indicating structural strength, destructive and nondestructive test analysis.
 - 3. Welder's Certificates: Submit certificates for welders employed on the Work, verifying AWS qualifications within the previous 12 months.

- F. Qualification Data
 - 1. For Fabricator
 - 2. For Erector

1.4 QUALIFICATIONS

- A. Fabricator: Company specializing in performing the Work of this Section with minimum three years experience.
- B. Erector: Company specializing in performing the Work of this Section with minimum three years experience.
- C. Welding Qualifications: Prior to commencing welding, welding procedures, welding operations, and welders shall be qualified in accordance with AWS D1.1.
 - 1. Welders who have not performed welding for a period of three or more months shall be requalified.
 - 2. Welders whose work fails to pass inspection shall be requalified before performing further welding.
 - 3. The costs of certifying qualifications shall be paid as part of the Work of this Section.

1.5 COORDINATION

- A. Coordinate the design, fabrication, and erection of structural steel with the requirements for openings and support of the Work of other Sections.
- B. Coordinate the location and installation of items to be supported by structural steel and provide supports necessary.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver welding electrodes to job site in unbroken containers or packages bearing manufacturer's name.
- B. Ship, store, and handle structural steel in a manner to prevent rusting and deformation. Store steel products off grade and positioned to drain rain water readily.
- C. Deliver bolts, nuts, and washers in bags or boxes, properly tagged for identification.
- D. Store other metal products in a weather-tight and dry place until ready for use in the Work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Provide products with an average recycled content of steel products so post-consumer recycled content plus one-half of pre-consumer recycled content is not less than the following:
 - 1. W-Shapes, Channels and Angles: 60 percent.
 - 2. Cold-Formed Hollow Structural Sections, Steel Pipe, Plate and Bar: 25 percent.
 - 3. All Other Steel Materials: 25 percent.

- B. Structural Steel Members: ASTM A36, A572 and A992, Grade 36 or 50 as indicated.
- C. Structural Tubing: ASTM A500, Grade B.
- D. Steel Pipe: ASTM A501 or ASTM A53, Type E or S, Grade B; galvanized where indicated, black elsewhere.

2.2 FASTENERS

- A. Shear Stud Connectors: ASTM A108 Grade 1010 through 1020, forged steel, headed, uncoated.
 - 1. Manufacturers
 - a. Nelson Stud Welding, Inc.
 - b. Tru-Weld Division, Tru-Fit Products Corporation.
 - c. Stud Welding Associates, Inc.
- B. Bolts and Nuts: ASTM A325 galvanized to ASTM A153 for galvanized members.
- C. Plain Washers: ANSI B18.22.1 Type A, galvanized.
- D. Beveled Washers: ANSI B18.23.1 galvanized.
- E. Anchor Bolts: ASTM A307, ASTM A490, or ASTM F1554 as indicated.
- F. Post-Installed Anchors: Proprietary type, designed for intended uses, and ICC ESR evaluated.
 - 1. Manufacturers
 - a. ITW Ramset/Red Head.
 - b. Simpson.
 - c. Hilti Co.
- G. Shims and Leveling Devices: Type required for temporary support of base plates; of sufficient size and capacity to support dead load of structure without deformation.
- H. All steel and metal fasteners exposed to damp conditions or the weather, except stainless steel, shall be hot-dip galvanized unless otherwise indicated.

2.3 ACCESSORIES

- A. Welding Electrodes: AWS D1.1; type required for materials being welded.
- B. Non-shrink Grout: In accordance with Section 03 60 00.
- C. Temporary Supports, Staying, and Bracing: As required by the conditions of installation.

2.4 FINISHES

- A. Shop and Touch-Up Primer
 - 1. Manufacturers
 - a. Tnemec; Tnemec Primers Series V10.
 - b. Rust-Oleum ; Red Rusty Metal Primer.
 - c. Benjamin Moore & Co.; M07 Universal Metal Primer.

2.5 SHOP FABRICATION

- A. Fabricate structural steel in accordance with AISC Specifications, and as indicated.
- B. Splices: Locate only as indicated on approved shop drawings or approved by the Owner's Representative.
- C. Preparation
 - 1. Prior to fabrication, straighten all materials by methods which will not damage material. Do not straighten any material until methods have been approved by the Owner's Representative.
 - 2. Prior to assembling component parts of a connection, thoroughly clean all contract surfaces of loose rust, scale, and burrs.
- D. Shop Welding
 - 1. Provide welded connections in shop where possible, unless otherwise indicated, in accordance with AWS D1.1.
 - 2. Welding shall be performed by welders certified to perform the Work.
 - 3. Weld by shielded-arc method, submerged-arc method, flux-coated arc method, or other method approved by AWS. Perform welding in accordance with AWS D1.1.
 - 4. Welds exposed to weather or damp conditions in the finished Work shall be continuous and watertight and shall be treated by hot or cold (field) galvanization.
- E. Bolted Connections
 - 1. Bolted connections shall have not less than two bolts.
 - 2. Punch, drill, or ream holes 1/16 inch larger than bolt diameter.
 - 3. Ream unfair holes, but only up to next larger bolt size. Comply with General Notes on Structural Drawings.
 - 4. If types of fastener are not indicated, use ASTM A325 bolts.
- F. Shear Stud Connectors
 - 1. Automatically end weld in accordance with AWS D1.1, Section 7, and the stud manufacturer's instructions.

2.6 SHOP FINISHING

- A. Surface Preparation
 - 1. Grind smooth weld spatter and sharp edges prior to cleaning.
 - 2. Prior to application of primer or delivery from shop, clean surfaces as follows:
 - a. SSPC SP-2 where structural steel is to receive cementitious fireproofing, or to be encased in cast-in-place concrete, or to be concealed by other construction in the completed Work.
 - b. SSPC SP-7 where structural steel is to remain exposed in the completed Work.
- B. Shop Primer
 - 1. Shop coat surfaces of structural steel with 3 mil minimum dry film thickness of primer, unless otherwise specified.
 - 2. Do not apply primer to within 2 inches of surfaces to be field welded, or to surfaces to receive cementitious fire-proofing, or to be encased in cast-in-place concrete.

3. Apply two coats of primer to surfaces of steel assemblies that will remain permanently concealed after assembly.
 4. Apply shop primer within eight hours of surface cleaning.
 5. Shop primer, of poor quality or insufficient thickness shall be touched-up or recoated by the fabricator, and to a condition acceptable to the Owner's Representative.
- C. Temporary Coating
1. Coat contact faces of steel which will be grouted for bearing, such as column base plates and similar items, with an oil-based, rust-inhibitive temporary coating containing no metallic pigment.
 2. Manufacturers
 - a. Houghton International Company; Rust-Veto 342.
 - b. Lanco; Polyurethane Oil Red Oxide Primer MM-100.
 - c. Columbia Paint & Coatings; Industrial Acrylic DTM Polyurethane.

2.7 QUALITY CONTROL

- A. Materials and fabrication procedures are subject to inspection and test in mill, shop, and field. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements. Promptly remove and replace materials or fabricated components that do not comply.

2.8 TESTING AND INSPECTION

- A. Testing and inspection shall be in accordance with CBC Section 1705A.2.
- B. Independent Testing Laboratory shall provide the following testing:
1. Perform testing in accordance with the provisions of Division 01.
 2. Perform nondestructive weld testing in accordance with CBC, Section 1705A.2.5.
 3. Shear Stud Connectors
 - a. At the beginning of each day's Work, make a minimum of two test stud welds to metal which is the same as the actual work piece, using the automatic welding equipment to be used for production welds.
 - b. Bend each stud 90 degrees by striking with a heavy hammer, and verify that there is no tearing out or cracking of the weld section.
- C. Owner's Representative will provide the following inspections:
1. Inspect material tags and mill certifications.
 2. Review written welding procedures.
 3. Verify welding materials and welder certifications.
 4. Continuously inspect welding in accordance with CBC, Section 1705A2.5.
 5. Inspect high strength bolts, nuts and washers in accordance with the CBC Section 1705A.2 and AISC 360 Section M2.5 as required.

2.9 TOLERANCES

- A. Tolerances shall be in accordance with AISC Code.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive the Work. Notify the Owner's Representative, in writing, of any conditions requiring corrective action.
- B. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Verify that field measurements are as indicated on Drawings and approved shop drawings. Report discrepancies to the Owner's Representative for clarification or resolution prior to starting erection.
- B. Anchor Bolts
 - 1. Upon completion of concrete placement, anchor bolts shall be rechecked for correct location and elevations; make necessary corrections.
 - 2. Projecting portion of anchor bolts shall be wire brushed, the washers and nuts replaced, and the bolt protected from dust and other foreign materials by a wrapping of a waterproof material.

3.3 ERECTION

- A. Install and erect structural steel in accordance with AISC Code and Specifications.
- B. Allow for erection loads and provide temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Column or column base plates shall be set on a steel shims or otherwise supported and the structure aligned and plumbed prior to grouting under the base plates.
- D. Place temporary bracing necessary for erecting before bolting in accordance with AISC recommendations. Additional or temporary bracing shall be provided wherever design loads may be exceeded during erection or placing of equipment.
- E. Welding
 - 1. Welding will be permitted only as indicated on the approved shop drawings.
 - 2. Welding shall be performed by welders certified to perform the Work.
 - 3. Weld by shielded-arc method, submerged-arc method, flux-coated arc method, or other method approved by AWS. Perform welding in accordance with AWS D1.1.
 - 4. Welds exposed to weather or damp conditions in the finished Work shall be continuous and watertight and shall be treated by hot or cold (field) galvanization.
- F. Bolted Connections
 - 1. Bolted connections shall have not less than two bolts.
 - 2. Ream unfair holes, but only up to next larger bolt size.
 - 3. As erection progresses, bolt up the Work to assume dead loads, lateral forces, and erection stresses.

- G. Assembly Using Standard Threaded Fasteners
 - 1. Beveled Washers: Provide under bolt heads or nuts riding on surfaces exceeding 5 percent slope with respect to head or nut.
 - 2. Tighten bolts for full bearing under heads and nuts and to snug-tight condition.
- H. Shear Stud Connectors: Automatically end weld in accordance with AWS D1.1, Section 7, and the stud manufacturer's instructions.
- I. Dissimilar metals shall be protected from galvanic corrosion by means of pressure tapes, coatings, or isolators. Aluminum in contact with concrete or grout shall be protected with a heavy coat of bituminous paint or two coats of zinc chromate.
- J. After steel is aligned, grout under base plates and elsewhere indicated in accordance with Section 03 60 00.
- K. Tack weld the nut and washer to base plate of columns where nut is exposed to view in completed construction.

3.4 FINISHES

- A. After erection, prime welds, abrasions, and surfaces not shop primed except surfaces to be in contact with concrete and surfaces to receive spray-on fireproofing or insulation.
- B. Field paint unpainted field connections, bolts, and similar parts with primer.

3.5 ERECTION TOLERANCES

- A. Erection tolerances shall be in accordance with AISC Code.
- B. Anchor Bolts: Setting Tolerances shall be in accordance with AISC Code of Standard Practice, Section 7.5.
- C. Individual members shall be considered plumb or level where the error does not exceed 1:750.
- D. Vertical dimensions shown as story height measured from the top of the beams at their connections at each column shall not vary by more than plus or minus 1/4 inch per story exclusive of column shortening due to dead load.
- E. Plumb displacement of the center line of columns from the established column line shall be no more than 1/4 inch per story, noncumulative.
- F. Floor framing shall be considered level if floor framing members on each floor, measured from the top of column connections, do not vary more than plus or minus 1/4 inch.
- G. Horizontal dimensions shall not vary more than plus or minus 1/4 inch per 100 feet for the length or width of the structure, But not to exceed a total of one inch.
- H. Maximum Offset From True Alignment: 1/4 inch.

3.6 TESTING AND INSPECTION

- A. Testing and inspection shall be in accordance with CBC Section 1705A.2.
- B. Independent Testing Laboratory shall provide the following testing:
 - 1. Perform testing in accordance with the provisions of Division 01.
 - 2. Perform nondestructive weld testing in accordance with CBC, Section 1705A.2.5.
 - 3. Shear Stud Connectors
 - a. At the beginning of each day's Work, make a minimum of two test stud welds to metal which is the same as the actual work piece, using the automatic welding equipment to be used for production welds.
 - b. Bend each stud 90 degrees by striking with a heavy hammer, and verify that there is no tearing out or cracking of the weld section.
- C. Owner's Representative will provide the following inspections:
 - 1. Inspect placement of all steel for conformance with Drawings and approved shop drawings to confirm member size and installation.
 - 2. Review written welding procedures.
 - 3. Verify welding materials and welder certifications.
 - 4. Continuously inspect welding in accordance with CBC, Section 1705A.2.5.
 - 5. Inspect high strength bolts, nuts and washers in accordance with the CBC Section 1705A.2 and AISC 360 Section M2.5 as required.

3.7 CLEANING

- A. After erection, thoroughly clean surfaces of foreign a deleterious matter such as dirt, mud, oil, and grease that could impair bonding of finishes, concrete, or fireproofing.

3.8 REPAIR AND ADJUSTMENTS

- A. Structural members shall not be cut or altered without prior approval of the Owner's Representative.
- B. Flame cutting will be permitted only as specifically approved by the Owner's Representative.
- C. Only light drifting will be permitted to draw parts together.
- D. Draft punching to match unaligned holes will not be permitted. Enlargement of holes necessary to make connections resulting from misfit shall be performed by the reaming or drilling, and the proper size bolt shall then be used. Ream unfair holes only up to next larger bolt size.
- E. Repair abraded areas of shop-applied coatings, and areas of weld where the shop-applied coating has been damaged with a primer or galvanizing repair compound, as applicable, that is compatible with the shop coating.

3.9 DEFECTIVE WORK

- A. Structural steel not conforming to required lines, details, dimensions, tolerances, finishes, strength, or other specified requirements shall be considered defective. Notify the Owner's Representative upon discovery of these conditions.
- B. Required repair or replacement of defective steel will be determined by the Owner's Representative.
- C. Do not patch, fill, touch-up, repair, or replace steel except upon express direction of the Owner's Representative for each individual area.
- D. Defective steel shall be repaired or replaced as recommended by the Owner's Representative at no additional expense to the Owner.

3.10 PROTECTION

- A. Protect structural steel from damage from subsequent construction operations.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Shop fabricated metal items as indicated on the Drawings.
2. Roof Access Ladder.
3. Wrought Iron Fence and Gate System.
4. Bicycle Rack.

B. Related Sections

1. Section 05 12 00 - Structural Steel Framing.
2. Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

- A. AISC - Manual of Steel Construction, Current Edition.
- B. AISI-D100 - Cold-Formed Steel Design Manual, Latest Edition.
- C. ANSI A14.3 - Ladders-Fixed: Safety Requirements.
- D. ANSI B18.22.1 - Plain Washers.
- E. ANSI B18.23.1 - Beveled Washers.
- F. ASTM A36 - Carbon Structural Steel.
- G. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless.
- H. ASTM A108 - Steel Bar, Carbon and Alloy, Cold-Finished.
- I. ASTM A123 - Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
- J. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- K. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- L. ASTM A283 - Low and Intermediate Tensile strength Carbon Steel Plates.
- M. ASTM A307 - Carbon Steel Bolts and Studs, 60,000-psi Tensile Strength.
- N. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- O. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

- P. ASTM A563 - Carbon and Alloy Steel Nuts.
 - Q. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - R. ASTM A706 - Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
 - S. ASTM A1011 - Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
 - T. ASTM E2016 - Industrial Woven Wire Cloth.
 - U. AWS A2.4 - Standard Symbols for Welding, Brazing and Nondestructive Examination.
 - V. AWS D1.1-05 - Structural Welding Code - Steel.
 - W. AWS D1.3-05 - Structural Welding Code - Sheet Steel.
 - X. SSPC PM-SET B/PM-SET C- Society for Protective Coatings: Painting Manuals Volume 1 and 2.
 - Y. CCR - California Code of Regulations: Title 24, 2016 - California Building Code (CBC).
- 1.3 SUBMITTALS
- A. Submit in accordance with Section 01 33 00 – Submittal Procedures.
 - B. Shop Drawings
 1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
 2. Include erection drawings, elevations, and details where applicable.
 3. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - C. Product Data
 1. Product data for products and materials indicated.
 2. Manufacturer's technical bulletins and installation/application instructions.
 3. Material Safety Data Sheets (MSDS).
 4. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content, the manufacturer, and the source of the recycled content data.
 - D. Certificates
 1. Manufacturer's Mill Certificate: Submit certificate that products meet or exceed specified requirements.
 2. Mill Test Reports: Submit manufacturer's certificates, indicating structural strength, destructive and nondestructive test analysis.
 3. Welder's Certificates: Submit certificates for welders employed on the Work, verifying AWS qualifications within the previous 12 months.

- E. Qualification Data
 - 1. Provide for Fabricator(s)

1.4 QUALIFICATIONS

- A. Fabricator: Company specializing in performing the Work of this Section with minimum three years experience.
- B. Welding Qualifications: Prior to commencing welding, welding procedures, welding operations, and welders shall be qualified in accordance with AWS D1.1.
 - 1. Welders who have not performed welding for a period of three or more months shall be re-qualified.
 - 2. Welders whose work fails to pass inspection shall be re-qualified before performing further welding.
 - 3. The costs of certifying qualifications shall be paid as part of the Work of this Section.

1.5 COORDINATION

- A. Coordinate the design, fabrication, and erection of the Work with the requirements for openings and support of and by the Work of other Sections.
- B. Provide templates required for accurately locating anchorages and fasteners required to anchor or attach items to the Work of other Sections. Supply the templates in a timely fashion so as not to delay the Work of other Sections.
- C. Where items specified under this Section are built into the Work of other Sections, provide those items to those Sections in a timely fashion to avoid delay of the Work of other Sections. Coordinate placement to verify accurate locations and correct installation.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver welding electrodes to job site in unbroken containers or packages bearing manufacturer's name.
- B. Ship, store, and handle fabricated items in a manner to prevent rusting and deformation. Store items off grade and positioned to drain rain water readily.
- C. Deliver bolts, nuts, and washers in bags or boxes, properly tagged for identification.
- D. Store other metal products in a weather-tight and dry place until ready for use in Work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Provide products with an average recycled content of steel products so post-consumer recycled content plus one-half of pre-consumer recycled content is not less than the following:
 - 1. W-Shapes, Channels and Angles: 60 percent.
 - 2. Cold-Formed Hollow Structural Sections, Steel Pipe, Plate and Bar: 25 percent.

3. All Other Steel Materials: 25 percent.
 - B. Steel Sections: ASTM A36.
 - C. Steel Tubing: ASTM A500, Grade B.
 - D. Stainless Steel: ASTM A167, Type 302 or 304.
 - E. Plates: ASTM A36 or A283.
 - F. Pipe: ASTM A53, Grade B.
 - G. Expanded Metal: Galvanized Carbon steel/flattened, 3/4 inch maximum opening; 14-gauge unless otherwise indicated.
 1. Manufacturers
 - a. Niles Expanded Metals.
 - b. McNichols Co.]
 - c. Amico.
- 2.2 FASTENERS
- A. Bolts, Nuts, and Washers
 1. Bolts: ASTM A307, Grade A.
 2. Nuts: ASTM A563, Grade A.
 3. Anchor Bolts: Heavy Hex.
 4. Elsewhere: Hex or Heavy Hex.
 5. Washers: ANSI B18.22.1 or ANSI B18.23.1.
 - B. Post-Installed Anchors: Proprietary type, designed for intended uses, and ICC ESR evaluated.
 1. Manufacturers
 - a. ITW Ramset/Red Head.
 - b. Simpson.
 - c. Hilti Co.
 - C. Embed Anchors: ASTM A36.
 - D. Shear Stud Connectors: ASTM A108 Grade 1010 through 1020, forged steel, headed, uncoated.
 1. Manufacturers
 - a. Nelson Stud Welding, Inc.
 - b. Tru-Weld Division, Tru-Fit Products Corporation.
 - c. Stud Welding Associates, Inc.
- 2.3 ACCESSORIES
- A. Welding Electrodes: AWS D1.1 or D1.3; type required for materials being welded.
 - B. Temporary Supports, Staying and Spacing: As required by Project conditions.
 - C. Shims and Leveling Devices: As required by Project conditions.

2.4 FINISHES

- A. Shop and Touch-Up Primer
 - 1. Manufacturers
 - a. Tnemec Co., Tnemec Primers Series V10.
 - b. Rust-Oleum Co., Red Rusty Metal Primer.
 - c. Benjamin Moore & Co.; M07 Universal Metal Primer.
- B. Touch-Up Primer for Galvanized Surfaces: Zinc rich type.
- C. Rust Protection: In accordance with Section 05 12 00 - Structural Steel Framing.
- D. Finishes:
 - 1. Shop Prime paint finish for interior locations.
 - 2. Galvanized for exterior use.

2.5 STEEL LADDERS

- A. Roof Access Ladder: Nominal 18 inches wide. Steel shapes as indicated; grind exposed welds smooth; firmly anchor as indicated.
 - 1. Solid rungs fitted into holes drilled in side rails, plug welded both sides. Space rungs 7 inches from wall surface unless otherwise indicated.
 - 2. Bracket supports at top, bottom, and intermediate points, maximum 60 inches on center.
- B. Ladders shall comply with safety requirements of ANSI A14.3 and CCR, Title 8, General Safety Orders, Sec. 3277.
- C. Finishes:
 - 1. Shop Prime paint finish for interior locations.
 - 2. Galvanized for exterior use.
 - 3. Final Finish: Field pained in accordance with Section 09 90 00 - Painting and Coating.

2.6 GUARDRAILS AND HANDRAILS

- A. Guardrails shall comply with CCR, Title 8, General Safety Orders, Section 3209.
- B. Guardrails shall comply with the 2016 California Building Code.
- C. Steel pipe, sized and anchored as indicated, minimum 1-1/2-inch diameter.
- D. Finishes
 - 1. Shop Prime paint finish at interior locations.
 - 2. Stainless Steel at exterior locations unless otherwise indicated; ASTM A167, Type 302, satin finish.
 - 3. (Not Used) Galvanized at exterior use where indicated on the Drawings.
 - 4. Final Finish: Field pained in accordance with Section 09 90 00 - Painting and Coating.

2.7 WROUGHT IRON FENCE AND GATES

A. Manufacturers:

1. Manufacturer Qualifications: Acceptable manufacturers shall have specialized in the manufacturing of wrought iron fence and gates systems comparable to specified system, for a minimum period of 5 years documented experience.
2. (Basis of Design) Merchants Metals: Secure-Weld Plus Series, Lafayette style panels. (<https://www.merchantsmetals.com>).
3. Or equal.

B. Quality Assurance:

1. The fence and gate system manufacturer shall be responsible for assuring the furnished and installed fence and gate system is appropriate for the intended use and application as indicated on the Drawings and specified herein. Should the fence and gate system manufacturer take exception to any portion of this Specification as being insufficient in the manufacturer's opinion, for the intended use and application, the manufacturer shall notify the Owner's Representative in writing of any conditions requiring corrective action prior to purchasing materials or commencing fabrication of any portion of the system.
 - a. Submittal of shop drawings shall be construed as the manufacturer's certification that the system design specified herein is appropriate in the manufacturer's opinion, for the intended use and application as indicated.
 - b. Should the fence and gate system manufacturer take exception to any portion of this Specification as being insufficient in the manufacturer's opinion, for the intended use and application, the fence and gate system manufacturer shall furnish "design build" services, working with the Owner's Representative, to provide an appropriate fence and gate system design at no additional cost to the Owner.

C. Wrought Iron Fence and Gates: Fabricated from galvanized square steel tubular members manufactured per ASTM F2408, having minimum yield strength of 45,000 psi..

1. Description: Commercial Grade Application; nominal 6-foot high galvanized steel fence system with shop applied powder coated finish. System is composed of fence panels, posts and footings, motor operated vehicle rolling gate, manually operated pair of swinging vehicle gates, and manually operated pedestrian swing gate. Fence panels are shop fabricated for field attachment to posts utilizing a bracket system that minimizes field welding.
2. Finish of Fence Panels, Posts, and Gates: Powder coated painted finish; shop applied; color: Black.
 - a. Components shall be manufactured and finish applied in compliance with ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets.
 - b. Finish shall meet or exceed the performance standards of the Corrosion Resistance Salt Spray Test; ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - c. Finish shall meet or exceed the Impact Resistance performance standards of ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

- d. Finish shall meet or exceed the Adhesion performance standards utilizing Method B of ASTM D3359 - Standard Test Methods for Measuring Adhesion by Tape Test.
- e. All primary components shall receive a thorough cleaning and pre-treatment as recommended with the coating manufacturer before receiving a zinc enriched powder primer coat of 2-4 mils thickness. Apply final TGIC polyester powder coat of 2-4 mils thickness to achieve an ultra-polyester finish. Pre-treatment dry-off, primer gel setting, and final curing shall be oven based.
3. Nominal Installed Height of Fence Posts, Fence Panels, and Gates: 6-feet above grade.
4. Fence Panels: Shop fabricated and finished; panels constructed of 3/4 inch square x 16 gauge steel pickets welded to 1-1/2 inch square x 14 gauge steel horizontal rails at the top and bottom of the panel. Pickets shall be equally spaced at 4-3/4 inches on center nominal (19 pickets per 94 inch wide panel) and extend past the top and bottom rails.
 - a. Provide pickets with pressed points.
5. Fence Posts: Shop fabricated and finished; posts constructed of 3 inch square x 10 gauge steel tubes. .
 - a. Provide standard hipped top post caps tack welded four sides to top of posts.
 - b. Set posts in concrete footings as specified herein.
6. Manually Operated Pedestrian Swing Gates (Pair): Nominal opening width: 6-feet 5-inches including removable 4-inch wide center mullion: shop fabricated and finished; For each opening provide two (2) 36-inch wide gate panels constructed of steel pickets matching the specified fence panels welded to 2 inch x 2 inch x 11 gauge steel horizontal top and bottom rails. The horizontal rails are welded to 2 inch square x 11 gauge vertical members occurring at each end of gate leaf. Pickets shall be equally spaced at 4-3/4 inches on center nominal and shall match the design of the fence panels. Weld pickets to the top and bottom rails. Provide 1/4 inch x 12 inch high steel plate at bottom of gates at push side, and as a lock rail centered on the exit (panic) device where occurs. Provide wire mesh or perforated metal covering as selected by Architect over entire gate having exit (panic) device on parking lot side of gate. Provide wire mesh or perforated metal covering as selected by Architect and on fence panel(s) adjacent to the gate exit (panic) device for a nominal 24 inch distance from the exit (panic) device. Provide framed opening to receive and mount the lever type lockset where occurs.
 - a. Conform to ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
 - b. Provide pickets with pressed points.
 - c. Gate Hinges: Provide heavy duty gate hinges as recommended by the gate manufacturer.
 - d. Provide bottom cane bolt and keeper on the outside face of gate to hold gate in both the open and closed positions.
 - i). Drill strike holes in the concrete walk to receive cane bolt.
 - e. Provide top bolt throw and keeper on outside face of gate to secure gate in closed position.
 - f. Provide gate stop at the latch side of the gate welded all around to the latch post.
 - g. Provide Knox box for Fire Department.
7. Pedestrian Swing Gate Posts and Removable Center Mullions: Shop fabricated and finished; posts and mullions constructed of 4 inch square x 10 gauge steel tubes.
 - a. Provide 4-1/2 inch square x 10 gauge steel tube sleeve set in concrete footing to receive the removable center mullion. Extend 6 inches above grade.
 - b. Provide standard hipped top post caps tack welded four sides to top of posts.

- c. Set posts in concrete footings as specified herein.
 - d. Prepare removable center mullions to receive recessed strike plates for the lock devices specified for the gates.
8. Post Footings: Posts shall be set plumb in concrete footings. The depth of the post hole shall be a minimum of 6 inches deeper than the required depth of the concrete footing with the bottom 6 inches of the hole filled with sand bedding. The steel post shall extend past the bottom of the concrete footing a minimum of 2 inches into the sand bedding to provide drainage. Top of concrete footing shall be at grade and crowned to shed water away from the post. Concrete shall have a minimum 28 day compressive strength of 3,000 psi. Minimum footing sizes shall be as follows:
- a. Fence Post Footings: Minimum concrete footing size shall be 12 inches in diameter x 30 inches deep.
 - b. Pedestrian Swing Gate Posts: Minimum concrete footing size shall be 16 inches in diameter x 30 inches deep.
9. Installation:
- a. Verify that field conditions are acceptable and are ready to receive the Work. Notify the Owner's Representative, in writing, of any conditions requiring corrective action.
 - b. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Beginning installation indicates acceptance of existing conditions.
 - c. Install in accordance with manufacturer's written instructions and approved submittal.
 - d. Gates shall be installed level and plumb in the closed position, with a nominal ground clearance of 3 inches, grade permitting.
10. Shop Drawings: Submit shop drawings showing Wrought Iron Fence and Gates installation, including plans, elevations, sections, details, and post footing design(s). Indicate dimensions, materials, components, method of installation and assembly.
11. Finish Touch-Up: Touch-up field applied tack welds and any powder coated paint surfaces damaged during the installation process in accordance with the paint coating manufacturer's written recommendations. Match color of shop applied finish. Provide Owner with one (1) quart of touch-up paint labeled as "Wrought Iron Fence - Newark".
12. Product Warranty: Fence Panels, Posts, and Gates shall carry the manufacturer's standard limited warranty that the system is free from defects in material and workmanship including cracking, peeling, blistering and corroding for a period of 10 years from the date of Substantial Completion.
13. Demonstration and Training: Provide instruction to the Owner's Representative and Facilities Maintenance Personnel in the proper adjustment, operation, and maintenance of the fence and gate system systems. Coordinate the date and time of the training session with the Owner's Representative a minimum of two (2) weeks prior to the training session.
14. Coordination: The General Contractor shall coordinate the division of Work related to this Item among trades.
- 2.8 BICYCLE RACKS

A. Manufacturers:

- 1. (Basis of Design) L.A. Steelcraft, Pasadena, CA; Model #WBR-703, 5-bike capacity, (www.lasteelcraft.com).

2. American Bicycle Security Company, Ventura, CA; Model #RR-2H, 5-bike capacity, (www.ameribike.com).
 3. Bike Security Racks Company, Wentworth, NH; Model #BS-4B-YC, 5-bike capacity, (www.bikeracks.com).
 4. Or equal.
- B. Description:
1. Capacity: Provide in a three (3) “loop” configuration (two up, one down) minimum, that allows a 5-bike capacity when a bicycle is secured to the outside of the rack at each end.
 2. Material: 2.375 inch OD nom., Schedule 40, ASTM A500, welded seamless steel pipe.
 3. Mounting: Below grade; embedded into concrete footings as indicated on the Drawings. Mount level, plumb and true with top of rack set at 36 inch nominal above finish slab.
- C. Finishes:
1. Factory finish: powder coat, 10 to 20 mils thickness; Color as selected by the Owner’s Representative from manufacturer’s full color range.

2.9 SHOP FABRICATION

- A. Preparation
1. Prior to fabrication, straighten all materials by methods which will not injure material. Do not straighten any material until methods have been reviewed by the Owner’s Representative.
 2. Prior to assembling component parts of a connection, thoroughly clean all contact surfaces of loose rust, scale, burrs; remove all local twists and bends.
- B. Fit and shop assemble in largest practical sections, for delivery to site.
- C. Fabricate items with joints tightly fitted and secured.
- D. Continuously seal joined members by continuous welds.
- E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, unless otherwise indicated.
- G. Exposed Mechanical Fastenings
1. Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- H. Shop Connections: Welded wherever possible, unless otherwise indicated.
- I. Field Connections
1. Bolted unless otherwise indicated.
 2. Provide bolts and holes for field connections.
- J. Bolted Connections
1. Bolted connections shall have not less than two bolts.

2. Drill, punch, or ream holes 1/16 inch larger than bolt diameter.
 3. Ream unfair holes, but only up to next larger bolt size.
- K. Assembly Using Standard Threaded Fasteners
1. Provide beveled washers under bolt heads or nuts riding on surfaces exceeding 5 percent slope with respect to head or nut.
 2. Tighten bolts for full bearing under heads and nuts and to snug-tight condition.
- L. Shop Welding
1. Perform welding in accordance with AWS D1.1.
 2. Provide welds of size indicated.
 3. Where weld size is not indicated, use AWS minimum weld size, but not less than 3/16-inch fillet welds.
 4. Make all welds exposed to the weather or damp conditions in the finished Work continuous and watertight.
 5. Rust protection in accordance with Section 05 12 00 - Structural Steel Framing.
- M. Close exposed ends of pipe and tube railings with continuously welded steel caps.
- 2.10 SHOP FINISHING
- A. Surface Preparation
1. Grind weld spatter and sharp edges smooth prior to cleaning.
 2. Prior to application of primer, clean surfaces as follows:
 - a. Steel to be encased in masonry or concrete SSPC SP-2.
 - b. Steel to remain exposed in the completed Work SSPC SP-7.
- B. Shop Primer
1. Apply shop primer within 8 hours of surface cleaning.
 2. Apply minimum 3 mils dry film thickness of primer to steel, unless otherwise specified.
 3. Do not apply primer within 2 inches of steel assemblies which are embedded in concrete.
 4. Apply two coats of primer to steel assemblies which are concealed in the finish Work.
 5. Touch-up shop primer of poor quality or insufficient thickness to a condition acceptable to the Owner's Representative.
- C. Galvanized Finish: Minimum 1.25 oz/sq. ft. zinc coating in accordance with ASTM A123.

2.11 QUALITY CONTROL

- A. Materials and fabrication procedures are subject to inspection and test in mill, shop, and field. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements. Promptly remove and replace materials or fabricated components that do not comply.

2.12 TESTING AND INSPECTION

- A. Testing and inspection shall be in accordance with CBC Section 1705A.2.
- B. Independent Testing Laboratory shall provide the following testing:

1. Perform testing in accordance with the provisions of Division 01.
 - a. Perform nondestructive weld testing as required in accordance with CBC, Section 1705A.5.2.
 - C. Owner's Representative will provide the following inspections:
 1. Inspect material tags and mill certifications.
 2. Review written welding procedures.
 3. Verify welding materials and welder certifications.
 4. Provide inspection of welding in accordance with CBC, Section 1705A.5.2.
- 2.13 TOLERANCES
- A. Tolerances shall be in accordance with AISC Code.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive the Work. Notify the Owner's Representative, in writing, of any conditions requiring corrective action.
- B. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Verify that field measurements are as shown on Drawings and approved shop drawings. Report discrepancies to the Owner's Representative for clarification or resolution prior to starting fabrication for the area affected.
- B. Clean and strip primed steel items to bare metal where site welding is required.
- C. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate Sections.

3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on Drawings and approved shop drawings.
 1. Perform field welding in accordance with AWS D1.1.
- D. Bolted Connections
 1. Bolted connections shall have not less than two bolts.
 2. Ream unfair holes, but only up to next larger bolt size.
 3. As erection progresses, bolt up the Work to assume dead loads, lateral forces, and erection stresses.

- E. Assembly Using Standard Threaded Fasteners
 - 1. Provide beveled washers under bolt heads or nuts riding on surfaces exceeding 5 percent slope with respect to head or nut.
 - 2. Tighten bolts for full bearing under heads and nuts and to snuggest condition.

3.4 FINISHES

- A. After erection, prime welds, abrasions, and surfaces not shop primed except surfaces to be in contact with concrete and surfaces to receive spray-on fireproofing or insulation.
- B. Field paint unpainted field connections, bolts, and similar parts with primer.

3.5 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, noncumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

3.6 TESTING AND INSPECTION

- A. Testing and inspection shall be in accordance with CBC Section 1705A.2.
- B. Independent Testing Laboratory shall provide the following testing:
 - 1. Perform testing in accordance with the provisions of Division 01.
 - 2. Perform nondestructive weld testing as required in accordance with CBC, Section 1705A.2.5.
- C. Owner's Representative will provide the following inspections:
 - 1. Inspect placement of all items for conformance with Drawings and approved shop drawings.
 - 2. Review written welding procedures.
 - 3. Verify welding materials and welder certifications.
 - 4. Provide welding inspection in accordance with CBC, Section 1705A.2.5.

3.7 CLEANING

- A. After erection, thoroughly clean surfaces of foreign a deleterious matter such as dirt, mud, oil, and grease that could impair bonding of concrete, finishes, or fireproofing.

3.8 REPAIR AND ADJUSTMENTS

- A. Items shall not be cut or altered without prior approval of the Owner's Representative.
- B. Repair abraded areas of shop-applied coatings, and areas of weld where the shop-applied coating has been damaged with a primer or galvanizing repair compound, as applicable, that is compatible with the shop coating.

3.9 DEFECTIVE WORK

- A. Work not conforming to required lines, details, dimensions, tolerances, finishes, strength, or other specified requirements shall be considered defective. Notify the Owner's Representative upon discovery of these conditions.
- B. Required repair or replacement of defective the Work will be determined by the Owner's Representative.
- C. Do not patch, fill, touch-up, repair, or replace items except upon express direction of the Owner's Representative for each individual area.
- D. Defective Work shall be repaired or replaced as recommended by the Owner's Representative at no additional expense to the Owner.

3.10 PROTECTION

- A. Protect installed items from damage from subsequent construction operations.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Structural and nonstructural wall and roof framing
2. Interior and exterior wood ceilings and finish trims.
3. Lumber (applicable as indicated on the Drawings):
 - a. Sawn dimensional wood framing material.
 - b. Blocking, nailers, and shims.
 - c. Wood furring.
 - d. Wood decking.
 - e. Roof crickets.
 - f. Roof curbs not integral to associated equipment.
4. Preservative treatment of wood.

B. Related Sections

1. Section 06 11 13 - Engineered Wood Products.
2. Section 06 16 00 - Sheathing.
3. Section 06 18 00 - Glued-Laminated Construction.
4. Section 06 20 00 - Finish Carpentry.
5. Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

- A. AITC - American Institute of Timber Construction.
- B. ALSC - American Lumber Standard Committee, American Softwood Lumber Standard, Voluntary Product Standard PS 20.
- C. ANSI/AWC NDS - National Design Specification for Wood Construction.
- D. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- E. AWPA - American Wood Protection Association, U1 – Use Category System: User Specification for Treated Wood.
- F. AWPA - American Wood Protection Association, M4 – Standard for the Care of Preservative-Treated Wood Products.
- G. FSC - Forest Stewardship Council, FSC STD-01 - 001 - Principles and Criteria for Forest Stewardship.
- H. WCLIB - West Coast Lumber Inspection Bureau, Standard Grading Rules for West Coast Lumber No. 17, Latest Edition.

- I. NHLA - National Hardwood Lumber Association, Rules for the Measurement & Inspection of Hardwood & Cypress , Latest Edition.
- J. 40 CFR, Part 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings.
- K. CCR - California Code of Regulations: Title 24, 2016 - California Building Code (CBC).

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. General:
 - 1. Provide product data showing Forest Stewardship Certification (FSC) certification.
 - 2. Provide product data indicating that the VOC content of all adhesives and sealants comply with the requirements of this Section.
 - 3. Provide product data indicating that all composite wood materials (Plywood, MDF, particle board, etc.) are free of added Urea formaldehyde.
- C. Product Data:
 - 1. Product data for products and materials indicated.
 - 2. Manufacturer's technical bulletins and installation/application instructions.
 - 3. Material Safety Data Sheets (MSDS).
 - 4. For adhesives, include printed statement of VOC content (in g/L less water).
 - 5. For composite-wood products, include documentation indicating that product contains no urea formaldehyde.
 - 6. For paints and coatings, include printed statement of VOC content.

1.4 COORDINATION

- A. Coordinate the design, construction, and installation of rough carpentry with the requirements of the Work of other Sections.
- B. For engineered wood products reference Section 06 11 13 - Engineered Wood Products.
- C. For wood sheathing products reference Section 06 16 00 – Sheathing.
- D. For glued-laminated products reference Section 06 18 00 - Glued-Laminated Construction.
- E. For fire-retardant treated wood products reference Section 06 20 00 – Finished Carpentry.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Handle, stack, and store lumber off the ground in such a manner that it will be protected from damage and prevented from absorbing moisture. Protect with waterproof covering that provides adequate air circulation. Secure covering to prevent blow-off and prevent damage.
- B. Do not store seasoned materials in wet or damp locations.
- C. Protect fire-retardant materials against high humidity and moisture during storage and erection.

- D. Deliver fasteners in bags or boxes, properly tagged for identification.
- E. Store fasteners and attachment devices off the ground in a dry location, protected from dirt, damage, and the elements.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Provide engineered wood products in lieu of sawn lumber where indicated on the Drawings.
- B. Lumber: Douglas Fir; S4S; West Coast Lumber Inspection Bureau (WCLIB) grade marked by an agency certified by WCLIB; each mill shipment shall be accompanied by a WCLIB certificate of inspection.; size shall be in accordance with PS 20; free of boxed heart; maximum 19 percent moisture content at time of installation; of the following min. grades.
 - 1. Studs (2 to 4 inches thick x 4 inches and wider): No. 2 Grade, unless noted otherwise in the Wood Notes on the structural drawings.
 - 2. Structural Joists and Planks (2 to 4 inches thick x 2 inches and wider): No. 1 Grade.
 - 3. Beams and Stringers, Posts and Timbers (less than 5 x 5 inches): No. 1 Grade.
 - 4. Beams and Stringers, Posts and Timbers (5 x 5 inches and larger): No. 1 Grade.
 - 5. Miscellaneous Light Framing Non-Load Bearing (2 to 4 inches thick x 2 to 4 inches wide): No. 2 Grade.
 - 6. Blocking: No. 2 Grade.
 - 7. Grounds: Straight and free from loose knots and knot holes.
 - 8. Roof Decking (2 to 4 inches thick x 5 inches and wider): No. 1 Grade.
- C. Lumber: Western Red Cedar; Kiln Dried; S4S; West Coast Lumber Inspection Bureau (WCLIB).grade marked by an agency certified by WCLIB; each mill shipment shall be accompanied by a WCLIB certificate of inspection.; nominal sizes as indicated on the Drawings; of the following minimum grades.
 - 1. Exterior Ceilings: Nominal 1 x 4 T&G; Clear Heart (WCLIB 102-b).
 - 2. Exterior Ceiling Trim: Sizes as indicated; A Clear (WCLIB 102-c).
- D. (NOT USED) Lumber: Red Oak; Kiln Dried; S4S; National Hardwood Lumber Association (NHLA) grade marked by an agency certified by NHLA; each mill shipment shall be accompanied by a NHLA certificate of inspection; nominal sizes as indicated on the Drawings; of the following minimum grades.
 - 1. Interior Handrails, Baseboards, Chair Rails, Wall Caps, and Trim: Stain Grade, FAS (NHLA Paragraphs 55 to 63 inclusive).

2.2 HARDWARE

- A. Provide engineered steel connectors specifically designed for connection type and application, and as indicated on the Drawings.
- B. Manufacturers:
 - 1. Simpson Strong-Tie Company.
 - 2. MiTek USA; USP Structural Connectors.
 - 3. KC Metal Products.
 - 4. Or equal.

2.3 FASTENERS

- A. Provide all nails, screws, bolts, washers, lag screws, joist hangers, tie straps, clips, and similar items as required to the complete Work.
- B. Nails: Use types and sizes as indicated, and in accordance with CBC Chapter 23 - Nailing Schedule, except sizes shall not be smaller than indicated.
- C. Powder Actuated Fasteners:
 - 1. Types and Sizes: As indicated or appropriate for the Work required and materials involved.
- D. Anchors:
 - 1. Toggle bolt type for anchorage to hollow masonry.
 - 2. Expansion shield and lag bolt type for anchorage to solid masonry or concrete.
 - 3. For fastenings secured to hardened concrete or masonry, inserts and sleeves shall be metal only.
 - 4. Bolt or ballistic fastener for anchorages to steel.
- E. Fastener Finishes:
 - 1. Fasteners in contact with pressure treated products shall be in accordance with the requirements of CBC Chapter 23.
 - 2. Fasteners in contact with fire-retardant treated products shall be in accordance with the requirements of CBC Chapter 23.
 - 3. Fasteners exposed to moisture, high humidity, or to the exterior shall be hot-dipped zinc-coated galvanized or cadmium-plated, unless otherwise indicated or specified.
 - 4. Nails and screws shall be corrosion resistant for exterior or damp areas.
 - 5. Finish nails and screws shall be bright finished for other interior Work.
 - 6. Machine bolts and washers shall be corrosion resistant.
- F. Adhesives: Epoxy for structural bonding rough carpentry.
 - 1. Low-Emitting Adhesives and Sealants: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Multipurpose Construction Adhesives: VOC content of not more than 70g/L.
 - 2. Manufacturers:
 - a. BASF Construction Chemicals; "Sonneborn 400".
 - b. OSI Pro-Series; SF-565 VOC Compliant Sub-Floor Adhesive.

2.4 WOOD TREATMENTS

- A. Wood shall be treated with appropriate fire retardant or preservative as necessary in accordance with exposure, wood species, and applicable codes. For fire-retardant treated wood products reference Section 06 20 00 – Finished Carpentry.
- B. Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Fire-Retardant Coatings: VOC content for coating category for which coating is formulated.
 - 2. Wood Preservatives: 350 g/L.

3. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 4. Non-Flat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 5. Floor Coatings: VOC not more than 100 g/L.
 6. Shellacs, Clear: VOC not more than 730 g/L.
 7. Shellacs, Pigmented: VOC not more than 550 g/L.
 8. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 9. Clear Wood Finishes, Varnishes: VOC content of not more than 350 g/L.
 10. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.5.
 11. Stains: VOC not more than 250 g/L.
- C. Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply with the following chemical restrictions:
1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 2. Restricted Components: Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.
 - j. 1,2-dichlorobenzene.
 - k. Diethyl phthalate.
 - l. Dimethyl phthalate.
 - m. Ethylbenzene.
 - n. Formaldehyde.
 - o. Hexavalent chromium.
 - p. Isophorone.
 - q. Lead.
 - r. Mercury.
 - s. Methyl ethyl ketone.
 - t. Methyl isobutyl ketone.
 - u. Methylene chloride.
 - v. Naphthalene.
 - w. Toluene (methylbenzene).
 - x. 1,1,1-trichloroethane.
 - y. Vinyl chloride.
- D. Where used for exposed locations, treatment materials shall be types guaranteed to not adversely affect durability and appearance of applied finishes.
- E. Treatment materials having a highly persistent, noticeable residual odor will not be permitted.
- F. After treatment, kiln or air dry lumber and plywood to a moisture content of 19 percent or less.

G. Pressure Treatment

1. Items requiring pressure treatment:
 - a. Wood used in conjunction with roofing, flashing, vapor barriers, and waterproofing.
 - b. Wood in contact with masonry or concrete.
 - c. Wood subject to insect attack.
 - d. Wood in contact with ground or water.
 - e. Additional locations required by codes, the Owner's representative, or accepted standard construction practice.
2. Pressure treat items after fabrication where possible. Use surface applied treatment for items cut after pressure treatment.
3. Do not mill or trim pressure treated items beyond limits recommended by treatment manufacturer.
4. Surface-Applied Wood Preservative (Type A)
 - a. Nonaqueous solution containing not less than 5 percent pentachlorophenol, commercially prepared and formulated to repel water and inhibit decay.
 - b. Suitable for application by either brush or dip methods.
 - c. Integral coloring to allow visual inspection of treated members.
5. Pressure-Treated Wood Preservative (Type B)
 - a. Required for lumber and plywood where indicated or specified and not otherwise required to be fire-retardant pressure treated (Type C).
 - b. Provide for lumber and plywood in contact with concrete, masonry, or grout.
 - c. Concealed Locations: Any process acceptable in accordance with AWPA Standard U1 and meeting specified requirements.
 - d. Exposed Locations: Treated members shall be milled smooth within limits permitted by process manufacturer.

H. Fire-retardant Treatment

1. For fire-retardant treatment of wood products reference Section 06 20 00 – Finished Carpentry.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready for installation of rough carpentry. Notify the Owner's Representative, in writing, of any conditions requiring corrective action.
- B. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected. Beginning of installation means acceptance of existing conditions.

3.2 NAILING

- A. Predrill undersize holes as necessary to prevent splitting.
- B. Drive nails straight and free from bends.
- C. At multiple or grouped nailing, set alternate nails at slightly different angles to improve strength.
- D. For trim or similar members, side-stagger alternate nails to prevent warp and twist.

- E. Where concealed, set nail heads flush to avoid interference with installation of materials to be applied next.
- F. Where exposed, set nail heads recessed for proper putty stopping.

3.3 FRAMING

- A. Construct and secure rough carpentry as indicated.
- B. Construction details, connections, and fastenings not otherwise indicated shall be in accordance with the requirements of CBC.
- C. Provide solid backing and blocking as indicated and required.
- D. Set members level and plumb, in correct position.
- E. Place horizontal members with crown side up.
- F. Cut and prepare ends and surfaces to effect full bearing, and as otherwise necessary for proper fit.
- G. Cut notches without overcutting inside corners.
- H. Plates and sills on concrete or masonry: Bed plates and sills of walls in Portland cement mortar where indicated on the Drawings, or when otherwise necessary to obtain continuous level bearing.
- I. Studs: Space as indicated; frame corners with not less than three studs. Set on single sole plate, cap with double top plate lapped at corners, lapped no less than 4 feet at splices.
- J. Posts, Girders, and Beams: Frame to true end bearings; provide supports and anchors of such design to hold securely in position and prevent base deterioration. Splice girders and beams only over bearings.
- K. Curb Members
 - 1. Curb roof openings, except where prefabricated curbs are provided.
 - 2. Construct curb members of single pieces.
 - 3. Form corners by alternating lapping side members.
 - 4. Coordinate curb installation with other Sections whose Work affects or is affected by the Work of this Section.

3.4 FIELD-APPLIED WOOD TREATMENT

- A. Surface Applied Preservative (Type A)
 - 1. Treat members after cutting, shaping, and bolting.
 - 2. Application
 - a. Apply in accordance with manufacturer's instructions.
 - b. Dip members for 15 minutes, or saturate by brushing on two complete coats at 10 minute intervals.
 - c. Air-dry two hours before setting treated members into place.

3.5 TESTING AND INSPECTION

- A. Testing and inspection shall be in accordance with CBC Section 1705A.5.
- B. Owner's Representative will provide the following inspections:
 - 1. Inspect wood structural elements and assemblies to ensure conformance with the Contract Documents.
 - 2. Inspect timber connectors to ensure conformance with the Contract Documents.

3.6 DEFECTIVE WORK

- A. When complete, rough carpentry shall be free from unnecessary cuts, holes, and other damage and defects.
- B. Rough carpentry not conforming to required lines, details, dimensions, tolerances, finishes, strength, or other specified requirements shall be considered defective. Notify the Owner's Representative upon discovery of these conditions.
- C. Required repair or replacement of defective rough carpentry will be determined by the Owner's Representative.
- D. Do not patch, fill, touch-up, repair, or replace rough carpentry except upon express direction of Owner's Representative for each individual area.
- E. Defective rough carpentry shall be repaired or replaced as recommended by the Owner's Representative at no additional expense to the Owner.

3.7 PROTECTION

- A. Protect rough carpentry from damage from subsequent construction operations.

END OF SECTION

SECTION 06 11 13

ENGINEERED WOOD PRODUCTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Laminated Veneer Lumber (LVL).
2. Prefabricated Wood Joists (I-Joists).
3. LVL Rim Boards.
4. Laminated Strand Lumber (LSL) wall framing material.
5. Accessories: Fasteners and connection hardware.

B. Related Sections

1. Section 05 12 00 - Structural Steel Framing.
2. Section 05 50 00 - Metal Fabrications.
3. Section 06 10 00 - Rough Carpentry.
4. Section 06 16 00 - Sheathing.
5. Section 06 18 00 - Glued-Laminated Construction.

1.2 REFERENCES

- A. AITC 105 - Recommended Practice for Erection of Structural Timber Framing by American Institute of Timber Construction.
- B. ASTM A36 - Carbon Structural Steel.
- C. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- D. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- E. ASTM A167 - Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet, and Strip.
- F. ASTM D5055 - Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists.
- G. ASTM D5456 - Standard Specification for Evaluation of Structural Composite Lumber Products.
- H. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- I. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- J. FSC STD-01-001 - Principles and Criteria for Forest Stewardship.
- K. CCR - California Code of Regulations, Title 24 - 2016 California Building Code (CBC).

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings: Indicate member types by manufacturer's series, size and spacing, locations, bridging, bracing, and connection details.
- C. Product Data
 - 1. Product data for products and materials indicated.
 - 2. Manufacturer's technical bulletins and installation/application instructions including:
 - a. Preparation instructions and recommendations.
 - b. Storage and handling requirements and recommendations.
 - c. Installation methods.
 - 3. Material Safety Data Sheets (MSDS).
 - 4. Provide technical data on wood preservative materials, application technique, and resultant performance information.
 - 5. For laminating adhesive used for engineered wood products, provide data indicating that product contains no urea formaldehyde.
 - 6. Provide current ICC ES Evaluation Report or IAPMO ES Evaluation Report for each type of product used.
- D. Performance Standards:
 - 1. I-joist products shall be tested and evaluated in accordance with ASTM D5055.
 - 2. Laminated veneer lumber (LVL) products shall be tested and evaluated in accordance ASTM D5456.
 - 3. Laminated Strand Lumber (LSL) shall be tested and evaluated in accordance with ASTM D5456.
- E. Design Data: Submit design calculations signed and sealed by a professional engineer registered in the State of the California.
- F. Test Reports: Upon request provide current structural, fire and sound test reports from recognized testing laboratories
- G. Certificates
 - 1. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacture of engineered wood products with five (5) years minimum experience.
- B. Installer Qualifications: Company with three (3) years minimum experience on projects of similar size and complexity.

1.5 QUALITY ASSURANCE

- A. Mock-Up: Provide a mock-up for evaluation of visually critical members and connections surface preparation techniques and application workmanship.

1. Finish areas and connection details designated by Owner's Representative.
2. Do not proceed with remaining work until workmanship, connection details, and finish are approved by Owner's Representative.
3. Correct mock-up as required to produce acceptable Work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Provide factory wrapping, packaging, and other means necessary to prevent damage or deterioration during shipment, handling, and storage, in accordance with Section 01 60 00.
- B. Store products in manufacturer's unopened packaging until ready for installation.
 1. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
 2. Keep materials dry and store on a hard, dry, level surface not in contact with the ground.
 3. Store materials in wrapped and strapped bundles stacked no more than 10 feet high.
 4. Support bundles to prevent excessive bowing. Support and separate bundles with dimension lumber spaced no more than 10 feet (3 m) apart. Keep supports in line vertically.
 5. Handle individual pieces in a manner to prevent physical damage during measuring, cutting and erection.

1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

- A. Warranty: Manufacturer's standard material warranty:
 1. Warranty Period: Lifetime Limited Warranty beginning with date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. RedBuilt.
- B. Weyerhaeuser.
- C. LP Building Products.
- D. Boise Cascade.
- E. Georgia-Pacific Wood Products.
- F. Roseburg.
- G. Or Equal.

2.2 MATERIALS

- A. Forest Certification: Provide members produced from wood obtained from forests certified by an FSC accredited certification body to comply with FSC STD-01-001.
- B. Laminated Veneer Lumber (LVL)
 - 1. Material: Ultrasonically and visually graded veneers arranged to specific patterns so that naturally occurring defects have no concentrated effect on the member's performance. Waterproof adhesive, bonded under pressure and heat.
 - a. Thickness: As indicated on the Drawings.
 - b. Depth: As indicated on the Drawings.
- C. Prefabricated Wood Joists (I-Joists)
 - 1. Material: Laminated veneer lumber top and bottom chords permanently attached to oriented strand board webs.
 - a. Top and Bottom Flanges: LVL – size as specified by manufacturer for I-joists indicated on structural drawings.
 - b. Web Thickness: As specified by manufacturer for I-joists indicated on structural drawings.
 - b. Depth: As indicated on the Drawings.
- D. LVL Rim Boards
 - 1. Material: Cross ply LVL specifically engineered for rim board application and sized to transfer vertical loads directly to sill plate.
 - a. Thickness: 1-1/4 inch, 1-1/2 inch, and/or 1-3/4 inch as indicated on the Drawings.
 - b. Depth: As indicated on the Drawings.
- E. Laminated Strand Lumber (LSL)
 - 1. Material: Strands arranged parallel to the finished product's length. MDI, bonded and cured under pressure and heat.
 - a. Thickness: As indicated on the Drawings.
 - b. Depth: As indicated on the Drawings.

2.3 ACCESSORIES

- A. Fasteners: Provide nail and fastener types and sizes as recommended by the engineered wood product manufacturer for the intended application, in accordance with the manufacturer's details and instructions, as required by code, and as indicated on the Drawings.
- B. Hardware: Provide engineered steel connectors specifically designed for connection type and application, and as indicated on the Drawings.
 - 1. Manufacturers:
 - a. Simpson Strong-Tie Company.
 - b. MiTek USA; USP Structural Connectors.
 - c. KC Metal Products.
 - d. Or equal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive the Work. Notify the Owner's Representative, in writing, of any conditions requiring corrective action.
- B. Verify that supports are ready to receive members.
- C. Verify sufficient end bearing area.
- D. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Coordinate placement of bearing and support items.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the installation under the Project conditions.

3.3 GENERAL INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install engineered wood products in compliance with approved shop drawings.
- C. Conditions and Practices Not Permitted:
 - 1. Do not place holes closer to supports than recommended by manufacturer.
 - 2. Do not over cut holes and damage flanges.
 - 3. Do not make holes with hammer unless a knockout is provided for this purpose.
 - 4. Do not hammer on flange and damage joist.
 - 5. Do not cut, notch or drill flange.
 - 6. Do not use 16d or larger nails in flange.
 - 7. Do not bevel cut joist ends inside edge of bearing.
 - 8. Do not support joist on web.
 - 9. Do not install visibly damaged joists.

3.4 LAMINATED VENEER LUMBER INSTALLATION

- A. Install laminated veneer lumber plumb and level.
- B. Accurately fit, align, securely fasten and install free from distortion or defects.
- C. Temporary Bracing:
 - 1. LVL shall be securely braced during construction. Temporary bracing shall be anchored to the ground, foundation, a braced wall or other completed, stable section of the structure.

2. Exercise caution when removing temporary bracing when applying sheathing. Remove bracing as sheathing is attached.
3. All rim joists, blocking, connections and temporary bracing shall be installed before erectors are allowed on the structure.
4. Impose no loads other than the weight of the erectors on the structure before it is permanently sheathed.
5. After sheathing, do not exceed design loads on members with construction materials.
6. Support members laterally at end bearings and cantilevers.
7. All conditions calling for notched or drilled beams must be reviewed and approved by a professional engineer licensed in the State of California.

3.5 I-JOIST INSTALLATION

- A. Accurately fit, align, securely fasten and install free from distortion or defects.
- B. Conditions and Practices Required:
 1. Carefully unload joists by lifting, using forklifts or cranes to avoid damage.
 2. Keep joists stored in wrapped and strapped bundles stacked no more than 10 feet high.
 3. Support bundles to prevent excessive bowing. Support and separate bundles with dimension lumber spaced no more than 10 feet apart. Keep supports in line vertically.
 4. Handle individual joists in a manner to prevent physical damage during measuring, cutting and erection.
 5. Handle joists vertically, not horizontally (flat).
 6. Use at least 1 by 4 temporary bracing members nailed to each joist with two 8d common nails. Keep rows of bracing parallel at no more than 8 feet apart.
 7. Use long pieces for bracing, not short blocks. Lap ends to form a continuous line of bracing.
 8. Anchor bracing at ends and at 25 feet intervals into a stable end wall or an area braced by sheathing or diagonal bracing.
 9. Exercise caution when removing temporary bracing when applying sheathing. Remove bracing as sheathing is attached.
 10. All rim joists, blocking, connections and temporary bracing shall be installed before erectors are allowed on the structure.
 11. Impose no loads other than the weight of the erectors on the structure before it is permanently sheathed.
 12. After sheathing, do not exceed design loads on joists with construction materials.
 13. Support joists laterally at end bearings and cantilevers.
 14. I-joists shall have a minimum end bearing length of 1-1/2 inches for all I-joists having a depth not greater than 16 inches and a minimum end bearing length of 2-1/2 inches for all I-joists deeper than 16 inches. All I-joists require a minimum intermediate bearing length of 3-1/2 inches regardless of series and depth.
 15. Refer to drawings and member schedule for end bearing and interior bearing stiffener requirements.

3.6 LAMINATED STRAND LUMBER INSTALLATION

- A. Install laminated strand lumber plumb and level.
- B. Accurately fit, align, securely fasten and install free from distortion or defects.

- C. Temporary Bracing:
 - 1. Securely brace LSL during construction by anchoring to the ground, foundation, a braced wall or other completed, stable section of the structure.
 - 2. Support members laterally at end bearings and cantilevers.
 - 3. Install all rim joists, blocking, connections and temporary bracing before erectors are allowed on the structure.
 - 4. Impose no loads other than the weight of the erectors on the structure before it is permanently sheathed.
 - 5. Exercise caution when removing temporary bracing to apply sheathing.
 - 6. After sheathing, do not exceed design loads on members with construction materials.
 - 7. All conditions calling for notched or drilled beams must be reviewed and approved by a professional engineer licensed in the State of California.

3.7 REPAIR AND ADJUSTMENT

- A. Touch-up, repair or replace damaged products before Substantial Completion.
- B. Repair of damaged members shall be by original fabricator only, and shall be subject to the approval of the Owner's Representative.
- C. Where members are field cut or trimmed, apply same sealer as used to seal shop cuts.

3.8 PROTECTION

- A. Protect members from damage from subsequent construction operations.

END OF SECTION

SECTION 06 16 00

SHEATHING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Exterior roof and wall structural sheathing.
 - 2. Telephone and electrical panel boards.
- B. Related Sections
 - 1. Section 06 10 00 - Rough Carpentry.
 - 2. Section 06 20 00 - Finished Carpentry.
 - 3. Division 26 - Electrical: for backboards.
 - 4. Division 27 - Communications: for backboards.

1.2 REFERENCES

- A. ANSI/AWC NDS - National Design Specification for Wood Construction.
- B. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
- C. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems.
- D. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- E. AWWA - American Wood Protection Association, U1 – Use Category System: User Specification for Treated Wood.
- F. DOC - U.S. Department of Commerce, DOC PS-1 or PS-2 - Voluntary Product Standard for Wood Structural Panels.
- G. FSC - Forest Stewardship Council, FSC-STD-01-001 - FSC Principles and Criteria for Forest Stewardship.
- H. 40 CFR, Part 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings.
- I. CCR - California Code of Regulations: Title 24, 2016 - California Building Code (CBC).

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.

- B. Product Data:
 - 1. Product data for products and materials indicated.
 - 2. Manufacturer's technical bulletins and installation/application instructions.
 - 3. Material Safety Data Sheets (MSDS).
 - 4. Products
 - a. Wood preservatives.
 - b. Proprietary connection devices.
 - 5. Provide product data showing Forest Stewardship Certification (FSC) certification for wood products.
 - 6. Provide product data indicating that the VOC content of all adhesives and sealants comply with the requirements of this Section.
 - 7. For paints and coatings, include printed statement of VOC content
 - 8. Provide product data indicating that all composite wood materials (Plywood, MDF, particle board, etc.) are free of added Urea formaldehyde.

1.4 COORDINATION

- A. Coordinate the design, construction, and installation of sheathing with the requirements of the Work of other Sections.
- B. For fire-retardant treated wood products reference Section 06 20 00 – Finished Carpentry.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Handle, stack, and store sheathing off the ground in such a manner that it will be protected from damage and prevented from absorbing moisture. Protect with waterproof covering that provides adequate air circulation. Secure covering to prevent blow-off and prevent damage.
- B. Do not store seasoned materials in wet or damp locations.
- C. Protect fire-retardant materials against high humidity and moisture during storage and erection.
- D. Protect sheathing against damage to edge, corner, and surfaces while unloading handling.
- E. Store sheathing in an enclosed area or protect as specified for lumber.
- F. Deliver fasteners in bags or boxes, properly tagged for identification.
- G. Store attachment devices off the ground in a dry location, protected from dirt, damage, and the elements.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Forest Certification: Provide sheathing produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001.

- B. Wood Structural Panels; DOC PS-1 or PS-2; identified by grade, bond classification, and performance category by the trademarks of the APA Guide to Plywood Grades or other approved testing agency.
 - 1. Concealed Sheathing: C/D - INT with exterior glue.
 - 2. Concealed Structural Components: Structural I C/D - INT with exterior glue.
 - 3. Telephone and Electric Terminal Boards: B/D - INT; 3/4 inch thick, square edges; fire-retardant pressure treated.
- C. Each piece of fire-retardant sheathing shall be labeled to show compliance with the UL requirement specified and shall be grade stamped with the applicable AWWPA quality mark indicating the preservative and retention.

2.2 FASTENERS

- A. Furnish all nails, screws, bolts, washers, lag screws, tie straps, clips, and similar items as required to complete Work.
- B. Nails and Screws: Use types and sizes as indicated on the drawings, and in accordance with CBC Chapter 23, except sizes shall not be smaller than indicated.
- C. Fastener Finishes
 - 1. Fasteners in contact with pressure treated products shall be in accordance with the requirements of CBC Chapter 23.
 - 2. Fasteners in contact with fire-retardant treated products shall be in accordance with the requirements of CBC Chapter 23.
 - 3. Fasteners exposed to moisture, high humidity or to the exterior shall be hot-dipped galvanized or cadmium-plated, unless otherwise indicated or specified.
 - 4. Nails and screws shall be corrosion resistant for exterior or damp areas.
 - 5. Finish nails and screws shall be bright finished for other interior Work.
 - 6. Machine bolts and washers shall be corrosion resistant.
- D. Adhesives: ASTM C557.
 - 1. Epoxy for structural bonding rough carpentry.
 - 2. VOC Content for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 or ASTM D3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.
 - a. Use adhesives that have a VOC content of 50g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Manufacturers
 - a. BASF Construction Chemicals; "Sonneborn 400".
 - b. OSI Pro-Series; SF-565 VOC Compliant Sub-Floor Adhesive.

2.3 WOOD TREATMENTS

- A. Wood shall be treated with appropriate fire retardant or preservative as necessary in accordance with exposure, wood species, and applicable codes.
- B. Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Fire-Retardant Coatings: VOC content for coating category for which coating is formulated.
 2. Wood Preservatives: 350 g/L.
 3. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 4. Non-Flat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 5. Floor Coatings: VOC not more than 100 g/L.
 6. Shellacs, Clear: VOC not more than 730 g/L.
 7. Shellacs, Pigmented: VOC not more than 550 g/L.
 8. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 9. Clear Wood Finishes, Varnishes: VOC content of not more than 350 g/L.
 10. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
 11. Stains: VOC not more than 250 g/L.
- C. Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply with the following chemical restrictions:
1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 2. Restricted Components: Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.
 - j. 1,2-dichlorobenzene.
 - k. Diethyl phthalate.
 - l. Dimethyl phthalate.
 - m. Ethylbenzene.
 - n. Formaldehyde.
 - o. Hexavalent chromium.
 - p. Isophorone.
 - q. Lead.
 - r. Mercury.
 - s. Methyl ethyl ketone.
 - t. Methyl isobutyl ketone.
 - u. Methylene chloride.
 - v. Naphthalene.
 - w. Toluene (methylbenzene).
 - x. 1,1,1-trichloroethane.
 - y. Vinyl chloride.
- D. Where used for exposed locations, treatment materials shall be types guaranteed to not adversely affect durability and appearance of applied finishes.
- E. Treatment materials having a highly persistent, noticeable residual odor will not be permitted.

- F. After treatment, kiln or air dry lumber and plywood to a moisture content of 19 percent or less.

- G. Pressure Treatment: AWP A U1.
 - 1. Items requiring pressure treatment
 - a. Wood used in conjunction with roofing, flashing, vapor barriers, and waterproofing.
 - b. Wood in contact with masonry or concrete.
 - c. Wood subject to insect attack.
 - d. Wood in contact with ground or water.
 - e. Additional locations required by codes, the Owner, or accepted standard construction practice.
 - 2. Pressure treat items after fabrication where possible. Use surface applied treatment for items cut after pressure treatment.
 - 3. Do not mill or trim pressure treated items beyond limits recommended by treatment manufacturer.
 - 4. Surface-Applied Wood Preservative (Type A)
 - a. Nonaqueous solution containing not less than 5 percent pentachlorophenol, commercially prepared and formulated to repel water and inhibit decay.
 - b. Suitable for application by either brush or dip methods.
 - c. Integral coloring to allow visual inspection of treated members.
 - 5. Pressure-Treated Wood Preservative (Type B)
 - a. Required for sheathing where indicated or specified and not otherwise required to be fire-retardant pressure treated (Type C).
 - b. Provide for sheathing in contact with concrete, masonry, or grout.
 - c. Concealed Locations: Any process acceptable in accordance with AWP A Standard C1 and meeting specified requirements.
 - d. Exposed Locations: Treated sheathing shall be milled smooth within limits permitted by process manufacturer.

- H. Fire-retardant Treatment: AWP A U1.
 - 1. Items requiring Fire-retardant treatment
 - a. Sheathing used in Type I and II buildings.
 - b. Exposed sheathing.
 - c. Sheathing used in fire-rated assemblies.
 - d. Sheathing requiring reduced flame/fuel/smoke ratings.
 - e. Communications backboards.
 - f. Electrical mounting boards.
 - g. Additional locations required by codes, the Owner, or accepted standard construction practice.
 - 2. Fire-Retardant Pressure Treatment (Type C)
 - a. Processes shall meet requirements of CBC 2303.2, and requirements specified herein.
 - b. Treated sheathing shall be listed and labeled in accordance with UL BMD Section "Treated Plywood (BUGV)."
 - 3. Treated sheathing shall be UL Classified FR-S or shall have equivalent flame-spread and smoke-developed values.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready for installation of sheathing. Notify the Owner's Representative, in writing, of any conditions requiring corrective action.
- B. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Construct and secure sheathing as indicated.
- B. Make provision for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Construction details, connections, and fastenings not otherwise indicated shall be in accordance with the requirements of CBC.
- D. Drive nails straight and free from bends. Do not overdrive.
- E. Provide solid backing and blocking as indicated and required.
- F. Cut notches without overcutting inside corners.
- G. Install sheathing perpendicular to framing members, with ends staggered, over firm bearing.
- H. Allow expansion space at edges and ends.
- I. Attach sheathing with fasteners of type, size, and spacing as indicated on the Drawings.
- J. Use sheathing clips at unsupported edges of sheathing between supporting framing members.

3.3 BACKBOARDS

- A. Install telephone and electrical panel backboards.
- B. Size backboards as indicated; where not indicated, over-size the backboards, with respect to the supported equipment, by 12 inches on all sides.
- C. Sand to leave paintable surface.

3.4 FIELD-APPLIED WOOD TREATMENT

- A. Surface Applied Preservative (Type A)
 - 1. Treat members after cutting, shaping, and bolting.

2. Application
 - a. Apply in accordance with manufacturer's instructions.
 - b. Dip members for 15 minutes, or saturate by brushing on two complete coats at 10 minute intervals.
 - c. Air-dry two hours before setting treated members into place.
 - B. Fire-Retardant Pressure Treatment (Type C)
 1. After cutting, shaping, and boring, retreat surfaces using materials and methods in accordance with manufacturer's instructions.
- 3.5 TOLERANCES
- A. Surface Flatness of Sheathing Without Load: 1/4 inch in 10 feet maximum, and 1/2 inch maximum in 30 feet.
- 3.6 TESTING AND INSPECTION
- A. Testing and inspection shall be in accordance with CBC Section 1705A.5.
 - B. Owner's Representative will provide the following inspections:
 1. Inspect sheathing and assemblies to ensure conformance with the Drawings and Specifications.
 2. Inspect sheathing connectors to ensure conformance with the Drawings and Specifications.
- 3.7 DEFECTIVE WORK
- A. When complete, sheathing shall be free from unnecessary cuts, holes, and other damage and defects.
 - B. Sheathing not conforming to required lines, details, dimensions, tolerances, finishes, strength, or other specified requirements shall be considered defective. Notify the Owner's Representative upon discovery of these conditions.
 - C. Required repair or replacement of defective sheathing will be determined by the Owner's Representative.
 - D. Do not patch, fill, touch-up, repair, or replace sheathing except upon express direction of the Owner's Representative for each individual area.
 - E. Defective sheathing shall be repaired or replaced as recommended by the Owner's Representative at no additional expense to the Owner.
- 3.8 PROTECTION
- A. Protect sheathing from damage from subsequent construction operations.

END OF SECTION

SECTION 06 18 00

GLUED-LAMINATED CONSTRUCTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Glue laminated wood units.
 - 2. Steel hardware and attachment brackets.
- B. Related Sections
 - 1. Section 05 12 00 - Structural Steel Framing
 - 2. Section 05 50 00 - Metal Fabrications.
 - 3. Section 06 10 00 - Rough Carpentry.
 - 4. Section 06 11 13 - Engineered Wood Products
 - 5. Section 06 16 00 - Sheathing.

1.2 REFERENCES

- A. AITC 105 - Recommended Practice for Erection of Structural Timber Framing by American Institute of Timber Construction.
- B. AITC 110 - Standard Appearance Grades for Structural Glued-Laminated Timber.
- C. AITC 117 - Structural Glued-Laminated Timber of Softwood Species.
- D. ANSI A190.1 - Structural Glued Laminated Timber.
- E. ASTM A36 - Carbon Structural Steel.
- F. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- G. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- H. ASTM A167 - Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet, and Strip.
- I. ASTM A307 - Carbon Steel Bolts and Studs, 60,000-psi Tensile Strength.
- J. ASTM A325 - Structural Bolts Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- K. ASTM D2559 - Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions.
- L. ASTM D3737 - Practice for Establishing Allowable Properties for Structural Glued-Laminated Timber.

- M. AWPAC28 - Preservative Treatment of Structural Glued-Laminated Members and Lamination Before Gluing of Southern Pine, Coastal Douglas Fir, Hemfir and Western Hemlock by Pressure Processes.
- N. DOC PS 56 - US Product Standard for Structural Glued-Laminated Timber.
- O. FSC STD-01-001 - Principles and Criteria for Forest Stewardship.
- P. CCR - California Code of Regulations, Title 24 - 2016 California Building Code (CBC).

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings: Indicate sizes and spacing of members, loads and cambers, bearing and anchor details, bridging and bracing, and framed openings.
- C. Product Data
 - 1. Product data for products and materials indicated.
 - 2. Manufacturer's technical bulletins and installation/application instructions.
 - 3. Material Safety Data Sheets (MSDS).
 - 4. Provide technical data on wood preservative materials, application technique, and resultant performance information.
 - 5. For laminating adhesive used for structural glued-laminated timber, provide data indicating that product contains no urea formaldehyde.
- D. Samples: Submit samples for selection of finish colors.
- E. Certificates
 - 1. Submit three copies of AITC Certificate of Conformance prior to delivery of units.
 - 2. Chain-of-custody (COC) certificates certifying that products specified to be made from certified wood comply with forest certification requirements.
- F. Qualification Data
 - 1. For manufacturer.

1.4 DESIGN REQUIREMENTS

- A. Grade Combination: 24F-V8 DF/DF for multiple spans or cantilevers, 24F-V4 DF/DF elsewhere, unless otherwise noted. See structural drawings for 20F-V12 AC/AC or 20F-V13 AC/AC at canopy fascia beams.
- B. Allowable Bending Stress (fb): 2,400 psi for DF/DF, and 2,000 psi for AC/AC.

1.5 COORDINATION

- A. Coordinate the design, construction, and installation of members with the requirements of the Work of other Sections.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacture of glued-laminated structural units with five (5) years minimum experience, and certified by the American Institute of Timber Construction (AITC).

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Provide factory wrapping, packaging, and other means necessary to prevent damage or deterioration during shipment, handling, and storage, in accordance with Section 01 60 00.
- B. Ship, handle, and store members in accordance with manufacturer's instructions.
- C. Protect members in accordance with AITC requirements for individually wrapped material.
- D. Store members on level supports above the ground, separated by wood strips to permit air circulation around each unit. Cover and protect from exposure to weather.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Forest Certification: Provide members produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001.
- B. Lumber: Douglas Fir-Larch, unless otherwise noted (Alaska Yellow Cedar at canopy fascia beams).
 - 1. Conform to WCLIB grading rules.
 - 2. Comply with AITC 110, AITC 117, and additional limitations of DOC PS 56.
 - 3. Inspect and identify by individual piece.
 - 4. Certify as meeting the requirements of the nominal size of the individual lamination by an approved lumber grading agency.
 - 5. Grade resawn lumber on the basis of the resawn size.
 - 6. Complete grading prior to start of gluing operation.
- C. Adhesive: ASTM D2559; for wet-use condition of service. Use adhesives that contain no urea-formaldehyde resins.
- D. Steel Connections and Brackets: ASTM A36; weldable quality, hot-dip galvanized to ASTM A123 to 1.25 ounces per square foot.
- E. Steel Connections and Brackets: ASTM A167 Type 304 stainless steel.
- F. Hardware: ASTM A325, structural quality steel; hot-dipped galvanized to 1.25 ounces per square foot.
- G. Anchor Bolts: ASTM A307.
- H. Bolts, Nuts, and Washers: ASTM A307.

- I. Sealer: Clear penetrating type suitable to retard transmission of moisture.
- J. Bearing Plate Anchors: Size and type indicated; where not indicated, provide size and type best suited for intended use.

2.2 FABRICATION

- A. Conform to requirements of CCR Title 24, Part 2, and ANSI/AITC A190.1.
- B. Fabricate glued-laminated structural members in accordance with AITC architectural grade where exposed to view, industrial grade or better elsewhere.
- C. Fabricate for dry condition of use, timber service temperature not to exceed 150 degrees F. Glue shall be same as for wet condition of use.
- D. End Joints
 - 1. End joints shall be pre-glued, plain scarf joints.
 - 2. Portions of scarf in adjacent laminations shall be separated by a minimum of 6 inches.
 - 3. Strength reducing defects such as wane shall not be permitted in or near end joints.
 - 4. The sum of the sizes of knots appearing in a beveled surface of a scarf joint shall not exceed 1/4 the nominal width of the lamination.
 - 5. Plain scarf joints shall have a slope not greater than 1:10.
 - 6. Subject to the acceptance of the Owner's Representative, finger joints may be substituted for the above described scarf joints.
- E. Moisture Content
 - 1. At the time of gluing, the moisture content of lumber shall be not less than 7 percent, nor more than 12 percent.
- F. Individual Laminations: 2-inch or less; uniform in each member.
 - 1. Surface to be glued shall be clean and free from oil and other foreign matter.
 - 2. Laminations shall be machine finished, not sanded, to a smooth surface and uniform thickness with maximum allowable variation of 1/64 inch.
 - 3. Warp, twist, or other characteristics which will prevent close contact of adjacent glued surfaces shall not be permitted.
- G. Adhesives
 - 1. Each lot number of adhesives shall be certified to be manufactured to conform to these specifications.
 - 2. Mixing, spreading, pot life, storage life, working life, and assembly life shall be in accordance with manufacturer's recommendations.
 - 3. Mechanical spreaders shall be used, except at scarfs.
- H. Clamping
 - 1. Method shall be such as to provide uniform pressure over entire area.
 - 2. Clamping may start at any point, but shall continue to an end or ends.
 - 3. Gluing pressure shall assure close surface contact and provide uniformly thin glue line, but shall not exceed 100 psi.
 - 4. Clamping time and curing process shall be in accordance with adhesive manufacturer's instructions.

5. Nailing in lieu of clamping shall not be permitted.
 - I. Preservative Treatment
 1. After laminating, dressing, sanding, and end cutting each member to final size and shape, pressure treat in compliance with AWWA C28.
 2. Solution shall be free of water repellants and other substances which might interfere with application of finishes.
 - J. Sealing
 1. Immediately after end cutting each member to final length, and after wood treatment, apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood coated for not less than 10 minutes.
 2. After fabrication and sanding of each unit, and after end cut sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit.
 - K. Verify dimensions and site conditions prior to fabrication.
 - L. Cut and fit members accurately to length to achieve tight joint fit.
 - M. Fabricate member with camber built in.
 - N. Do not splice or join members in locations other than that indicated, without approval by the Owner's Representative.
 - O. Fabricate steel hardware and connections with joints neatly fitted, welded, and ground smooth.
 - P. Identification
 1. Affix AITC Quality Control Mark on each glued-laminated structural unit; locate on surface which will not be exposed in the completed Work.
 2. Suitably mark each member and wrapping to identify final location in Work.
 3. Identify tops of beams, unless configuration leaves top visible.
- 2.3 FINISHING
- A. Apply manufacturer's standard "dry appearance" penetrating acrylic stain and sealer; type resistant to mildew and fungus. Oven dry.
 - B. Color: Selected from manufacturer's standards.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive the Work. Notify the Owner's Representative, in writing, of any conditions requiring corrective action.
- B. Verify that supports are ready to receive members.
- C. Verify sufficient end bearing area.

- D. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Coordinate placement of bearing and support items.

3.3 ERECTION

- A. Erect in accordance with AITC 105 and CCR Title 24.
- B. Install connectors and fittings.
- C. Set members level and plumb, in correct positions.
- D. Provide temporary bracing and anchorage to hold members in place until permanently secured.
- E. Fit members together accurately without trimming, cutting, or other unauthorized modification. Fit squarely on supports; do not use shims.
- F. Do not cut or drill members except as indicated on approved shop drawings.

3.4 TOLERANCES

- A. Framing Members: 1/2 inch maximum from true position.

3.5 REPAIR AND ADJUSTMENT

- A. Repair of damaged members shall be by original fabricator only, and shall be subject to the approval of the Owner's Representative.
- B. Where members are field cut or trimmed, apply same sealer as used to seal shop cuts.

3.6 PROTECTION

- A. Remove protective wrappings only after adjacent Work has been completed and there is no threat of damage to glue laminated units.
- B. Protect members from damage from subsequent construction operations.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Finish carpentry items, other than shop prefabricated casework.
2. Fire-retardant wood treatment for plywood telephone and electrical backboards.
3. Hardware and attachment accessories.
4. Telephone and electrical panel backboards.
5. Installation of construction components typically installed by Finish Carpenters.
 - a. Chair Rail System.

B. Related Sections:

1. Section 06 10 00 - Rough Carpentry for:
 - a. Interior and exterior Western Red Cedar 2x T&G ceiling boards and trims.
2. Section 06 16 00 - Sheathing.
3. Section 09 90 00 - Painting and Coating.
4. Section 08 70 00 - Hardware.
5. Division 26 - Electrical: for backboards.

1.2 REFERENCES

- A. ANSI A208.1 - Particleboard.
- B. ASTM D3498 - Standard Specification for Adhesives for Field Gluing Plywood to Lumber Framing for Floor Systems.
- C. DOC – U.S. Department of Commerce, DOC PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.
- D. FSC - Forest Stewardship Council, FSC STD-01 - 001 - Principles and Criteria for Forest Stewardship.
- E. WI - Woodwork Institute - Architectural Woodwork Standards.
- F. 40 CFR, Part 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings.
- G. AWWA - American Wood Protection Association, U1 – Use Category System: User Specification for Treated Wood.
- H. CCR - California Code of Regulations: Title 24, 2016 - California Building Code (CBC).

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data:
 - 1. Product data for products and materials indicated.
 - 2. Manufacturer's technical bulletins and installation/application instructions.
 - 3. Material Safety Data Sheets (MSDS).
 - 4. For adhesives and glues used at Project site, include printed statement of VOC content.
 - 5. For composite wood products, documentation indicating that product contains no urea formaldehyde.
 - 6. For paints and coatings, include printed statement of VOC content.
 - 7. Provide product data showing Forest Stewardship Certification (FSC) certification for wood products.
 - 8. Provide product data indicating that all composite wood materials (Plywood, MDF, particle board, etc.) are free of added Urea formaldehyde.
- C. Certificates:
 - 1. Identification: In lieu of stamping for grade and fire retardant rating on exposed to view lumber and plywood, submit manufacturer's certificate that products meet or exceed the specified requirements.

1.4 REGULATORY REQUIREMENTS

- A. Materials and fabrication of finish carpentry work shall be in accordance with the Custom Grade requirements of WI Architectural Woodwork Standards unless otherwise indicated.
- B. Fire Retardant Treatment: CBC Section 2303.2.
 - 1. Conform to applicable code requirements for fire retardant treatment.

1.5 COORDINATION

- A. Coordinate the design, construction, and installation of finished carpentry with the requirements of the Work of other Sections.
- B. For wood sheathing products reference Section 06 16 00 - Sheathing.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products suitably wrapped or packaged to protect against damage. Do not remove protective coverings until time of installation.
- B. Store materials in interior ventilated locations, under constant minimum temperature of 60 degrees Fahrenheit and maximum relative humidity of 55 percent.

PART 2 PRODUCTS

2.1 MATERIALS - GENERAL

- A. Forest Certification: Provide sheathing produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001.

2.2 MATERIALS - INTERIOR FINISHED CARPENTRY

- A. Particleboard; ANSI A208.1: Grade M-2, made with binder containing no urea-formaldehyde resin.
- B. Plywood: Douglas Fir; DOC PS-1: A/C - INT with exterior glue; grade stamped by APA on other approved testing agency; 4 x 10 foot panels where used as interior wall finish, 4 x 8 foot panels elsewhere.

2.3 ACCESSORIES

- A. Glue
 - 1. Aliphatic resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
 - 2. VOC Content: Not more than 30 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Multipurpose Construction Adhesive
 - 1. Formulation complying with ASTM D3498 that is recommended for indicated use by adhesive manufacturer.
 - 2. VOC Content: Not more than 70 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 FIRE-RETARDANT TREATMENT

- A. Fire-retardant treated lumber:
 - 1. Each piece of fire-retardant lumber shall be labeled to show compliance with the UL requirement specified and shall be grade stamped with the applicable AWPA quality mark indicating the preservative and retention.
- B. Manufacturers:
 - 1. Arch Wood Protection Inc.; Dricon FRT Wood.
 - 2. J. H. Baxter & Co.; D-Blaze.
 - 3. Hoover Treated Wood Products Inc.; Pyro-Guard.
- C. Fire-retardant Treatment
 - 1. Items requiring Fire-retardant treatment
 - a. Wood where indicated on the Drawings to be fire-retardant treated.
 - b. Wood used in fire-rated assemblies that require fire-retardant treated wood.
 - c. Wood requiring reduced flame/fuel/smoke ratings.
 - d. Communications backboards.
 - e. Electrical mounting boards.

- f. Additional locations required by codes, the Owner's Representative, or accepted standard construction practice.
- D. Fire Retardant: "FR-S" Rating Under UL Classification; chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25.
- E. Provide fire retardant treatment for interior wood materials.
1. Size before treatment to minimize cutting after treatment.
 2. Provide UL approved identification on fire retardant treated material.
 3. Brush coat surfaces cut after treatment using same formulation as impregnated at plant, in accordance with manufacturer's instructions.
- F. Moisture Content: After treatment, re-dry wood to moisture content specified for wood prior to treatment.
- G. Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Fire Retardant Coatings: VOC content for coating category for which coating is formulated.
 2. Wood Preservatives: 350 g/L.
 3. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 4. Non-Flat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 5. Floor Coatings: VOC not more than 100 g/L.
 6. Shellacs, Clear: VOC not more than 730 g/L.
 7. Shellacs, Pigmented: VOC not more than 550 g/L.
 8. Primers, Sealers, and Under-coaters: VOC content of not more than 200 g/L.
 9. Clear Wood Finishes, Varnishes: VOC content of not more than 350 g/L.
 10. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.5.
 11. Stains: VOC not more than 250 g/L.
- H. Chemical Components of Field Applied Interior Paints and Coatings: Provide products that comply with the following chemical restrictions:
1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 2. Restricted Components: Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.
 - j. 1,2-dichlorobenzene.
 - k. Diethyl phthalate.
 - l. Dimethyl phthalate.
 - m. Ethylbenzene.

- n. Formaldehyde.
- o. Hexavalent chromium.
- p. Isophorone.
- q. Lead.
- r. Mercury.
- s. Methyl ethyl ketone.
- t. Methyl isobutyl ketone.
- u. Methylene chloride.
- v. Naphthalene.
- w. Toluene (methylbenzene).
- x. 1,1,1-trichloroethane.
- y. Vinyl chloride.

2.5 FABRICATION

- A. Fabricate products in accordance with Custom Grade requirements of WI Architectural Woodwork Standards.
- B. Insofar as possible, cuts required to accommodate the Work of other Sections shall be made in the shop.
- C. Shop fabricated products in whole units or in partial units as most practical for handling and transportation. Assemble partial units in place so that each complete unit becomes a unified whole visually and structurally.
- D. Fabricate fillers and scribe strips of same materials and finishes as units with which they are associated.
- E. Make cuts for hardware neat and true.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive the Work. Notify the Owner's Representative, in writing, of any conditions requiring corrective action.
- B. Verify mechanical, electrical, and building items affecting the Work of this Section are placed and ready to receive this Work.
- C. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Remove products from their protective wrappings as near the area of installation as possible.
- B. Before installation, back prime wood.
- C. Before installation, prime paint surfaces of items and assemblies to be in contact with cementitious materials.
- D. When specifically approved by Owner's Representative, items and assemblies may be painted under provisions of Section 09 90 00 prior to installation.

3.3 INSTALLATION

- A. Install finish carpentry in accordance with referenced standards and the manufacturer's printed instructions.
- B. Set Work straight, plumb, level, and true to line indicated, with tight joints between sections or units; scribe to wall and other surfaces as required.
- C. Where plywood is secured directly to framing members, apply with ends over firm bearing and staggered.
- D. Set trim in place in full lengths, without piecing. Where use of single lengths is not possible, bevel butt joints. Unless otherwise indicated, miter joints at exterior angles; cope interior angles of molded parts.
- E. Hardware Installation: Install hardware per manufactures instructions after final finishing has been completed. Fit securely. Recess screw heads for covering.
- F. Provide anchoring and fastening devices required for installation, including wood and sheet metal screws, bolts, toggle bolts, lag screws and expansion shields, and similar items; fastenings shall be electroplated.
- G. Set nails and screws and completely fill or putty nail and screw holes; leave smooth and flush with adjacent surfaces.
- H. Blind nail tongue and groove ceiling boards.
- I. Install specialty products in accordance with the manufacturers written instructions, the approved shop drawings, and as indicated on the Drawings.

3.4 BACKBOARDS

- A. Install telephone and electrical panel backboards.
- B. Size backboards as indicated; where not indicated, provide a minimum 48-inch by 96-inch by 3/4-inch thick backboard.

3.5 DEFECTIVE WORK

- A. Finish carpentry not conforming to required lines, details, dimensions, tolerances, finishes, or other specified requirements shall be considered defective. Materials damaged beyond repair or stained beyond cleaning shall be considered defective. Notify the Owner's Representative upon discovery of these conditions.
- B. Required repair or replacement of defective finish carpentry will be determined by the Owner's Representative.
- C. Defective finished carpentry shall be repaired or replaced as recommended by the Owner's Representative at no additional expense to the Owner.

3.6 PROTECTION

- A. Protect plastic laminate covered casework from damage from subsequent construction operations until Acceptance by the Owner's Representative.

END OF SECTION

SECTION 06 41 16

PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Shop fabricated custom plastic-laminate-clad cabinet units.
 - 2. Cabinet hardware.
 - 3. Preparation for installing utilities.
 - 4. Plastic laminate countertops.
 - 5. Plastic laminate corner guards.
- B. Related Sections:
 - 1. Section 06 20 00 - Finish Carpentry.
 - 2. Section 09 21 16 - Gypsum Board Assemblies.
 - 3. Section 09 90 00 - Painting and Coatings.

1.2 REFERENCES

- A. AHA 135.4- Basic Hardboard.
- B. ANSI 208.1- Particleboard.
- C. ANSI 208.2- Medium Density Fiberboard (MDF) for Interior Applications.
- D. ASTM D 1037 - Method for Evaluating Properties of Wood Base Fiber and Particle Panel Materials.
- E. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- F. FS-MMM-A-130 - Adhesive, Contact.
- G. NEMA LD3- High Pressure Decorative Laminates.
- H. WI - Woodwork Institute - Architectural Woodwork Standards.
- I. Forest Stewardship Council (FSC).
- J. CCR - California Code of Regulations: Title 24, 2016 - California Building Code (CBC).

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 - Submittal Procedures.

- B. Shop Drawings:
 - 1. Indicate the cabinet Work in full detail.
 - 2. Show materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware, hardware location, and schedule of finishes.
 - 3. Indicate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that casework can be supported and installed as indicated on the drawings and as specified herein.
 - 4. Bear WI Certified Compliance Grade Stamp indicating grade specified.
 - C. Product Data:
 - 1. Product data for products and materials indicated.
 - 2. Manufacturer's technical bulletins and installation/application instructions.
 - 3. Material Safety Data Sheets (MSDS).
 - 4. For installation adhesives, including printed statement of VOC content.
 - 5. Provide product data indicating that all composite wood materials (Plywood, MDF, particle board, etc.) are free of added Urea formaldehyde.
 - D. Samples: Complete range of manufacturer's standard, solid, plastic laminate colors and textures for selection of color/texture combinations.
 - E. Certification: Prior to delivery to the jobsite, furnish a WI Certified Compliance Certificate certifying that products to be furnished for this project will meet the requirements of the grade specified.
- 1.4 QUALITY ASSURANCE
- A. Verify field measurements prior to preparing shop drawings.
 - B. All products and construction shall be in accordance with WI Architectural Woodwork Standards.
 - C. Product requirements
 - 1. Plastic Laminate Covered Casework: Custom Grade; frameless construction; flush overlay doors and drawers unless otherwise indicated.
 - 2. Laminated Plastic Countertops, Splashes, and Wall Corner Guards: Custom Grade.
 - D. In addition to other provisions of this section, laminate materials used on casework shall meet the following requirements.
 - 1. When tested in accordance with ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials, the Smoke Developed Index Rating shall not exceed 450, and the Flame Spread Index Rating shall not exceed 25.
- 1.5 COORDINATION
- A. Coordinate the design, construction, and installation of the Work with the requirements of the Work of other Sections.

- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that casework can be supported and installed as indicated on the drawings and as specified herein.
 - C. Coordinate the Work with plumbing and electrical rough-in.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver and store products suitably wrapped or packaged to protect against damage. Do not remove protective coverings until time of installation.
 - B. Store products indoors, in a dry location, out of the way of construction activities.
 - C. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by casework manufacturer. During and after installation, maintain same temperature and humidity conditions in building spaces as will occur after occupancy.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Wood Products: Comply with the following:
 - 1. Recycled Content of Medium-Density Fiberboard and Particleboard: Provide products with an average recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 30 percent.
 - 2. Medium Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
 - 3. Hardboard: AHA 135.4.
 - 4. Particleboard: ANSI A208.1, Grade M-2.
- B. High Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
 - 1. General purpose type (0.050 inch thick) with Backer type (0.020 inch thick) backing sheet for general use.
 - 2. Cabinet Liner type (0.020 inch thick) for interiors of casework.
 - 3. Owner's Representative will select a maximum of two color/texture combinations from manufacturer's standard range.
- C. Adhesives:
 - 1. General: Do not use adhesives that contain urea formaldehyde.
 - 2. VOC Content for Installation Adhesives and Glues: Comply with the following limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Wood Glues: 30 g/L.
 - b. Contact Adhesive: 250 g/L.

2.2 ACCESSORIES

- A. Finish Hardware:
 - 1. Provide finish hardware in conformance with WI Architectural Woodwork Standards, Section 10 and Appendix A, unless otherwise indicated.

2. Heavy duty wraparound offset for overlay doors with non-removable pin; dull chrome finish.
 3. Door and drawer pulls:
 - a. Manufacturers:
 - 1) Sugatsune USA; No. H-42-C-2 Stainless Steel Pulls.
 - 2) Stanley Hardware Division; No. 4484, US28.
 - 3) Or equal.
 4. Drawer slides: Metal type, as indicated in the WI Architectural Woodwork Standards, Section 10 and Appendix A; full extension with no deflection. 1/2 inch slide space, 100 pound load capacity.
 5. Shelf standards: Let in, extending from top to bottom of cabinets.
 - a. Manufacturers:
 - 1) Knappe and Vogt; No. 255 x 256.
 - 2) Or equal.
 6. Catches:
 - a. At Doors with Locks.
 - 1) Manufacturers:
 - a) Ives; No. 2 Elbow Catches.
 - b) Or equal.
 - b. Other: Magnetic type.
 - 1) Manufacturers:
 - a) EPCO; No. 592.
 - b) Stanley Hardware Division; No. 41.
 - c) Or equal.
 7. Gate Hinges: Double acting, spring loaded.
 8. Gate Latch: Snap latch with retractable thumb turn.
 9. Cabinet Door and Drawer Locks: Where indicated on the Drawings.
 - a. Manufacturers:
 - 1) Corbin Cabinet Locks (CCL Security Products): Series 0738; 7/8-inch bore for drawers with Strike No. 2540.
 - 2) Corbin Cabinet Locks (CCL Security Products): Series 0737; 7/8-inch bore for doors with Strike No. 2540.
 - 3) The above items are an Owner;s Standard – no substitutions allowed.
 - b. Keying:
 - 1) Pin tumbler locks with keyway as selected by Owner’s Representative, keyed alike by building.
 - 2) Provide for each key combination, two keys for each lock or a minimum of 10 keys, whichever is greater. Provide 5 blanks.
 - 3) Deliver keys to the Owner’s Representative in clearly marked, sealed envelopes.
- B. Screws:
1. Straight shank double thread particle board screws or other type best suited for intended application in accordance with referenced standards.
- C. PVC Grommet: Where indicated on the Drawings.
1. Cove Stick: 3/4 inch radius; same thickness as core material; no voids at joints, no voids between plastic laminate and cove stick.
 2. Other materials shall be in conformance with the applicable referenced standards.

2.3 FABRICATION

- A. Fabricate products in accordance with Custom Grade requirements of WI Architectural Woodwork Standards, Section 10 and Appendix A. In addition, semi-exposed portions shall be covered with polyester overlay.
- B. Insofar as possible, make in the shop, cuts required to accommodate the Work of other Sections. Verify locations of cut-outs from onsite dimensions. Prime paint or seal contact surfaces of cut edges.
- C. Shop fabricates products in whole units or in partial units as most practical for handling and transportation.
 - 1. Assemble partial units in place in such manner that each complete unit becomes a unified whole visually and structurally.
 - 2. Fabricate fillers and scribe strips of same materials and finishes as units with which they are associated.
 - 3. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
 - 4. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Make corners and joints hairline. Locate counter butt joints minimum 2 feet from sink cut-outs.
 - 5. Cap exposed plastic laminate edges with material of same finish and pattern.
- D. Counter Tops and Splashes:
 - 1. Plastic laminate covered, meeting Custom Grade requirements of WI Architectural Woodwork Standards, Section 11 and Appendix A; exposed ends self-edged.
 - 2. Fabricate countertop surfaces pressure glued to plywood or particle core backing without visible joints.
 - 3. Counter top with sinks:
 - a. Fully formed; self-edge at cutouts for under-counter mounted sinks. Make cutouts for under-counter sinks only after verifying locations and opening sizes.
 - b. Make cutouts for top-mounted sinks only after verifying locations and opening sizes.
 - c. When sink fittings are deck mounted, make cutouts for fittings only after verifying locations and opening sizes.
 - 4. Cove backsplash, square butt end splash, rolled edge
- E. Drawer Boxes:
 - 1. Provide with sub-fronts and applied finish fronts securely fastened, with square corners.
 - 2. Provide plastic laminate covered casework with shelf edges drawer fronts.
 - 3. Provide drawers with metal slides as specified.
 - 4. Provide each drawer with key lock where indicated.
- F. Doors:
 - 1. Flush overlay type, hinged to swing flat against the face of adjoining cabinet or the side of cabinet, with square corners.
 - 2. Provide plastic laminate covered casework with self-edged doors.
 - 3. Do not notch door or cabinet ends, or divisions to receive hinge.
 - 4. Provide each door with key lock where indicated.

- G. Shelves:
 - 1. 3/4 inch thick for spans up to 35 inches and 1-inch thick for spans over 35 inches up to 48 inches, and adjustable to 1 inch on center.
 - 2. Recess metal shelf standards into the end panels.
 - H. Plastic Laminate Covered Casework: Cabinet liner finish on cabinet interiors, including faces and edges of shelving therein, and interior door faces.
 - I. Wall Mounted Shelving: Fabricate shelving with plastic laminate finish in accordance with Custom Grade requirements of WI Architectural Woodwork Standards, Section 10 and WI Architectural Woodwork Standards Appendix A.
 - J. Provide matching plastic laminate panels above wall cabinets; align face of panels with face of wall cabinet door, or edge of cabinets without doors.
 - K. Make cuts for hardware neat and true. Install hardware and fit securely.
 - L. Plastic Laminate Covered Corner Guards: Sizes and profiles as indicated in the Drawings.
- 2.4 FACTORY FINISHING
- A. Prime paint and seal surfaces in contact with metallic or cementitious materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive the Work. Notify the Owner's Representative, in writing, of any conditions requiring corrective action.
- B. Verify adequacy of backing and support framing.
- C. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Beginning installation indicates acceptance of existing conditions.

3.2 PREPARATION

- A. Remove products from their protective wrappings as near the areas of installation as possible.

3.3 INSTALLATION

- A. Install products rigid, plumb, level, and true; scribe to fit.
- B. Secure units in accordance with 2016 California Building Code requirements and in no case less than 16 inches on center for wall hung units and 32 inches on center for base units.
- C. Attach components in concealed locations.
- D. Use threaded steel concealed joint fasteners to align and secure adjoining counter tops casework and telephone enclosure.

- E. Carefully scribe casework which is against other building materials, leaving gaps of 1/32 inch maximum. Do not use additional overlay trim for this purpose.
- F. Install plastic laminate wall splash guards using manufacturer-recommended adhesive. Install in longest lengths possible to minimize joints.

3.4 CLEANING AND ADJUSTING

- A. Following completion of installation, remove dirt and other adhering foreign matter from installed products.
- B. Clean interior and exterior surfaces of casework; clean and polish hardware, all in conformance with manufacturer's recommendations and referenced standards.
- C. Adjust drawers, doors, movable shelves, and other operating parts to operate easily and smoothly without binding or excessive play.

3.5 DEFECTIVE WORK

- A. Casework not conforming to required lines, details, dimensions, tolerances, finishes, or other specified requirements shall be considered defective. Materials damaged beyond repair or stained beyond cleaning shall be considered defective. Notify the Owner's Representative upon discovery of these conditions.
- B. Required repair or replacement of defective casework will be determined by the Owner's Representative.
- C. Defective casework shall be repaired or replaced as recommended by the Owner's Representative at no additional expense to the Owner.

3.6 PROTECTION

- A. Protect plastic laminate covered casework from damage from subsequent construction operations until Acceptance.

END OF SECTION

SECTION 07 21 00

BLANKET INSULATION – THERMAL AND ACOUSTICAL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermal blanket (batt) insulation.
2. Acoustical blanket (batt) insulation.
3. Related accessories.
4. Continuous Air Barrier / Vapor Barrier: for installation over the thermal insulation on the interior warm side of the building conditioned envelope.

B. Related Sections:

1. Section 06 10 00 - Rough Carpentry.
2. Section 06 11 13 - Engineered Wood Products.
3. Section 07 22 00 - Roof and Deck Insulation.
4. Section 07 84 00 - Firestopping.
5. Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

- A. ASTM C272 - Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
- B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
- C. ASTM C665 Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- D. ASTM D226/D226M - Standard Specification for Asphalt Saturated Organic Felt Used in Roofing and Waterproofing.
- E. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.
- F. ASTM D5116 - Standard Guide for Small Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data:
 - 1. Product Data: For each type of product indicated.
 - 2. For adhesives used at Project site, include printed statement of VOC content.
 - 3. For glass fiber products, include printed statement of VOC content and ASTM D 5116 emission test results.

1.4 DELIVERY, HANDLING, AND STORAGE

- A. Deliver and store insulation in the manufacturer's original packaging, clearly identified with manufacturer's name, and name, type, and thickness of insulation.
- B. Store insulation indoors, protected from moisture and other sources of damage.
- C. Follow additional requirements of the manufacturer.
- D. Delivery, handling and storage shall be in accordance with the provisions of Division 01.

1.5 PROJECT CONDITIONS

- A. Do not install insulation of types specified herein in lieu of materials specified in Section 07 84 00 - Firestopping.
- B. Do not install insulation until building is sufficiently enclosed or protected against absorption of moisture by the insulation, and do not install insulation unless supporting framing and surrounding construction is in a thoroughly dry condition.

PART 2 PRODUCTS

2.1 THERMAL BLANKET INSULATION

- A. Materials: ASTM C665, Type III, Class C; glass fiber or mineral fiber units; Kraft-faced unless otherwise indicated.
 - 1. Flame Spread Rating: Not Rated.
 - 2. Smoke Developed Rating: Not Rated.
 - 3. General Note: Kraft-faced insulation will burn and must not be left exposed. The use of this product in the Project is intended in all instances to be enclosed within the framing cavity and covered on the interior side of the construction with gypsum board or other approved interior finish. Notify Owner's Representative if exposed conditions exist.
- B. Manufacturers:
 - 1. Owens-Corning Fiberglas Corp.; EcoTouch; PSK.
 - 2. Manville; Formaldehyde-Free; PSK.
 - 3. Certainteed; Formaldehyde-Free; PSK

- C. Locations:
 - 1. Exterior Stud Walls: 5 1/2 inch thickness; R-19 unless otherwise indicated.
 - 2. Framed Roof: 9-1/2 inch thickness; R-30 unless otherwise indicated.
 - a. General Note: Additional building envelope roof insulation may be provided by Section 07 22 00 - Roof and Deck Insulation.
- D. Width:
 - 1. Exterior Stud Walls: As required to fit framing.
 - 2. Framed Roof: As required to fit framing.
- E. Sustainability Requirements: Provide glass fiber blanket insulation as follows:
 - 1. Certified to include a minimum of 58% total recycled content.
 - 2. Free of Formaldehyde: Insulation manufactured with no formaldehyde.

2.2 ACOUSTICAL BLANKET INSULATION

- A. Material: ASTM C665, Type I; unfaced, glass-fiber or mineral-fiber units.
- B. Thickness: Nominal 2-3/4 inches, unless otherwise indicated.
- C. Width: As required to fit stud wall construction indicated.
- D. Locations: Concealed within the interior perimeter walls around the following room areas as required to provide a complete separation from adjacent room areas:
 - 1. All single accommodation Toilet Rooms.
 - 2. All Offices, Library, and Conference Room.
 - 3. Nurse, Resource Center, and all Classrooms.
 - 4. Other locations that may be indicated on the Drawings.
- E. Manufacturers:
 - 1. Owens-Corning; Sound Attenuation Batt Insulation Blankets.
 - 2. Manville; Sound Control Batts.
 - 3. Certainteed; Sound Control Batts.
- F. Sustainable Design Requirements: Provide glass-fiber blanket insulation as follows:
 - 1. Free of Formaldehyde: Insulation manufactured with no formaldehyde.

2.3 INSTALLATION MATERIALS

- A. Mechanical Fasteners:
 - 1. Type recommended by insulation manufacturer and capable of securely and rigidly fastening insulation in place, and approved by the Owner's Representative. Submit five samples of fastener and the manufacturer's installation instructions to the Owner's Representative.
 - 2. Separate attachment of the insulation batt facing to the framing members is not required if the insulation is securely held in place by friction fit until a continuous air barrier / vapor barrier is installed over the top of the insulation facing tabs and secured to the framing members with mechanical fasteners.

2.4 CONTINUOUS AIR BARRIER / VAPOR BARRIER

- A. Manufacturers:
 - 1. CertainTeed Corporation: MemBrain, Continuous Air Barrier & Smart Vapor Retarder.
 - 2. Or equal.
- B. Continuous Air Barrier / Vapor Barrier:
 - 1. Description: Sheet material; 2-mil thick film of polyamide (nylon) film. .
 - 2. Conforms to ASTM C 665 Section 7.4.
 - 3. Water Vapor Permeance
 - a. ≤ 1.0 perm (ASTM E 96, Desiccant method).
 - b. > 10 perms (ASTM E 96, Water method).
 - 4. Fungi Resistance: No growth (ASTM C 1338).
 - 5. Fire Resistance:
 - a. ASTM E 84 Surface burning characteristics: Max. Flame Spread Index: 20;
Max. Smoke Developed Index: 55.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces to receive thermal and acoustical insulation are satisfactory for their installation.
- B. Verify that substrate, adjacent materials, and insulation are dry.
- C. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. General Note: Kraft-faced insulation will burn and must not be left exposed. The facing must be installed in substantial contact with the finish material. Protect facing from open flame or heat source.
- B. Blanket Insulation:
 - 1. Install insulation where indicated, as specified, and in accordance with the manufacturer's printed instructions; fasten in place with manufacturer recommended fastening method.
 - 2. Install with factory applied membrane facing toward building interior unless otherwise indicated.
 - 3. Install snugly between framing members, with ends snugly fitted between units and against adjacent construction.
 - 4. Carefully cut and fit insulation around pipes, conduit, and other obstructions and penetrations.
 - 5. Where door and window frames occur in framing, cut additional strips of insulation and hand pack as necessary to thoroughly fill voids in and around such frames.

6. Do not fill indicated air spaces with insulation.
- C. Continuous Air Barrier / Vapor Barrier:
1. Install over the thermal insulation on the interior warm side of the building conditioned envelope in accordance with manufacturer's written instructions.
- D. Acoustical Insulation:
1. Install in accordance with manufacturer's instructions for conditions encountered.
 2. Fit insulation to exterior side of mechanical and electrical services within the plane of insulation.
 3. Fill entire width of stud cavities.
 4. Install in one or more layers as indicated, or to achieve the indicated STC rating, whichever is greater.
 5. Where insulation does not fill the cavity depth, provide supplementary support to hold the insulation in place.
 6. Provide temporary support to hold insulation in place until permanent supporting finish materials are applied.
 7. Trim insulation neatly to fit spaces tightly, without gaps or voids.
 8. Install insulation inside door and window frames, boxed studs, shim spaces, and other miscellaneous spaces which might otherwise provide a path for uninterrupted sound transmission.

END OF SECTION

SECTION 07 22 00

ROOF AND DECK INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. At Roofs: Gypsum roof board over insulation board system over wood deck.
2. At Parapet Sidewalls: Gypsum roof board over wood sheathing

B. Related Sections:

1. Section 06 16 00 - Sheathing.
2. Section 07 21 00 - Blanket Insulation – Thermal and Acoustical.
3. Section 07 54 00 - Thermoplastic Membrane Roofing.
4. Section 07 60 00 - Flashing and Sheet Metal.

1.2 REFERENCES

- A. ASTM C1280 - Application of Gypsum Sheathing Board.
- B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
- C. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- D. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Coverings.
- E. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- F. FS HH-I-1972/1 - Insulation Board, Thermal, Polyurethane or Polyisocyanurate, Faced with Aluminum Foil on Both Sides of the Foam.
- G. FS HH-I-1972/2 - Insulation Board, Thermal, Polyurethane or Polyisocyanurate, Faced with Asphalt/Organic Felt, Asphalt/Asbestos Felt, or Asphalt/Glass Fiber Felt on Both Sides of the Foam.
- H. FS HH-I-1972/3 - Insulation Board, Thermal, Polyurethane or Polyisocyanurate, Faced with Perlite Insulation Board on One Side and Asphalt/Organic Felt or Asphalt/Glass Fiber Felt on the Other.
- I. UL - Underwriters Laboratories: Fire Hazard Classifications; Fire Resistance Directory; Assemblies.
- J. Underwriters Laboratories: UL 790 - Standard Test Methods for Fire Tests of Roof Coverings.

- K. Underwriters Laboratories: UL 263 - Fire Tests of Building Construction and Materials.
- L. CCR - California Code of Regulations, Title 24, 2016 California Building Code (CBC).

1.3 SYSTEM DESCRIPTION

- A. Roof Insulation System: Rigid board system consisting of gypsum roof board and insulation board system; approved by roofing manufacturer, meeting requirements of the 2016 California Building Code, specified requirements, and Reference Standards.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 - Submittal Procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, limitations.
- C. Manufacturer's Installation Instructions:
 - 1. Indicate special environmental conditions required for installation.
 - 2. Indicate adhesive recommendations.
 - 3. Indicate fastener recommendations and attachment locations and spacings.
 - 4. Indicate installation techniques.
- D. Manufacturer's Certificate:
 - 1. Certify that products meet or exceed specified requirements.
 - 2. Certify that insulation is approved by manufacturer for use with specified roofing membrane materials.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with 10 years documented experience.
- B. Applicator: Company specializing in performing the work of this section with 5 years documented experience and approved by manufacturer.

1.6 REGULATORY REQUIREMENTS

- A. Conform to the 2016 California Building Code for roof assembly fire hazard requirements.
- B. Underwriters Laboratories, Inc. (UL): Conform to requirements of indicated UL Assembly.

1.7 PRE-INSTALLATION CONFERENCE

- A. Attend conference specified in Section 07 54 00 - Thermoplastic Membrane Roofing.
- B. Review installation procedures and coordination required with related Work.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Division 01.

- B. Deliver products in manufacturer's original containers, dry, undamaged, seals and labels intact.
- C. Store products in weather protected environment, clear of ground and moisture.

1.9 PROJECT CONDITIONS

- A. Do not install adhesives when temperature or weather conditions are detrimental to successful installation, or are not in compliance with manufacturers' recommendations.

PART 2 PRODUCTS

2.1 INSULATION MATERIALS

- A. Gypsum Roof Board - 1/2 inch thick; glass-mat faced.
 - 1. At Roofs: Install gypsum roof board over insulation materials.
 - 2. At Parapet Sidewalls: Install gypsum roof board over wood sheathing.
 - 3. Roof Board Joint Tape: Heat resistant type.
 - a. Apply where recommended by roof membrane manufacturer.
- B. Insulation Board: Closed-cell polyisocyanurate foam core bonded to fiber-reinforced facers on both sides; conforming to ASTM C 1289, Type II, Class 1 with square edges.
 - 1. Blowing Agent: Zero ODP, 3rd generation.
 - 2. Fire Ratings:
 - a. UL 1256, No. 120 and 123.
 - b. UL 790 (ASTM E 108), Class A at 1 inch thickness.
 - c. UL 263 (ASTM E 119) Hourly Rated P Series Roof Assemblies.
 - 3. Compressive Strength: 25 pounds per square inch (172 kPa) Grade 3.
 - 4. R Value: Provide insulation board with LTTR (Long Term Thermal Resistance) in accordance with ASTM C 1289, Annex A1. Minimum thickness of panels shall be as follows:
 - a. In combination with the thickness of the tapered insulation where occurs, as required to achieve a total minimum value of R-8 (nominal 1.5 inch thickness at a nominal R-Value of R-5.6 per inch).
 - b. General Note: Required building envelope R-30 roof insulation is provided by Section 07 21 00 - Blanket Insulation – Thermal and Acoustical.
 - 5. Layers: As required to achieve roof slopes indicated on the Drawings.
 - 6. Board Size: Manufacturer's standard board size.
- C. Tapered Insulation Board: Closed-cell polyisocyanurate foam core bonded to fiber-reinforced facers on both sides; conforming to ASTM C 1289, Type II, Class 1 with square edges.
 - 1. Blowing Agent: Zero ODP, 3rd generation.
 - 2. Fire Ratings:
 - a. UL 1256, No. 120 and 123.
 - b. UL 790 (ASTM E 108), Class A at 1 inch thickness.
 - c. UL 263 (ASTM E 119) Hourly Rated P Series Roof Assemblies.
 - 3. Compressive Strength: 25 pounds per square inch (172 kPa) Grade 3.

4. R Value: Provide insulation board with LTTR (Long Term Thermal Resistance) in accordance with ASTM C 1289. Minimum thickness of tapered insulation boards shall be 1/2 inch (12.5 mm) unless otherwise indicated on the Drawings.
 - a. In combination with the thickness of the underlying insulation board where occurs, as required to achieve a total minimum value of R-8 (nominal 1.5 inch thickness at a nominal R-Value of R-5.6 per inch).
 - b. General Note: Required building envelope R-30 roof insulation is provided by Section 07 21 00 - Blanket Insulation – Thermal and Acoustical.
5. Slope of tapered insulation board shall be 1/8 inch (3.18 mm) and 1/4 inch (6.35 mm) per foot as indicated on the Drawings.
6. Board Size: Manufacturer's standard board size.

2.2 MANUFACTURERS

- A. Gypsum Roof Board:
 1. (Basis of Design) Georgia Pacific; Dens-Deck Roof Board.
 2. USG Corporation; SECURROCK Glass-Mat Roof Board.
 3. Or equal.
- B. Insulation Board and Tapered Insulation Board:
 1. (Basis of Design) GAF: EnergyGuard.
 2. Johns Manville: Enrgy-3.
 3. Sika Sarnafil: Sarnatherm.
 4. Or equal.

2.3 FASTENERS, JOINT TAPE, AND/OR ADHESIVES

- A. Appropriate for each component, purpose intended, and approved by UL, and in accordance with manufacturer's written installation instructions.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Installation of materials specified in this Section is specified in Section 07 54 00 - Thermoplastic Membrane Roofing.

END OF SECTION

SECTION 07 26 00
VAPOR RETARDERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vapor retarder membrane - slab on grade.
 - 2. Accessories.
- B. Related Sections:
 - 1. Section 03 20 00 - Concrete Reinforcing.
 - 2. Section 03 30 00 - Cast-In-Place Concrete

1.2 REFERENCES

- A. ASTM D1709 - Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
- B. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
- C. ASTM E1745 - Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- D. ASTM F1249 - Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

1.3 SYSTEM DESCRIPTION

- A. Under-slab vapor retarder membrane system.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data: Indicate conformance to specified requirements.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Minimum 15 mil thick polyolefin geo-membrane.
- B. Manufactured with ISO certified virgin resins.

- C. Membrane Properties:
 - 1. Water Vapor Retarder Membrane: ASTM E1745 Meets or exceeds Class B.
 - 2. Water Vapor Transmission Rate: ASTM E96 0.006 gr./ft²/hr. or lower
 - 3. Permeance Rating: ASTM E96 0.01 gr./ft²/hr. or lower.
 - 4. Puncture Resistance: ASTM E1745 minimum 1970 grams.
 - 5. Tensile Strength: ASTM E1745 minimum 45.0 lbf/in.

2.2 MANUFACTURERS

- A. W. R. Meadows; Perminator.
- B. Stego Industries LLC; Stego Wrap (15 mil), Vapor Barrier.
- C. Fortifiber Corp; Moistop Ultra 15.

2.3 ACCESSORIES

- A. Seam Tape:
 - 1. High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4 inches.
- B. Pipe Boots:
 - 1. Construct pipe boots from vapor retarder membrane material and pressure sensitive tape per manufacturer's instructions.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are acceptable and are ready to receive the Work. Notify the District's Representative, in writing, of any conditions requiring corrective action.
- B. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install after substrate construction and penetrating work has been completed, and defective work is corrected.
- B. Place filter fabric over gravel layer in accordance with the Structural Drawings and Specification Appendix A - Soils Report. Install in accordance with the manufacturer's written instructions
- C. Place vapor retarder using widest practical width of film.
 - 1. Use reinforced vapor retarder membrane over base material.
 - 2. Install proprietary products in accordance with manufacturer's instructions.

3. Where laps are required, lap not less than 6 inches, and seal with vapor retarder membrane tape.
 4. Extend to extremities of area.
 5. Turn up 2 inches at perimeter walls, apply adhesive and tape in place. Box-fold at inside corners; do not cut.
 6. Repair damage to film with vapor retarder membrane tape prior to placing covering sand layer. Cut film around pipes and conduit piercing retarder membrane with undersized holes and apply vapor barrier tape to ensure maximum barrier effectiveness.
- D. Protect vapor retarder membrane so that other trades do not puncture, damage or otherwise cause deterioration of vapor retarder membrane.
- E. Coordinate with other Sections for the placement of welded wire fabric, reinforcing steel, pipes, conduits, and other items on top over vapor retarder membrane to prevent punctures.
- F. Trim off excess material after slab is placed.

END OF SECTION

SECTION 07 42 13
METAL WALL PANELS

PART 1 GENERAL

- 1.1 SUMMARY
- A. Section includes
 - 1. Preformed metal system for building walls with related flashings and accessory components.
 - 2. Underlayment: Moisture Barrier.
 - B. Related Sections
 - 1. Section 06 10 00 - Rough Carpentry.
 - 2. Section 06 20 00 - Finish Carpentry.
 - 3. Section 06 16 00 - Sheathing.
 - 4. Section 07 60 00 - Flashing and Sheet Metal
 - 5. Section 07 90 00 - Joint Protection: Field-applied panel sealants.
- 1.2 REFERENCES
- A. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - B. ASTM A924 - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- 1.3 SUBMITTALS
- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - B. Submit manufacturer's product data including design specifications.
 - C. Shop Drawings: Indicate dimensions, layout, joints, construction details, methods of anchorage, and finish.
 - D. Samples:
 - 1. Submit samples for selection of panel and trim color and finish from manufacturer's standard line.
 - 2. Submit samples of finish, 6 by 6 inches in size illustrating selected finish color, sheen and texture.
 - E. Manufacturer's instruction for field touch-up of damaged finish surface.
 - F. Submit warranties for approval.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three (3) years experience.
- B. Installer: Company specializing in performing the Work of this Section approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- B. Stack pre-finished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials which may cause discoloration or staining.
- D. Submit warranty for approval prior to purchase of materials.

1.6 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

1.7 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Two (2) years from date of Project substantial completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: Ten (10) years from date of Project substantial completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. (Basis of Design) AEP Span; Nu-Wave Corrugated Series; 20 Gage; vertical application; 7/8 inch deep corrugations x 36 inch wide panels; panel lengths as indicated on the Drawings.
- B. Centria.
- C. Or equal.

2.2 EXTERIOR SHEET MATERIALS

- A. Pre-coated Galvanized Steel; ANSI/ASTM A653/A653M: Grade A - G90 zinc coating; shop pre-coated with fluorocarbon coating.

2.3 ACCESSORIES

- A. Fasteners: Manufacturer's standard corrosion resistant type fastener system to suit application.
- B. Underlayment:
 - 1. Moisture Barrier: Two layers of Grade D building paper.
 - a. Water Vapor Transmission: 35 grams when tested per ASTM E96.
 - b. Water Resistance: Minimum 30 minutes when tested per ASTM D779.
- C. Gaskets and Closure Strips: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant; color selected by Owner's Representative.
- D. Field Touch-up Paint: As recommended by panel manufacturer.

2.4 COMPONENTS

- A. Exterior Sheet - Wall Panels: Min. 24 gage thick pre-coated steel stock; profile as indicated.
- B. Trim and Closure Pieces, Caps, and Flashings: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
- C. Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; formed to required angles.

2.5 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

- B. Form pieces in longest practical lengths.
- C. Fabricate corner flashings, trims, and caps, of one continuous piece.

2.6 FINISH

- A. Exposed Exterior and Interior Surfaces: Color as selected by the Owner's Representative from manufacturer's full range of colors.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify adjacent construction is ready to receive the Work of this Section.
- B. Verify that framing members and substrates are ready to receive the metal roof panel system.
- C. Do not commence Work until unsatisfactory conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Underlayment: Install underlayment over areas to receive metal wall panels. Install underlayment with long dimension of sheets perpendicular to supports. Install horizontally with each course shingled (weather lapped) 2 inches over layer below.
- B. General: Install metal wall panels in accordance with manufacturer's instructions and recommendations, as applicable to project conditions and supporting substrates. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement, in accordance with approved shop drawings.
- C. Fasten metal wall panels to structural supports; aligned, level, square, and plumb. Install all components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weather resistant.
- E. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim and with upper pieces shingled, lapped, and sealed, over lower pieces to fit substrates and to result in waterproof and weather-resistant performance.
- F. Protect surfaces in contact with dissimilar metals with bituminous paint. Allow to dry prior to installation.

- G. (Not Applicable - Horizontal Installation) Joints in vertical metal wall panels are not permitted.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal wall panel installation, including accessories. Report results in writing.
- B. Remove and replace applications of metal wall panels where inspections indicate that they do not comply with specified requirements.

3.4 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. Clean and wash pre-finished surfaces with mild soap and water, rinse with clean water.

3.5 TOUCH-UP

- A. Touch-up damaged surface finishes in accordance with manufacturer's directions.
- B. Damaged surface finish touch-up visible from a distance of 10 feet will not be approved. Replace damaged components than cannot up touched-up to the satisfaction of the Owner's Representative at no additional cost to the Owner.

END OF SECTION

SECTION 07 54 00

THERMOPLASTIC MEMBRANE ROOFING (Mechanically Attached)

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. At Roof: Installation of gypsum roof board, and roof insulation materials specified in Section 07 22 00.
2. At Parapet Sidewalls: Installation of gypsum roof board specified in Section 07 22 00.
3. Roofing membrane.
4. Base flashings.

B. Related Sections:

1. Section 06 16 00 - Sheathing.
2. Section 07 22 00 - Roof and Deck Insulation: Gypsum roof board, and roof insulation.
3. Section 07 60 00 - Flashing and Sheet Metal.
4. Section 07 90 00 - Joint Protection: Exterior joint sealants.

1.2 REFERENCES

- A. ASTM D570 - Standard Test Method for Water Absorption of Plastics.
- B. ASTM D751- Standard Test Methods for Coated Fabrics.
- C. ASTM D1149 - Standard Test Methods for Rubber Deterioration Cracking in an Ozone Controlled Environment.
- D. ASTM D1204 - Standard Test Method for Linear Dimensional Changes of Non-rigid Thermoplastic Sheeting or film at Elevated Temperature.
- E. ASTM D2136 - Standard Test Method for Coated Fabrics Low Temperature Bend Test.
- F. ASTM D2565 - Standard Practice for Xenon-Arc Exposure of Plastics Intended for Outdoor Applications.
- G. ASTM D4434 - Standard Specification for Poly (Vinyl Chloride) Sheet Roofing.
- H. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- J. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.
- K. ASTM E119 - Test Method for Fire Tests of Building Construction and Materials.

- L. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
- M. American Society of Civil Engineers (ASCE) - ASCE 7-10 - Minimum Design Loads for Buildings and Other Structures (1 Jan 2006).
- N. CCR Title 24 - California Code of Regulations Title 24, 2016 California Building Code and 2016 California Fire Code.
- O. CCR - California Code of Regulations, Title 24, Part 11 - 2016 California Green Building Code.
- P. Single Ply Roofing Institute (SPRI):
 - 1. ANSI/SPRI IA-1-2005 - Standard Field Test Procedure for Determining the Mechanical Uplift Resistance of Insulation Adhesives over Various Substrates.
 - 2. ANSI/SPRI FX-1-2006 - Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.
 - 3. ANSI/SPRI RP-4-2008 - Wind Design Standard for Ballasted Single-Ply Roofing Systems.
 - 4. ANSI/SPRI ES-1-2003 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
- Q. NRCA - National Roofing Contractors Association: Roofing and Waterproofing Manual.
- R. UL - Underwriters Laboratories: Fire Hazard Classifications; Fire Resistance Directory.
- S. Cool Roof Rating Council (CRRC).

1.3 SYSTEM DESCRIPTION

- A. Mechanically attached PVC single ply membrane roofing system installed over gypsum roof board, and roof insulation materials specified in Section 07 22 00; related PVC clad metal flashings; and accessories.
- B. Design Requirements:
 - 1. Fire Resistance Classification: UL Class B.
 - 2. Comply with NRCA Roofing and Waterproofing Manual Construction Details for PVC Single Ply Membrane.
 - 3. Roof membrane system shall withstand uplift forces caused by winds as defined in CCR Title 24.
 - 4. Completed installation shall comply with indicated UL Listed Assembly.
 - 5. Completed roof surfaces shall not pond water.
 - 6. "Energy Star" Compliant.
 - 7. Roof membrane system shall be a CRRC listed product.
- C. Performance Requirements:
 - 1. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

2. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings:
 1. Shop Drawings shall be approved by roof membrane manufacturer.
 2. Indicate:
 - a. Outline of roof and roof size.
 - b. Deck type.
 - c. Layout of gypsum roof boards.
 - d. Layout of insulation boards showing staggered joints and fastening pattern.
 - e. Type and layout of membrane sheets and membrane attachment methods.
 - f. Locations and types of penetrations.
 - g. Perimeter and penetration details.
 - h. Fastener specifications and attachment details.
 3. Shop Drawings will be required for final inspection of the Warranted Roof.
- C. Product Data:
 1. Provide product data sheets on membrane materials, flashing materials, and other components of the membrane system.
- D. Samples:
 1. Submit two samples of each membrane type proposed for use, 12 x 12 inch in size.
 2. Submit two samples of each flashing material.
- E. Manufacturer's Installation Instructions: Indicate special precautions required for seaming the membrane, and other instructions specified in this Section.
- F. Manufacturer's Certificate:
 1. Certify that products and system meet or exceed specified requirements.
 2. Certify that products and system meet identified code requirements.
 3. Certify that membrane and other components used in conjunction with the work of this Section are compatible with substrates over which they are to be applied.
 4. Certify that products and system are "Energy Star compliant, high-reflectance, high-emittance roof with an emissivity of 0.9 and an initial reflectance of 0.65. Solar Reflectance Index (SRI) shall be equal or greater than 78.
- G. Manufacturer's Field Reports:
 1. Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, results of fastener pull-out tests, and other items with possible effect on installation or performance.
 2. Submit after each inspection of roofing system to verify satisfactory conditions for start of installation, satisfactory installation methods, and satisfactory completed installation.

H. Quality Control Submittals:

1. Credentials: Prior to starting roofing, submit letter from roofing manufacturer indicating approval of applicator to install their products.
2. Design and Specification Approval: Prior to starting roofing, submit signed statement from applicator indicating that the roofing design and specifications are suitable for this project.
3. Warranty: Provide sample of warranty to be furnished in accordance with the terms specified herein.

I. Approved applicator shall supply the manufacturer and Owner Representative with Record (as-built) Shop Drawing for final inspection.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications:

1. Roof membrane manufacturer's approved applicator for minimum of five years prior to the bid date of the Project.

1.6 REGULATORY REQUIREMENTS

A. Solvents and their application shall conform to the air quality requirements set forth by the Butte County Air Quality Management District (BCAQMD).

1.7 PREINSTALLATION CONFERENCE

- A. Convene a conference one week prior to commencing the work of this Section, under provisions of Division 01.
- B. Require attendance of parties directly affecting the work of this Section. Include Owner's Representative, roofing manufacturer's representative, superintendent, sheet metal installer and associated roofing trades.
- C. Review job procedures, precautions and roofing methods to be used.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, handle, and protect products under provisions of Division 01.
- B. Conform to manufacturer's delivery, storage, and handling requirements.
- C. Deliver materials in original manufacturer's unopened containers or wrappings, labeled with manufacturer's name, brand name, installation instructions, and identification of various items.
- D. Store materials within temperature range recommended by manufacturer.
- E. Protect stored materials from moisture.
- F. Store and handle flammable materials away from sparks and open flame. Follow precautions outlined on container, supplied by manufacturer, required by regulatory authorities.

- G. Replace materials determined by Owner's Representative and manufacturer to be damaged.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply roofing materials during ambient conditions not approved by manufacturer.
- B. Do not apply materials to damp or frozen surfaces.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.10 WARRANTY

- A. Provide ten year written warranty under provisions of Division 01.
- B. Warranty:
 - 1. By material manufacturer, installer, and Contractor, jointly and severally, and signed by officers of each company.
 - 2. Cover materials and labor required to repair leaks or water intrusion through the membrane roof, and flashing installed in conjunction with the roof system.
 - 3. Cover the supply and replacement of insulation that may be damaged by intrusion of water through the roof membrane.
- C. Exclusions: Guarantee need not include damage due to lightning, hailstorms, hurricanes, earthquakes, or similar unusual natural occurrences.

PART 2 PRODUCTS

2.1 PVC ROOF MEMBRANE SYSTEM

- A. Manufacturers:
 - 1. (Basis of Design) GAF: Everguard.
 - 2. Johns Manville: SP8RM-SC.
 - 3. Sika Sarnafil: Sarnafil S327 EnergySmart.
 - 4. Or equal.

- B. Membrane; ASTM D4434: Type III, Class A reinforced Polyvinyl Chloride sheet; 0.080 inch thick, minimum 72 inch nominal roll width; white color; conforming to the following criteria:

<u>Properties</u>	<u>Test</u>	<u>Results</u>
Breaking Strength, min.	ASTM D751	200 Pounds
Elongation at Break, min.	ASTM D751	15 Percent
Seam Strength, min	ASTM D751	75 Percent (of Breaking)
Retention of Properties after heat aging of membrane (168 hours at 90 degrees C.)		
Breaking Strength, min.	ASTM D751	80 Percent
Elongation, min.	ASTM D751	80 Percent
Tear Resistance, min.	ASTM D751	45 Pounds
Low Temperature Bend	ASTM D2136	Pass at -40 Degrees F.
Linear Dimensional Change, max.	ASTM D1204	0.5 Percent
Change in Weight After Immersion in Water, max.	ASTM D570	3.0 Percent
Water Vapor Permeance, max.	ASTM E96 (Proc. A)	30 Perms
Ozone Resistance	ASTM D1149	No Visible Effects

- C. Seaming Materials: As recommended by membrane manufacturer.

- D. Flashings:

1. Flexible Flashings: Type recommended by membrane manufacturer; white color when associated with white PVC roof membrane.
2. Counter flashings: Type recommended by membrane manufacturer; 0.020 inch thick PVC membrane laminated to minimum 25 gage galvanized sheet metal when associated with PVC membrane.

- E. Accessories:

1. Separation Sheet: Type recommended by membrane manufacturer, suitable for use in indicated fire-rated assemblies.
2. Roofing Nails: Galvanized hot dipped or non-ferrous type, size as required to suit application.
3. Sealants and Pitch Pocket Fillers: As recommended by membrane manufacturer.
4. Fasteners: Corrosion resistant; type recommended by membrane manufacturer, best suited for intended application.
5. Fastener Disks: Corrosion resistant; size, shape, and thickness in accordance with manufacturer's instructions.
6. Solvents: Type recommended by membrane manufacturer.
7. Protection Board: Rigid sheathing; type recommended by membrane manufacturer.

2.2 ROOF WALKWAY SURFACE

- A. Walkway Mat; PVC: reinforced, embossed; 0.096 inch thick; color selected by Owner's Representative from manufacturer's standards as required to contrast with roof membrane.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions are suitable to receive the work of this Section.
- B. Verify that substrate, adjacent materials, and insulation boards are dry and ready to receive insulation.
- C. Verify deck is supported and secure.
- D. Verify deck is clean and smooth, free of depressions, waves, or projections, dry, and properly sloped. Confirm dry deck by moisture meter with maximum moisture in accordance with limits recommended by manufacturer.
- E. Verify that work of other trades which penetrates roof deck has been completed; roof openings, curbs, pipes, sleeves, ducts, vents through roof are properly set; wood strips and reglets are in place.
- F. Verify elevations of roof drains, drain pans, and scuppers are correct for proper drainage, and that drain lines are open.
- G. Roofing applicator shall notify Owner's Representative in writing of unsuitable substrate conditions.
- H. Do not commence installation until unsuitable conditions have been corrected. Beginning of work means acceptance of existing conditions.

3.2 PREPARATION

- A. Prepare surfaces to receive membrane in accordance with membrane manufacturer's instructions.
- B. Install slip sheet over substrate when required by membrane manufacturer.
- C. Verify layout of work before beginning installation.
- D. Fill gaps greater than 1/4 inch in substrate.

3.3 PROTECTION DURING INSTALLATION

- A. Protect building surfaces against damage from roofing work.
- B. Do not use materials not recommended by manufacturer.
- C. Do not allow waste products (petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat) or direct steam venting to come in contact with roofing system.

- D. Do not allow membrane to come into contact with materials or vapors not permitted by manufacturer.
- E. Do not expose membrane or accessories to a constant temperature in excess of 180 degrees F.

3.4 INSTALLATION - GENERAL

- A. Install roofing system in accordance with manufacturer's instructions.
- B. Install materials only under temperature, moisture, and humidity conditions approved by manufacturer.

3.5 INSULATION APPLICATION

- A. Ensure substrate and insulation is clean and dry.
- B. Install field insulation in two layers.
- C. Mechanical Attachment:
 - 1. Mechanically fasten insulation to deck in accordance with insulation manufacturer's instructions.
- D. Place the constant thickness first layer(s) and the tapered thickness insulation upper layer to the required slope pattern in accordance with manufacturer's instructions.
- E. Minimum Total Insulation Thickness: As specified in Section 07 22 00 or as otherwise indicated on the Drawings.
- F. Place boards in accordance with the manufacturer's written instructions and the approved shop drawings.
- G. Lay boards with edges in moderate contact without forcing, 1/4 inch maximum joint width. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- H. Tapered Insulation:
 - 1. Install tapered insulation to form slopes or crickets as indicated or required.
 - 2. Lay tapered boards for a distance of 24 inches back from roof drains for positive drainage.
 - 3. Attach to base insulation as required to prevent shifting.
 - 4. Minimum Slope: 1/4 inch per foot.
 - 5. Provide smooth transitions. Abrupt or vertical drops not allowed at joints.
- I. Apply no more insulation than can be covered with membrane in same day, or before approaching precipitation.
- J. Tape joints of insulation in accordance with insulation manufacturer's instructions.
- K. Install temporary water cutoffs at completion of work each day and remove upon resumption of work.

3.6 GYPSUM ROOF BOARD APPLICATION

- A. Install gypsum roof board specified in Section 07 22 00.
- B. Ensure substrate and roof board is clean and dry.
- C. Cut roof board cleanly and accurately at roof breaks and protrusions to provide smooth surface. Butt joints to ensure gaps less than 1/4 inch wide. Tape joints in accordance with roofing manufacturer's instructions.
- D. Apply no more roof board than can be covered with membrane in same day, or before approaching precipitation.

3.7 MEMBRANE INSTALLATION

- A. Roll out membrane, free from wrinkles and tears; position without stretching. Allow membrane to relax approximately 1/2 hour prior to attachment if required by membrane manufacturer.
- B. Shingle joints in direction of drainage to shed water.
- C. Install disks and fasteners to clamp the membrane tightly to the substrate.
- D. Mechanically fasten to perimeter surfaces using approved fasteners and recommended spacing.
- E. Extend membrane minimum 8 inches up onto vertical surfaces, or attach to pre-manufactured flashing materials which extend up 8 inches minimum in accordance with approved manufacturer's details.
- F. Terminations: Make terminations according to manufacturer's standard details, NRCA Standard Details, and as indicated.
- G. Splices / Seams
 - 1. Surfaces to be spliced / seamed shall be clean and dry.
 - 2. Splice / seam in accordance with manufacturer's instructions, keeping surface of membrane clean.
 - 3. Heat weld splices / seams to permanently seal roof system.
 - 4. Test splices / seams minimum twice daily in accordance with manufacturer's requirements.
- H. Daily Seal
 - 1. Temporarily seal loose edge of membrane in accordance with manufacturer's instructions to ensure that water does not flow beneath completed sections of membrane system.
- I. Seal membrane around roof penetrations.

3.8 FLASHING INSTALLATION

- A. Apply, using longest pieces practicable. Lap and splice using methods, materials and details recommended by manufacturer.

- B. Flash around penetrations using factory prefabricated pipe seals where possible.
- C. Seal flashings and flanges of items penetrating membrane. Field fabricated seals may be used where necessary using manufacturer's standard details.

3.9 ROOF WALKWAY INSTALLATION

- A. Clean membrane and install walkway in accordance with manufacturer's recommendations.
- B. Install immediately adjacent to and surrounding each piece of roof top equipment, and elsewhere as indicated.

3.10 MANUFACTURER'S FIELD SERVICES

- A. Before start, during, and upon completion of installation, membrane manufacturer's technical representative shall conduct inspections to ensure that roofing system is installed in accordance with roofing manufacturer's recommended specifications and details.
- B. The membrane manufacturer's representative shall certify to the Owner in writing that the roof membrane system has been installed in accordance with the manufacturer's directions.

3.6 FIELD QUALITY CONTROL

- A. Perform field testing under provisions of Division 01.
- B. Water Test:
 - 1. Wet entire roof membrane, flashings, and roof accessories by means of soaker hose at the rate of not less than one inch per hour rain equivalent for a duration of not less than two hours.
 - 2. Inspect for water intrusion.
 - 3. Correct identified defects and irregularities.
 - 4. Repeat test until no water intrusion is found.
 - 2. Remove temporary dams and restore roofs at conclusion of water tests.

3.12 CLEANING

- A. In areas where finished surfaces are soiled by Work of this Section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.
- B. Repair or replace defaced or disfigured finishes caused by Work of this Section.

3.73 PROTECTION OF FINISHED INSTALLATION

- A. Where traffic must continue over finished roof membrane, protect surfaces.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Galvanized sheet metal.
2. Polyvinyl Chloride (PVC) coated galvanized sheet metal where indicated for use with PVC single ply membrane roofing system specified in Section 07 54 00.
3. Aluminum sill flashing.
4. Pre-finished galvanized sheet metal trims and flashings where indicated for use with metal wall panel system specified in Section 07 42 13 - Metal Wall Panels.
5. Fasteners.
6. Manufactured Reglets.

B. Related Sections:

1. Section 05 50 00 - Metal Fabrications.
2. Section 07 42 13 - Metal Wall Panels.
3. Section 07 54 00 - Thermoplastic Membrane Roofing (Mechanically Attached).
4. Section 07 90 00 - Joint Protection.
5. Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.
6. Section 09 90 00 - Painting and Coatings.

1.2 REFERENCES

- A. AA (Aluminum Association) - Aluminum Construction Manual: Aluminum Sheet Metal Work and Building Construction.
- B. AISI (American Iron and Steel Institute) - Stainless Steel - Uses in Architecture.
- C. ASTM A167 - Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- D. ASTM A240/A240M - Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- E. ASTM A653/A653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- F. ASTM A924 / A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- G. ANSI/ASTM B32 - Solder Metal.
- H. FS O-F-506 - Flux, Soldering, Paste and Liquid.

- I. NRCA - National Roofing Contractors Association: Roofing Manual.
 - J. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association: Architectural Sheet Metal Manual.
- 1.3 QUALITY ASSURANCE
- A. Applicator: Company specializing in sheet metal flashing work with minimum three (3) years experience.
 - B. Pre-installation Conference:
 - 1. Attend pre-installation conference with roofing installer, roofing manufacturer's representative, General Contractor and the Owner's Representative in accordance with Section 01 31 00 – Coordination and Project Meetings.
- 1.4 SUBMITTALS
- A. Submit in accordance with Section 01 33 00 – Submittal Procedures.
 - B. Shop Drawings: Indicate overall layout of sheet metal work; type, thickness, and details of sheet metal components; joints, expansion joints, attachment and anchoring of sheet metal components.
 - C. Warranties: Sample of special warranties.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver flashing and sheet metal wrapped for protection and marked to facilitate identification.
 - B. Stack preformed (and prefinished) material to prevent twisting, bending, or abrasion, and to provide ventilation.
 - C. Prevent contact with materials during storage which may cause discoloration, staining, or damage.
 - D. Store and handle in protective wrapping until ready for use.
- 1.6 PROJECT CONDITIONS
- A. Field Measurements: Before fabricating sheet metal, verify shapes and dimensions of surfaces to be covered.
- 1.7 SEQUENCING AND SCHEDULING
- A. Coordinate Work of this Section with work of other Sections whose work affects or is affected by the Work of this Section.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sheet Metal:

1. Other sheet metal, unless otherwise specified or indicated, shall be zinc-coated (Galvanized) Steel Sheet conforming to ASTM A653/A653M, G90 (Z275) coating designation; structural quality, mill phosphatized for field painting. Sheet metal flashing shall be 24 gauge minimum unless otherwise specified herein or indicated on the drawings.
2. Provide Polyvinyl Chloride (PVC) coating where indicated for use with PVC single ply membrane roofing system specified in Section 07 54 00.
3. Provide pre-finished galvanized sheet metal trims and flashings where indicated for use with metal wall panel system specified in Section 07 42 13 - Metal Wall Panels.
4. Provide associated trim, corner plates, clips, joint covers, and similar items, as required for a complete and watertight installation.

B. Fasteners:

1. Material:
 - a. Non-corrosive or hot-dipped galvanized, compatible with flashing and sheet metal material..
2. Type and Size:
 - a. Nails, rivets, sheet metal screws as indicated and as required to hold flashing and sheet metal securely in place.
 - b. Where sheet metal is installed over other sheet metal, fasten through 1 inch diameter tinned discs.
3. Spacing: 24 inches on center maximum, unless otherwise indicated.

C. Solder; ASTM B32: Alloy Grade 50A.

D. Flux; FS O-F-506.

E. Sealant; Type specified in Section 07 90 00.

F. Reglets:

1. Standard or surface mounting types, as indicated on the Drawings.
2. Manufacturers:
 - a. Fry Reglet Architectural Metals; Springlok Flashing System: Type STX Reglet; 24 gauge galvanized steel.
 - b. Or equal.
3. Accessories:
 - a. Factory manufactured mitered and sealed corners

G. Aluminum Sill Flashing:

1. Matching properties specified in Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.

2.2 FABRICATION

- A. Field fabricate only those items that cannot be fabricated in the shop.
- B. Fabricate profiles in the shapes and sizes indicated on the Drawings, or where required and not indicated, in accordance with the recommendations of the SMACNA Architectural Sheet Metal Manual referenced standard, and NRCA Roofing Manual for the particular application.
- C. Fabricate products in accordance with the reviewed approved Shop Drawings and the SMACNA Architectural Sheet Metal Manual referenced standard, and NRCA Roofing Manual.
- D. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- E. Form pieces in longest practical lengths.
- F. Form flashing and sheet metal to fit snugly and without sharp edges.
- G. Form seams neatly and make straight.
- H. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- I. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- J. Fabricate flashings vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- K. Joints:
 - 1. Make joints watertight and allow for expansion.
 - 2. Reinforce sheet metal corners as required.
 - 3. Conceal reinforcement within finished assembly.
- L. Fastenings: Use concealed hook strips and fasteners. Exposed hook strips and fasteners not acceptable.

2.3 FINISH

- A. Galvanized Items: Mill phosphatized for painted finish in accordance with Section 09 90 00.
- B. Backpaint concealed metal surfaces with one coat protective backing paint.
- C. Coat contacting dissimilar metals with protective compound.
- D. For Pre-Finished Galvanized Sheet Metal Items: As specified in Section 07 42 13 - Metal Wall Panels.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are satisfactory for the installation of flashing and sheet metal.
- B. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, cant strips and reglets are in place, and nailing strips located.
- C. Verify roofing membrane termination and base flashings are in place, sealed, and secure.
- D. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Remove dirt, foreign objects, and foreign materials from surfaces to receive flashing and sheet metal.
- B. Surfaces shall be clean, smooth, even, and free from defects prior to installation.

3.3 INSTALLATION

- A. Soldering:
 - 1. Clean contact surfaces before soldering.
 - 2. Perform soldering so as to thoroughly heat sheet metal and completely sweat solder through full seam width to produce joint of flowed solder 1 inch wide.
 - 3. Sweat lock seams full of solder flat and straight; clean with acid flux after soldering, and wash thoroughly.
- B. Mechanical Fastening:
 - 1. Join parts with concealed rivets or sheet metal screws, type and spacing in accordance with manufacturer installation instructions, NRCA Roofing Manual and approved shop drawings.
 - 2. Place sheets together before drilling.
- C. Lap Joints:
 - 1. Where lap joints are used, lap sheets at least 4 inches.
 - 2. Provide bead of sealant between and across the entire width/length of the lapped joints, placed 1 inch from exposed edge of joint.
- D. Butt Joints:
 - 1. Where butt joints are used, provide concealed backing alignment plates or sleeves fitted to one side of joint.
 - 2. Seal laps with approved sealer.
- E. Perform cutting, fitting, drilling, and similar work as required to accommodate the Work of other Sections.

- F. Window Sill Flashings:
1. Fabricate sill flashings of anodized aluminum to match window frame.
 2. To the extent possible, fabricate from one piece of metal for each window unit. Where more than one piece is required, leave joints between sections open 1/4 inch and back with formed back-up plates lapping each section a minimum of 3 inches.
 3. Seal laps with silicone sealant in accordance with Section 07 90 00 - Joint Protection.
 4. Where window sections extend around corners, provide prefabricated mitered and soldered internal and external corners.
 5. Fold back exposed edges 1/2 inch on the underside.
 6. Coat contacting dissimilar metals with protective compound.
- G. Door and Window Head Drip Flashings:
1. Fabricate head drip flashings of galvanized steel.
 2. To the extent possible, fabricate from one piece of sheet metal for each door and window unit. Where more than one piece is required, leave joints between sections open 1/4 inch and back with formed back-up plates lapping each section a minimum of 3 inches.
 3. Seal laps with butyl sealer.
 4. Where window sections extend around corners, provide prefabricated mitered and soldered internal and external corners.
 5. Fold back exposed edges 1/2 inch on the underside.
 6. Coat contacting dissimilar metals with protective compound.
- H. Wall Base / Sill and Horizontal Trim Drip Flashings:
1. Fabricate wall base / sill and horizontal trim drip flashings of galvanized steel.
 2. Lap joints as specified herein may be used unless otherwise indicated on the Drawings or recommended by the SMACNA Architectural Sheet Metal Manual for the particular application.
 3. Provide prefabricated mitered and soldered internal and external corners.
 4. Fold back exposed edges 1/2 inch on the underside.
 5. Coat contacting dissimilar metals with protective compound.
- I. Vertical Flashings at Material Transitions, Corners, and Walls Ends:
1. Fabricate vertical flashings at material transitions, corners, and walls ends of galvanized steel.
 2. To the extent possible, fabricate from one piece of sheet metal. Where more than one piece is required, provide lap joint as specified herein, with the upper piece shingled over the top of the lower piece.
 3. Fold back exposed edges 1/2 inch on the underside.
- J. Gravel Stops:
1. Fabricate gravel stops of galvanized steel.
 2. Provide prefabricated mitered and soldered internal and external corners.
 3. Leave joints between sections open 1/4 inch and back with formed back-up plates lapping each section and a minimum of 3 inches.
 4. Seal laps with approved sealer.
 5. Fold back exposed edges 1/2 inch on the underside.

- K. Parapet Caps:
 - 1. Fabricate of 22 gauge galvanized steel unless otherwise indicated.
 - 2. Provide prefabricated mitered internal and external corners.
 - 3. Leave joints open 1/4 inch between sections, back with formed back-up plates lapping each section and a minimum of 3 inches.
 - 4. Seal laps with butyl sealer.

 - L. Expansion Joints:
 - 1. Fabricate of 22 gauge galvanized steel unless otherwise indicated.
 - 2. Fabricate in accordance with SMACNA.

 - M. (Not Used) Hanging Gutters:
 - 1. Fabricate of 24 gauge galvanized steel, unless otherwise indicated.
 - 2. Lap joints between sections 1 1/2 inches, rivet and solder.
 - 3. Provide loose locked expansion joints midway between outlet tubes to provide for 1 1/2 inches movement in both directions.
 - 4. Provide expansion joints with cover strips in a manner to provide free movement and watertight connection.
 - 5. Form outlet tubes of same material and thickness as gutter and lock and solder the longitudinal seam.
 - 6. Flange the upper end of tubes and rivet and solder to the lining.
 - 7. Extend tubes into downspouts at support gutters with 20 gauge strap hangers and install spreaders at midpoint between hangers.

 - N. (Not Used) Downspouts:
 - 1. Fabricate downspouts of 24 gauge galvanized steel unless otherwise indicated.
 - 2. Telescope end joints 1 1/2 inches and lock longitudinal joints.
 - 3. Hold downspouts in position 1 inch clear of the wall with 1/16 inch by 1 inch galvanized steel downspout straps spaced not more than 10 feet on center and securely fasten to the wall with expansion anchors.

 - O. Reglets and Counterflashings:
 - 1. Install reglets and counterflashings in accordance with the manufacturer's printed installation drawings and instructions as indicated, and approved shop drawings.

 - P. Completed installations shall be weathertight.
- 3.4 CLEANING
- A. Following installation, clean exposed surfaces of flashing and sheet metal of excess solder and dirt; remove grease and oil with appropriate solvent; wipe surfaces with clean rags, and leave in condition suitable for the application of paint.

END OF SECTION

SECTION 07 72 33

ROOF HATCHES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Factory-fabricated roof hatches for ladder access.
2. Telescoping ladder safety post.

B. Related Sections:

1. Section 05 50 00 - Metal Fabrications (for roof ladder).
2. Section 06 16 00 - Sheathing.
3. Section 06 10 00 - Rough Carpentry.
4. Section 06 20 00 - Finish Carpentry.
5. Section 07 54 00 - Thermoplastic Membrane Roofing (Mechanically Attached).
6. Section 07 60 00 - Flashing and Sheet Metal.
7. Section 09 21 16 - Gypsum Board Assemblies.
8. Section 09 90 00 - Painting and Coatings.

1.1 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.
- C. Product Data: Submit manufacturer's product specifications.
- D. Warranty: Submit copy of manufacturer's standard warranty.

1.2 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.3 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five (5) years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. (Basis of Design) The Bilco Company; Type S Roof Hatch.
- B. Milcor; RB Series Roof Hatch.
- C. Babcock-Davis; BRHPG Series Roof Hatch.
- D. Nystrom Building Products; Personnel RHPG Series Roof Hatch.
- E. Or equal.

2.2 ROOF HATCH

- A. Furnish and install where indicated on the Drawings.
 - 1. Single leaf, metal roof hatch; galvanized steel.
 - 2. Size: 30 inches x 36 inches. Hatch cover hinged on the 30 inch long side.
 - 3. The roof hatch shall be pre-assembled from the manufacturer.
- B. Performance Characteristics:
 - 1. Cover shall be reinforced to support a minimum live load of 40 psf with a maximum deflection of 1/150th of the span and a 140 psf wind uplift.
 - 2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
 - 3. Operation of the cover shall not be affected by temperature.
 - 4. The entire hatch shall be weather tight with fully welded corner joints on cover and curb.
- C. Cover: Shall be 14 gauge paint bond G-90 galvanized steel with a 3" beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.
- D. Cover insulation: Shall be fiberglass of 1" thickness, fully covered and protected by a metal liner 22 gauge paint bond G-90 galvanized steel.
- E. Curb: Shall be 12 inches in height and of 14 gauge paint bond G-90 galvanized steel. The curb shall be formed with a 3-1/2 inch flange with 7/16 inch holes provided for securing hatch to the roof deck. The curb shall be equipped with an integral metal cap flashing of the same gauge and material as the curb, fully welded at the corners. The curb shall incorporate a factory installed flashing system to provide a weather-proof seal over the roofing membrane.
- F. Curb insulation: Shall be rigid, high-density fiberboard of 1 inch thickness on outside of curb.
- G. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent

accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe through bolted to the curb assembly.

- H. Hardware:
 - 1. Heavy pintle hinges shall be provided
 - 2. Cover shall be equipped with a spring latch with interior and exterior turn handles
 - 3. Roof hatch shall be equipped with interior padlock hasps.
 - 4. The latch strike shall be a stamped component bolted to the curb assembly.
 - 5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1 inch diameter red vinyl grip handle to permit easy release for closing.
 - 6. Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be zinc plated and chromate sealed.
 - 7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.
- I. Finishes: Factory finish shall be alkyd based red oxide primed steel.

2.3 MISCELLANEOUS TRIM AND ACCESSORIES

- A. Ladder Safety Post: For permanent installation to the top two rungs of the fixed roof access ladder below hatch cover. Capable of providing a positive hand-hold to enable the user to enter or exit the roof opening in an upright and balanced position.
 - 1. Equal to Bilco Model LU-1; steel construction; factory powder coated: yellow color.
 - a. Safety post shall be designed with a telescoping tubular section that locks automatically when fully extended.
 - b. Upward and downward movement shall be controlled by a stainless steel spring balancing mechanism.
 - c. Automatically locks in the fully raised position.
 - d. Release lever allows the post to be easily lowered to its retracted position.
 - e. Unit shall be completely assembled with fasteners for securing to the ladder rungs in accordance with the manufacturer's instructions.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are satisfactory for the installation of the Work of this Section.
- B. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected.

3.2 INSTALLATION

- A. Install roof hatch unit(s) square, plumb and level, accurately aligned to position intended and securely anchored in place, in accordance with the manufacturer's written instructions and approved submittals.
- B. Install ladder safety post(s) securely to rungs of the roof access ladder(s) in accordance with the manufacturer's written instructions and approved submittals.

3.3 ADJUSTING AND CLEANING

- A. Test ladder safety post(s) for proper function and adjust until proper operation is achieved.
- B. Test roof hatch unit(s) for proper function and adjust until proper operation is achieved.
- C. Clean all roof hatch surfaces in accordance with manufacturer's instructions.
- D. Exposed roof hatch surfaces shall be clean and free from scratches, dents, tool marks, stains, discoloration, and other defects and damage.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fireproof firestopping materials and related accessories.
- B. Related Sections:
 - 1. Section 07 84 43 - Fire-Resistant Joint Sealants
 - 2. Section 09 21 16 - Gypsum Board Assemblies.
 - 3. Division 21 - Fire Suppression.
 - 4. Division 22 - Plumbing.
 - 5. Division 23 - Heating, Ventilating, and Air Conditioning
 - 6. Division 26 - Electrical.

1.2 REFERENCES

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- C. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.
- D. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
- E. UL - Underwriters' Laboratories, Inc.: Various Fire-Resistance and Smoke Protection publications including but not limited to:
 - 1. UL-209 - Tests for Fire Resistance of Building Joint Systems.
 - 2. Underwriter's Laboratory Fire Resistance Directory, Latest Edition.
- F. CCR - California Code of Regulations, Title 24 - 2016 California Building Code (CBC). Chapter 7.

1.3 SYSTEM DESCRIPTION

- A. Fireproofing Materials: Designed as a complete system to retard the passage of heat and smoke for intended application.

1.4 QUALITY ASSURANCE

- A. Applicator: Company approved by manufacturer.
- B. Materials shall have been tested to provide fire rating at least equal to that of the construction.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings: For each firestopping system, show each kind of construction condition in which firestopping systems are installed; also show relationships to adjoining construction. Include firestopping system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-stopping systems configuration for construction and penetrating items.
- C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- D. Certificate: Certify that system and installation meet or exceed specified requirements.
- E. Provide product data sheets showing the VOC content of all adhesives and sealants. The VOC content shall not exceed the limits listed in this Section.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLINGS

- A. Deliver materials in the manufacturer's original, unopened containers or packages with manufacturer's name, labels, product identification, lot numbers, and mixing and installation instructions, as applicable.
- B. Store materials in the original, unopened containers or packages, and under conditions recommended by manufacturer.

1.7 JOB CONDITIONS

- A. Follow manufacturer's instructions for temperature, ventilation, and other conditions for mixing and installing foam seals.
- B. Follow manufacturer's precautions when using materials considered toxic or otherwise hazardous.
- C. Do not install firestopping until:
 - 1. Cementitious fireproofing Work has been completed, including repairs thereof.
 - 2. Building is sufficiently enclosed or protected against adverse weather conditions.
 - 3. Supporting framing and surrounding construction is thoroughly dry.

1.8 SEQUENCING

- A. Sequence work to permit firestopping materials to be installed after adjacent and surrounding work is complete.

PART 2 PRODUCTS

2.1 MATERIALS

A. General:

1. Materials shall be as listed and tested in UL Building Materials Directory.
2. When tested in accordance with ASTM E84, ASTM E119 flame spread, and smoke developed ratings shall not exceed 25 and 450, respectively, as determined per ASTM E84.

B. Form materials to remain in place in the completed Work and sealant used for firestopping Work shall be UL listed.

C. Miscellaneous firestopping materials include: fire rated gypsum board, metal, wood, etc. Appropriate sizes and configurations in accordance with specified tested UL system.

2.2 MINERAL-FIBER FIRESTOPPING

A. Manufacturer: Semi-rigid mineral fiber insulation, minimum 4 pcf density.

1. Thermafiber; Thermafiber Safing Insulation.
2. Manville; Pyro-Fiber.
3. Fibrex Insulations; Fibrex Safing Insulation.
4. Or equal.

B. Support Clips: Custom design and fabricated from galvanized sheet steel to suit project conditions.

1. Thermafiber; Thermafiber Safing Impaling Clips.
2. Manville.
3. Fibrex Insulations.
4. Or equal.

2.3 FOAM FIRESTOPPING

A. Manufacturer: Two component silicone elastomer.

1. 3M; Penetration Firestopping Foam.
2. Dow Corning Corp.; 3-6548 Silicone RTV Foam.
3. Specified Technologies Inc (STI); Pensil Series PEN200 Two Part Silicone Firestop Foam.
4. Or equal.

B. Accessories:

1. Forming/Damming Materials: Mineral fiberboard or other type recommended by foam manufacturer.
2. Primer, Sealant, and Solvent Cleaner: As recommended by foam manufacturer.

2.4 FIRESTOP BLOCK & PLUG SYSTEMS

- A. Manufacturer:
 - 1. (Basis of Design): Hilti Construction Chemicals, Inc.:
 - a. CFS-BL Firestop Block.
 - b. CFS-PL Firestop Plug.
 - 2. Or equal.
- B. Accessories:
 - 1. Collar (where required): Hilti Construction Chemicals, Inc.: CFS-CC Firestop Cable Collar. For firestop block and plug systems by other manufacturers, provide that manufacturer's collar, or collar as otherwise recommended by the manufacturer.
 - 2. Other accessories as required, or as otherwise recommended by the manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Inspect openings and voids to be sealed to determine if conditions are satisfactory for the proper installation of firestopping.
- B. If unsatisfactory conditions exist, do not commence Work until such conditions have been corrected. Beginning application indicates acceptance of conditions.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, and other matter which may adversely affect products or performance.
- B. Install backing materials to arrest liquid material leakage.
- C. Where firestopping is installed at locations which will remain exposed in the completed Work, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and protect firestopping as necessary against damage from other construction activities.

3.3 INSTALLATION

- A. Prepare and install firestopping applicable to Project conditions in accordance with the manufacturer's printed instructions, specified tested UL system and approved shop drawings.
- B. Mineral Fiber Firestopping:
 - 1. Provide in units of sufficient thickness to allow compression for a tight friction fit when installed.
 - 2. Provide in units of width sufficient to fill the depth of the void space using single width pieces only.
 - 3. Install units with ends tight against terminal end construction, and with intermediate joints well compressed together and tight.

4. For vertical void spaces, provide support clips near each end of each mineral fiber unit, spaced at not over 24 inches on center.
- C. Foam Firestopping:
1. Provide form materials as necessary to retain foam when placed.
 2. Prime contact surfaces when required by foam manufacturer.
 3. Inject foam into void spaces with sufficient care and attention to assure that foam develops full and complete contact with adjoining surfaces, and that space is filled free from air pockets.
 4. Cure foam 24 hours, remove form materials not required to remain, and inspect foam in place.
 5. Provide additional foam or sealant as necessary to fill insufficient depth of foam and remaining voids.
- D. Firestop Block and Plug Systems:
1. Install in accordance with the manufacturer's latest published instructions and in accordance with the tested and certified systems from Underwriter's Laboratory or other testing and inspecting agency acceptable to authorities having jurisdiction (SFM).
- E. Finish surfaces of firestopping which is to remain exposed in the completed Work to a uniform and level condition.
- 3.4 CLEANING
- A. Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.
 - B. Leave finished work in neat, clean condition with no evidence of spillovers or damage to adjacent surfaces.
- 3.5 FIRESTOPPING SCHEDULE
- A. Provide firestopping for conditions specified whether or not firestopping is indicated, and if indicated, whether such material is designated as insulation, safing, block and plug, or otherwise.
 - B. Insulation types specified in other Sections shall not be installed in lieu of firestopping materials specified herein.
 - C. Building Exterior Perimeters:
 - D. Where exterior facing construction is continuous past a structural floor and a space would otherwise remain open between the inner face of the wall construction and the outer perimeter edge of the structural depth of the structural floor, exclusive of supporting girders or beams.
 - E. Firestopping shall be provided whether or not there are clips, angles, plates, or other members bridging or interconnecting the facing and floor systems, and whether or not such items are continuous.

- F. Interior Walls and Partitions:
1. Where a wall or partition is continuous past a structural floor, such as at vertical shafts, and a space would otherwise remain open between the wall face and perimeter edge of the adjoining structural floor, provide firestopping to completely fill such space for the full depth of the structural floor, exclusive of supporting girders or beams.
 2. Provide firestopping whether or not there are clips, angles, plates, or other members bridging or interconnecting the wall and floor systems, and whether or not such items are continuous.
 3. Where the top edge of a fire-rated wall or partition abuts and is at right angles to fluted type metal decking, and the construction is such that would otherwise leave the flute spaces open, provide firestopping to completely fill such open flute spaces for the full depth or width of the wall or partition.
- G. Penetrations:
1. Penetrations include conduit, cable, wire, pipe, duct, or other elements which pass through one or both outer surfaces of a floor roof, wall, or partition.
 2. Where penetrations occur at fire-rated walls or partitions of solid type construction, requiring protected openings, provide firestopping to completely fill spaces around the penetration, and for the full depth of the wall or partition.
 3. Where penetrations occur at fire-rated walls or partitions of hollow type construction, requiring protected openings, provide firestopping to completely fill spaces around the penetration, on each side of the wall or partition, and for a depth not less than the thickness of the wall or partition finish materials.
 4. These requirements for penetrations shall apply whether or not sleeves have been provided, and whether or not penetrations are to be equipped with escutcheons or other trim.
- H. Provide firestopping to fill miscellaneous voids and openings in fire-rated construction.

END OF SECTION

SECTION 07 84 43

FIRE-RESISTANT JOINT SEALANTS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section Includes:
 - 1. Fire-resistive joint sealants.
- B. Related Sections include the following:
 - 1. Section 07 84 00 - Firestopping: Systems installed in openings in walls and floors with and without penetrating items.
 - 2. Section 07 90 00 - Joint Protection: Non-fire-resistive joint sealants.

1.2 REFERENCES

- A. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- B. ASTM E119 - Test Methods for Fire Tests of Building Construction and Materials.
- C. ASTM E 814 - Fire Test of Penetration Firestop Systems.
- D. ASTM E1966 - Fire-Resistive Joint Systems.
- E. UL - Underwriters' Laboratories, Inc.: Various Fire-Resistance and Smoke Protection publications including but not limited to:
 - 1. UL-209 - Tests for Fire Resistance of Building Joint Systems.
 - 2. Underwriter's Laboratory Fire Resistance Directory, Latest Edition.
- F. CCR - California Code of Regulations, Title 24 - 2016 California Building Code (CBC). Chapter 7.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.
- B. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, and with movement capabilities indicated as determined by UL 2079.
- C. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data: For each type of product indicated.
 - 1. For sealants and sealant primers used inside the weatherproofing system, include printed statement of VOC content.
- C. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction (SFM) that demonstrates compliance with requirements for each condition indicated.
 - 1. Submit documentation of tested and certified systems, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction assemblies and penetrating items.
- D. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.
- E. Field quality-control test reports.
- F. Evaluation Reports: Evidence of fire-resistive joint systems' compliance with an ICC Evaluation Service (ICC-ES) Evaluation Report specific to each unique joint application and product utilized.

1.5 QUALITY ASSURANCE

- A. Applicator: Company with minimum three (3) years experience in the application of materials of the type specified in this Section.
- B. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 - 1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
 - 2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
 - a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
 - b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
- C. Notify the Owner's Representative at least seven days in advance of fire-resistive joint system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until the Owner's Representative has examined each installation.

PART 2 PRODUCTS

2.1 MATERIALS, GENERAL

- A. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: Not more than 250 g/L.
 - 2. Nonmembrane Roof Sealants: 300 g/L.
 - 3. Single-Ply Roof Membrane Sealants: 450 g/L.
 - 4. Sealant Primers for Nonporous Substrates: Not more than 250 g/L.
 - 5. Sealant Primers for Porous Substrates: Not more than 775 g/L.
 - 6. Modified Bituminous Sealant Primers: 500 g/L.

2.2 MANUFACTURERS

A. Manufacturers

1. (Basis of Design) Hilti Construction Chemicals, Inc.:
 - a. (Basis of Design): FS-ONE High Performance Intumescent Firestop Sealant.
 - b. CP 606 Flexible Firestop Sealant. (For use in listed certified systems not specifically tested and certified for use with the Basis of Design product.)
2. Bio Fireshield, Inc.
3. United States Gypsum Company (USG).
4. Dow Corning Corp.
5. 3M, Electrical Products Division.

2.3 FIRE-RESISTIVE JOINT SYSTEMS

- A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.
- B. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of work.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.
 2. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates or damaging adjoining surfaces.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated and in accordance with approved shop drawings.
- B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply fill materials so they contact and adhere to substrates formed by joints.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

- A. Inspections: The Owner's Representative will inspect fire-resistive joint systems and prepare inspection reports state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.
- B. Inspection of completed installations of fire-resistive joint systems shall take place in successive stages as installation of fire-resistive joint systems proceeds. Do not proceed with installation of joint systems for the next area until inspection determines completed work shows compliance with requirements.
- C. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.
- D. Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- E. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.

3.5 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.6 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

- A. Provide fire-resistive joint systems for conditions specified whether or not the fire-resistive joint systems are indicated on the Drawings.
- B. As designated for the various systems as indicated on Drawings.
- C. Where not specifically indicated on the Drawings, as appropriate to the type of construction requiring fire stopping protection, provide tested and certified systems equivalent to UL System Numbers WL1085, WL1056, WL3047, WL5029, and WL8004 for framed wall through-penetrations. For other types of construction conditions requiring fire stopping protection, provide tested and certified systems from Underwriter's Laboratory Fire Resistance Directory, Latest Edition, or other testing and inspecting agency acceptable to authorities having jurisdiction. Prior to installation, submit systems proposed to be used in the Work in accordance with the provisions specified elsewhere in this Section.

END OF SECTION

SECTION 07 90 00
JOINT PROTECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Preparing sealant substrate surfaces.
 - 2. Sealant and backing.
- B. Related Sections:
 - 1. Section 17 84 43 - Fire Resistant Joint Sealants.
 - 2. Sealants used in conjunction with building components as indicated in all Divisions.

1.2 REFERENCES

- A. ASTM C732 - Aging Effects of Artificial Weathering on Latex Sealing Compounds.
- B. ASTM C834 - Standard Specification for Latex Sealing Compounds.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- D. ASTM C1184 - Standard Specification for Structural Silicone Sealants.
- E. Federal Specification TT - S 001 543A (COM - NBS) Class A for silicone building sealants.
- F. Federal Specification TT - S - 00230C (COM - NBS) Class A for one - component building sealants.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data:
 - 1. For sealants and sealant primers used inside the weatherproofing system, including printed statement of VOC content.
- C. Samples: Submit showing the standard colors available for each sealant material intended for installation in an exposed location.
- D. Certificates: Submit certificate that materials specified and proposed for use are suitable for intended application.
- E. Manufacturer's installation instructions.
- F. Warranties: Sample of special warranties.
- G. Provide MSDS sheet for all Joint Sealants.

1.4 QUALITY ASSURANCE

- A. Applicator: Company with minimum three (3) years experience in the application of materials of the type specified in this Section.
- B. Regulatory Requirements: Joint Sealers shall meet all current limits set by regulatory agencies regarding Volatile Organic Compounds (VOC).

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in the unopened, original containers or unopened packages with manufacturer's name, labels, product identification, and lot numbers where appropriate.
- B. Store materials in the original, unopened containers or packages, and under conditions recommended by manufacturer.

1.6 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which 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. Failures include but are not limited to the following:
 - a. Air and/or water penetration.
 - b. Loss of adhesion or cohesion.
 - c. Failure to cure.
 - 2. Warranty Period: Two (2) years from date of Notice of Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Failures include but are not limited to the following:
 - a. Loss of adhesion or cohesion.
 - b. Failure to cure.
 - 2. Warranty Period: One (1) year from date of Notice of Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.1 MATERIALS, GENERAL

- A. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Architectural Sealants: Not more than 250 g/L.
 2. Nonmembrane Roof Sealants: 300 g/L.
 3. Single-Ply Roof Membrane Sealants: 450 g/L.
 4. Sealant Primers for Nonporous Substrates: Not more than 250 g/L.
 5. Sealant Primers for Porous Substrates: Not more than 775 g/L.
 6. Modified Bituminous Sealant Primers: 500 g/L.

2.2 SEALANTS

- A. Sealant Application: To prevent water infiltration through interior and exterior joints; glazing joint sealants.
1. Manufacturers:
 - a. Dow Corning Corp.; No. 795.
 - b. General Electric Co.; Silpruf.
 - c. Pecora Corp.; 864.
 - d. Sonneborn Building Products; Omniseal.
 - e. Tremco; Spectrem 1.
 2. Low modulus silicone sealant in accordance with ASTM C920, Type S, Grade NS, Class 50.
- B. Sealant Application: General purpose joint sealant for bedding fixtures, partitions, equipment, and dissimilar finishes, at walls and floors to facilitate sanitary conditions by eliminating open joints between contact surfaces.
1. Manufacturers:
 - a. Tremco; 834 Siliconized Interior Acrylic Latex Sealant.
 - b. Sonneborn Building Products; Sonolac.
 - c. Pecora Corp.; AC 20.
 2. Latex acrylic based sealant in accordance with ASTM C834
- C. Sealant Application: Acoustical sealant to assist in sound attenuation through wall and ceiling joints at locations indicated on the drawings.
1. Manufacturers - Tape:
 - a. Norton Co.; Norseal V740.
 - b. Arlon; Series 9A.
 2. Polyvinylchloride foam tape with pressure sensitive adhesive on one side, 3/4 inch wide by the thickness required to accommodate unevenness of substrate and completely fill openings between partition framing and building floors and concrete or masonry walls.
 3. Manufacturers - Compound:
 - a. Pecora Corp.; DynaTrol II.
 - b. Tremco; Acoustical Sealant.

4. Permanently resilient type manufactured specifically for acoustical applications.

2.3 MISCELLANEOUS MATERIALS

- A. Backer Rod:
 1. Material: Closed cell foam, non-staining, non-gassing, resilient material such as neoprene, butyl, or polyurethane, compatible with sealant to be used.
 2. Sized and shaped to control depth of sealant and to provide 20 percent to 50 percent compression upon insertion.
- B. Joint Cleaner:
 1. General: As recommended by sealant manufacturer.
 2. For metal and glass: Xylol, xylene, toluol, or toluene.
- C. Primer: As recommended by sealant manufacturer for use intended.
- D. Masking Tape: Pressure sensitive adhesive paper type.
- E. Bond Breaker: Pressure sensitive adhesive polyethylene tape.

2.4 SEALANT COLORS

- A. Sealant color for use in exposed locations shall be as selected by the Owner's Representative from manufacturer's standard colors.
- B. Wherever sealants are not exposed to view, provide manufacturer's standard color which has the best overall performance characteristics for the application indicated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Inspect joints to be sealed to determine if conditions are satisfactory for the proper installation of joint sealants.
- B. If unsatisfactory conditions exist, do not commence Work until such conditions have been corrected. Beginning of installation means acceptance of existing conditions.

3.2 GENERAL

- A. Provide sealant wherever necessary to:
 1. Prevent moisture infiltration.
 2. Facilitate cleaning and sanitation.
 3. Seal exposed exterior joints around door and window frames, and other items indicated to be set in sealant.
 4. Seal exterior joints and roof flashings as recommended by:
 - a. Roof membrane manufacturer.
 - b. NRCA - National Roofing Contractors Association: Roofing Manual.
 - c. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association: Architectural Sheet Metal Manual.

3.3 PREPARATION

- A. Cleaning: Clean joint surfaces, using joint cleaner as necessary, of dust, dirt, oil, grease, rust, lacquers, laitance, release agents, moisture, and other matter which could adversely affect adhesion of sealants.
- B. Masking: Mask areas adjacent to joints.
- C. Priming: Apply primer, if required, in accordance with manufacturer's printed instructions.
- D. Joints shall enclose sealant on three sides:
 - 1. Where adequate joints for sealants have not been provided, suitable joints shall be cleaned out to the depth required, or as indicated, and ground to a minimum width of 1/4 inch without damage to the adjoining Work, unless otherwise specified or indicated.
 - 2. No grinding shall be performed on metal surfaces.

3.4 APPLICATION

- A. Install sealant and backing materials in accordance with manufacturer's instructions.
- B. Apply in accordance with manufacturer's instructions regarding ambient temperature for application and curing.
- C. Install backing materials in joints using blunt instrument to avoid puncturing.
 - 1. Do not twist backing while installing.
 - 2. Install backing so that joint depth is 50 percent of joint width, minimum 1/4 inch deep.
- D. Apply sealants in joints using pressure gun with nozzle cut to fit joint width.
- E. Place sealants in uniform, continuous beads without gaps or air pockets.
- F. Tool joints to required configuration within 10 minutes of sealant application.
- G. If masking materials are used, remove immediately after tooling.
- H. Seal joints adjacent to painted Work before the final coat of paint is applied.
- I. Verify adhesion of sealants to substrates.

3.5 CLEANING

- A. Remove spilled and excess materials adjacent to joints without damaging adjacent surfaces.
- B. Leave finished Work in neat, clean condition with no evidence of spillovers or damage to adjacent surfaces.

END OF SECTION

SECTION 08 11 00

METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Standard steel doors, 16 gauge.
2. Standard steel frames, 16 gauge for doors up to 42-inches in width.
3. Standard steel frames, 14 gauge for doors over 42-inches in width.
4. Standard steel frames, 16 gauge for glazed window openings.

B. Related Sections:

1. Section 08 14 16 - Flush Wood Doors.
2. Section 08 70 00 - Hardware.
3. Section 08 80 00 - Glazing.
4. Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

- A. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors & Frames.
- B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finished Painted Steel Surfaces for Steel Doors and Frames.
- C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings.
- D. ANSI/SDI 250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- E. ANSI/SDI 250.11 - Recommended Erection Instructions for Steel Frames.
- F. Steel Door Institute: SDI-111 - Recommended Standard Details for Steel Doors & Frames and Accessories.
- G. Steel Door Institute: SDI-113 - Test Procedure and Acceptance Criteria for Apparent Thermal Performance for Steel Door and Frame Assemblies.
- H. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
- I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- J. ASTM A659/A659M - Standard Specification for Commercial Steel, Sheet and Strip Carbon (0.16 percent Maximum, to 0.25 Percent Maximum), Hot-Rolled.

- K. ASTM A794 - Standard Specification for Commercial Steel, Sheet, Carbon, (0.16 percent Maximum to 0.25 percent Maximum) Cold-Rolled.
- L. ASTM A924/A924M - Standard Specification for General Requirements for Sheet Steel, Metallic-Coated by the Hot-Dip Process.
- M. ASTM D2201 - Standard Practice for Preparation of Zinc-Coated and Zinc Alloy-Coated Steel Panels for Testing Paint and Related Coating Products.
- N. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
- O. U.L. - Underwriters Laboratories Inc.
- P. Certification Listings; Warnock Hersey International Inc.
- Q. Additional Standards as referenced in ANSI/SDI A250.8.
- R. CCR - California Code of Regulations: Title 24, 2016 - California Building Code (CBC).

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data: Provide manufacturer's standard details and catalog data demonstrating compliance with referenced standards. Provide installation instructions.
- C. Certificates:
 - 1. Provide manufacturer's certification that products are in accordance with referenced standards and per architectural details.
 - 2. Provide evidence of manufacturer's membership in the Steel Door Institute.
- D. Shop Drawings: Submit for approval the following:
 - 1. Door, frame, and hardware schedule in accordance with SDI-111-D.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide all products from a single manufacturer who is a member of the Steel Door Institute.
- B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect products indoors, in a dry location, out of the way of construction activities:
 - 1. Store under cover.
 - 2. Place units on 4 inch high wood sills or in a manner that will prevent rust or damage.
 - 3. Do not use non-vented plastic or canvas shelters.
 - 4. Should wrappers become wet, remove immediately.
 - 5. Provide 1/4 inch space between doors to promote air circulation.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Steel Sheet for Doors and Frames:
 - 1. Cold rolled steel; ASTM A794 and A568.
 - 2. Hot rolled, pickled, and oiled steel; ASTM A659 and A568.
 - 3. Hot dipped zinc coated steel; ASTM A924 and A653: Class A40 for alloyed coatings or G60 for spangled coatings, minimum.
- B. Steel Sheet for Anchors and Accessories:
 - 1. Electrolytically deposited zinc coated steel; ASTM D2201 and ASTM A568: Class B (0.075 oz/sf), minimum.

2.2 MANUFACTURERS

- A. Steel Doors and Frames:
 - 1. Steelcraft, a subsidiary of Ingersoll-Rand.
 - 2. Ceco Door, a subsidiary of ASSA ABLOY.
 - 3. Security Metal Products, a subsidiary of ASSA ABLOY.
 - 4. Curries Company, a subsidiary of ASSA ABLOY.
 - 5. Titan Metal Products.
 - 6. Deansteel Manufacturing Company.
 - 7. Or equal.

2.3 STEEL DOORS

- A. Door Type: Seamless steel doors with composite construction.
- B. Provide metal doors of the types and styles indicated on the drawings and schedules, in accordance with ANSI/SDI A250.8 Level 3 "Extra Heavy-Duty", Model 2 "Seamless"; 16 gauge sheet steel; 1-3/4 inch door thickness.
- C. Construct doors in accordance with ANSI/SDI 250.8.
- D. For doors at fire-rated openings: Comply with NFPA 80:
 - 1. Affix permanent labels attesting to fire resistance.
- E. Finish: Factory primed in accordance with ANSI/SDI 250.10 and field painted.
- F. Construct full flush and seamless door cores as follows:
 - 1. Fire-rated doors: In accordance with listed construction.
 - 2. Honeycomb core.
 - 3. Polyurethane foam core.
 - 4. Polystyrene foam core.
 - 5. Unitized grid core.
 - 6. Steel stiffeners core.
- G. Provide inserted louvers in accordance with SDI-111-C where indicated on the drawings and schedules.

1. Type: Inverted “V” blade.

2.4 STEEL FRAMES

- A. Provide metal frames for door and window openings of the types and styles indicated on the drawings and schedules, in accordance with ANSI/SDI A250.8:
 1. For frame openings up to 42-inches in width: ANSI/SDI 250.8 Level 3 “Extra Heavy-Duty”; 16 gauge sheet steel, with fully welded mitered corners.
 2. For frame openings over 42-inches in width: ANSI/SDI 250.8 Level 4 “Maximum Duty”; 14 gauge sheet steel, with fully welded mitered corners.
- B. Construct frames in accordance with ANSI/SDI 250.8.
- C. For frames at fire-rated openings: Comply with NFPA 80:
 1. Affix permanent labels attesting to fire resistance.
- D. Finish: Factory primed in accordance with ANSI/SDI 250.10 and field painted.
- E. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike side jambs of single-door frames and 2 silencers on heads of double-door frames. Furnish and install rubber silencers.
- F. Provide metal frames for glazed window openings of the types and styles indicated on the drawings and schedules, in accordance with ANSI/SDI A250.8 Level 3 “Extra Heavy-Duty”; 16 gauge sheet steel, with fully welded mitered corners.
 1. Provide metal glazing stops in accordance with ANSI/SDI A250.8 matching the steel frame. Glazing stops shall be of the proper size and design to receive the glazing materials specified, and shall be pre-drilled for screw-attachment to the metal frame.

PART 3 EXECUTION

3.1 EXAMINATION

- A. The installer shall verify that project conditions are suitable before beginning installation of frames:
- B. Correct unsatisfactory condition before proceeding with installation.
- C. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install frames in accordance with ANSI/SDI 250.11 - Recommended Erection Instructions for Steel Frames.
- B. Install doors plumb and in true alignment and fasten to achieve the maximum operational effectiveness and appearance of the unit. Maintain clearances in accordance with ANSI 250.8, and with NFPA 80 at fire-rated door assemblies.

3.3 TOUCH-UP

- A. Prime Coat Touch-Up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

3.4 ADJUST AND CLEAN

- A. Adjust doors for proper operation, free from binding or other defects.
- B. Clean and restore soiled surfaces. Remove scraps and debris, and leave site and a clean condition.

END OF SECTION

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Solid core doors with wood veneer faces.
2. Shop priming of flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.
4. Vision panel frames.

B. Related Sections

1. Section 08 11 00 - Metal Door and Frames.
2. Section 08 70 00 - Hardware.
3. Section 08 80 00 - Glazing.
4. Section 08 70 00 - Hardware.
5. Section 09 90 00 - Painting and Coating.

1.2 REFERENCES

- A. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- B. ASTM E162 - Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
- C. WI - Woodwork Institute - Architectural Woodwork Standards.
- D. CCR - California Code of Regulations: Title 24, 2016 - California Building Code (CBC).
- E. Forest Stewardship Council (FSC).
- F. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
- G. U.L. - Underwriters Laboratories Inc.
- H. Certification Listings; Warnock Hersey International Inc.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data: Manufacturer's data for each type of door, including details of core and edge construction and trim for openings and louvers.
 1. For each composite-wood product used, documentation indicating that the bonding agent contains no urea formaldehyde.

2. Chain of custody (COC) certificates certifying that products specified to be made from certified wood comply with forest certification requirements.
 - C. Shop Drawings: Indicate location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, and other pertinent data
- 1.4 QUALITY ASSURANCE
- A. Quality Standard: Comply with the following standard.
 1. WI Quality Standard: "Architectural Woodwork Standards" of the Woodwork Institute for grade of door, core, construction, finish, and other requirements.
 2. Provide WI Certified Compliance Certificate indicating that doors meet requirements of grades specified.
 - B. Single-Source Responsibility: Obtain doors from one source and by a single manufacturer.
 - C. Forest Stewardship Council (FSC): Wood doors shall be produced from wood products that are certified in accordance with the Forest Stewardship Council's (FSC) Principals and Criteria for wood building components.
 - D. Fire-Rated Wood Doors: Provide wood doors that comply with NFPA 80; and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's instructions.
 1. Comply with WI Architectural Woodwork Standards, Section 2 – Care and Storage for delivery, storage, and handling of doors.
 - B. Identify each door with individual opening numbers as designated on shop drawings, using temporary, removable, or concealed markings
- 1.6 WARRANTY
- A. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form signed by Manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 1/4 inch in a 36 inch by 84 inch section or that show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3 inch span, or do not conform to tolerance limitations of referenced quality standards.
 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors where defect was not apparent prior to hanging.
 2. Warranty shall be in effect during the following period of time after date of Notice of Completion
 - a. Solid Core Interior Doors: 10-year minimum warranty

- B. Identify each door with individual opening numbers as designated on shop drawings, using temporary, removable, or concealed markings.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Interior Flush Wood Doors / Non-Rated Solid Core: Comply with the following requirements:
1. Faces: White birch, plain sliced to match existing.
 2. Grade: Custom.
 3. Construction: Manufacturer's standard core construction.
 4. Blocking: Provide composite blocking designed to maintain fire resistance of door but with improved screw-holding capability of same thickness as core and with minimum dimensions as follows:
 - a. 5 inch top rail blocking.
 - b. 5 inch bottom rail blocking.
 - c. 5 inch by 18 inch lock blocks.
 - d. 5 inch midrail blocking
 5. Edge Construction: Provide manufacturer's standard laminated-edge construction for improved screw-holding capability and split resistance as compared to edges composed of a single layer of treated lumber.
- B. Interior Flush Wood Doors / Fire-Rated Solid Core: Comply with the following requirements:
1. Faces: White birch, plain sliced to match existing.
 2. Grade: Custom.
 3. Construction: Manufacturer's standard core construction as required to provide fire-resistance rating indicated. Comply with NFPA 80.
 4. Blocking: Provide composite blocking designed to maintain fire resistance of door but with improved screw-holding capability of same thickness as core and with minimum dimensions as follows:
 - a. 5 inch top rail blocking.
 - b. 5 inch bottom rail blocking.
 - c. 5 inch by 18 inch lock blocks.
 - d. 5 inch mid-rail blocking.
 5. Edge Construction: Provide manufacturer's standard laminated-edge construction for improved screw-holding capability and split resistance as compared to edges composed of a single layer of treated lumber.
 6. Affix permanent label attesting to fire resistance of the door to the hinge side edge of the door.
- C. Vision Panel Frames: Sizes, types, and profiles indicated on the drawings and schedules.
1. Manufacturer's standard frame formed of 0.0478 inch thick cold-rolled steel sheet, factory primed.
 2. At fire-rated doors assemblies the vision panel frames shall be approved for use in doors of the fire-rating indicated.

2.2 MANUFACTURERS

- A. Interior Flush Wood Doors:
 - 1. Jeld-Wen, Inc.
 - 2. Graham Wood Doors, a subsidiary of ASSA ABLOY.
 - 3. Mohawk Flush Doors, a subsidiary of Masonite International.
 - 4. CraftMaster Interior Doors, a subsidiary of Craftmaster Manufacturing, Inc.
 - 5. Or equal.

- B. Vision Panel Frames: 20 gauge cold rolled steel; with grey primer finish at doors to receive painted finish; with bronze baked enamel finish at doors to receive transparent stain finish.
 - 1. Anemostat Door Products: LoPro Standard Metal Vision Frame
 - 2. Or equal.

2.3 FABRICATION

- A. Fabricate flush wood doors to comply with following requirements:
 - 1. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels:
 - 2. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame shop drawings, DHI A115-W series standards, and hardware templates.
 - a. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with factory machining.

- B. Openings: Cut and finish openings through doors at the factory to comply with applicable requirements of referenced standards:
 - 1. Vision Panel Openings: Of sizes and locations in doors as indicated on the drawings and schedule

2.4 SHOP PRIMING

- A. Transparent Stain Finish: Shop-seal faces and edges of doors for transparent finish with stain, other required pretreatments, and first coat of finish as specified in Section 09 90 00 - Painting and Coating, for wood doors that are indicated on the drawings and schedules to receive a transparent stain finish.

- B. Painted Finish: Shop-seal faces and edges of doors for painted finish with primer, other required pretreatments, and first coat of finish as specified in Section 09 90 00 - Painting and Coating, for wood doors that are indicated on the drawings and schedules to receive a painted finish

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are satisfactory for installation.
- B. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install door in accordance with manufacturer's instructions and approved shop drawings.
- B. Install traffic door, free from warp, twist, or distortion.

3.3 ADJUSTMENTS

- A. Adjust doors for smooth, even operation and required strip overlap.

3.4 CLEANING

- A. Clean surfaces, touch up finish coats, and prepare for finish painting where indicated.

END OF SECTION

SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall access doors.
2. Ceiling access doors.
3. Related hardware.

B. Related Sections:

1. Section 08 70 00 - Door Hardware.
2. Section 09 21 16 - Gypsum Board Assemblies.
3. Section 09 30 13 - Ceramic Tiling.
4. Section 09 90 00 - Painting and Coating.
5. Division 22 – Fire Suppression.
6. Division 22 - Plumbing.
7. Division 23 - Heating, Ventilating, and Air Conditioning.
8. Division 26 - Electrical.

1.2 REFERENCES

- A. UL - Underwriters' Laboratories, Inc.: Fire Hazard Classifications.
- B. ASTM A568 - Steel Sheet, Carbon and High Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
- C. ASTM A653/A653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM E162 - Test method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
- F. CCR - California Code of Regulations, Title 24 - 2016 California Building Code (CBC).

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data: Manufacturer's standard descriptive literature.
- C. Shop Drawings: Indicate locations, materials, dimensions, product configuration, finish, fire ratings, and attachment to adjacent construction.

- D. Manufacturer's installation instructions.

1.4 SYSTEM REQUIREMENTS

- A. Access Doors: Provide wall and ceiling access doors as indicated and as required for access to equipment.
- B. Coordinate locations of equipment with access doors of size and type appropriate for the use and location.
- C. All access door assemblies requiring fire resistance ratings shall bear either UL, W.H. or F.M. labels for class required. Labels shall be attached to door and frame.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Company with minimum five (5) years experience in the manufacture of products of the type specified; regularly and presently engaged in product manufacture.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's standard protective packaging.
- B. Do not remove protective packaging until ready for installation.
- C. Follow manufacturer's instructions for storage and handling.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the Work of this Section with other Sections whose work affects or is affected by the Work of this Section.
- B. Coordinate the building-in of anchors and similar items.

PART 2 PRODUCTS

2.1 ACCESS DOORS

- A. Manufacturer/Type: Metal access doors and fire rated metal access doors shall be:
 - 1. Milcor Incorporated Rated and Non-Rated Models DW, M, AT, ATR, FR, and PW doors.
 - 2. J.L. Industries Rated and Non Rated Models WB, TM, CT, FRC, FD and K doors.
 - 3. Nystrom Rated and Non-Rated Models APWB, APTM, APA, APAW, APFR (Series) and APPW.
 - 4. Or equal.
- B. Finish: Factory prime coated for paint finish; refer to Section 099000 Painting and Coating.
- C. Locks: Provide key operated 6-pin cylindrical type cylinder locks. Coordinate keying

with the Owner's Representative.

- D. Furnish anchorage suitable to the construction at location of the access door.
- E. Panels shall be selected from the products listed to accommodate ceiling or wall fire rating and to match adjacent ceiling or wall finish material unless otherwise noted.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify rough openings for doors and frames are correctly sized and located for access to items behind frames.
- B. Verify correct placement of built-in frames and accessories.
- C. Verify that conditions are satisfactory for the installation of doors.
- D. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install access doors in accordance with manufacturer's instructions and approved shop drawings.
- B. Secure rigidly in place in accordance with approved shop drawings.
- C. Install frames plumb and level in wall and ceiling openings, parallel to building lines.
- D. Position to provide convenient access to valves, ductwork, and other mechanical and electrical work requiring access as indicated and directed.

3.3 CLEANING, ADJUSTMENTS, AND PROTECTION

- A. Clean and adjust for smooth, even operation.
- B. Protect finished installation.

END OF SECTION

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum Storefront System.
2. Aluminum Storefront Entrance Door System.
3. Glass and glazing of systems; entrance door hardware and components; storefront framing, perimeter trims, accessories, shims and anchors, and perimeter sealing of storefront.

B. Related Sections:

1. Section 07 90 00 - Joint Protection.
2. Section 08 70 00 - Hardware.
3. Section 08 80 00 - Glazing.

1.2 REFERENCES

- A. AA - Aluminum Association.
- B. American Architectural Manufacturers Association - AAMA 501.
- C. American Architectural Manufacturers Association - AAMA 507.
- D. American Architectural Manufacturers Association - AAMA 1801.
- E. ASTM B221 - Aluminum Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
- F. ASTM B 456 - Standard Specification for Electrodeposited Coatings of Copper plus Nickel plus Chromium and Nickel plus Chromium.
- G. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- H. ASTM C141 - Standard Guide for Structural Sealant Glazing.
- I. ASTM E283 - Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors.
- J. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

- K. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- L. ASTM E1425 - Standard Practice for Determining the Acoustical Performance of Windows, Doors, Skylight, and Glazed Wall Systems.
- M. National Fenestration Rating Council – NFRC 100: Procedure for Determining Fenestration Product U-Factors.
- N. National Fenestration Rating Council – NFRC 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- O. National Fenestration Rating Council – NFRC 500: Procedure for Determining Fenestration Product Condensation Resistance Values.
- P. CCR - California Code of Regulations, Title 24 - 2016 California Building Code (CBC).

1.3 PERFORMANCE

- A. General Performance: Aluminum-framed storefront system shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
 - 1. Design Wind Loads: Determine design wind loads applicable to the Project from basic wind speed indicated in miles per hour, according to ASCE 7, Chapter 27 (Directional Procedure), and Chapter 30 (Components and Cladding), based on mean roof heights above grade indicated on Drawings.
 - a. Basic Wind Speed: 89 MPH; 115 MPH (ultimate).
 - b. Risk Category: III.
 - c. Exposure Category: C.
- B. Aluminum Framed Entrance Performance Requirements:
 - 1. Wind loads: Provide storefront system, including anchorage, capable of withstanding wind load design pressures of 30 lbs./sq. ft. inward and 30 lbs./sq. ft. outward.
 - 2. Air Infiltration: For single acting offset pivot or butt hung entrances in the closed and locked position, the test specimen shall be tested in accordance with ASTM E283 at a pressure differential of 6.24 psf (300 Pa) for single doors and 1.567 psf for pairs of doors. A single 3'-0" x 7'-0" (915 mm x 2134 mm) entrance door and frame shall not exceed 0.50 cfm per square foot. A pair of 6'-0" x 7'-0" (1830 mm x 2134mm) entrance doors and frame shall not exceed 1.0 cfm per square foot.

C. Storefront System Performance Requirements:

1. Air Infiltration: The test specimen shall be tested in accordance with ASTM E283. Air infiltration rate shall not exceed 0.06 cfm/ft² (0.3 l/s · m²) at a static air pressure differential of 6.24 psf (300 Pa).
2. Water Resistance: The test specimen shall be tested in accordance with ASTM E331. There shall be no leakage at a minimum static air pressure differential of 8 psf (383 Pa) as defined in AAMA 501.
3. Uniform Load: A static air design load of 20 psf (958 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.
4. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data: Provide manufacturer's information on materials and finishes.
- C. Shop Drawings: Include wall opening and component dimensions; wall opening tolerances required; anchorage and fasteners; affected related work; sections of typical members, operational clearances, details of accessories, and installation details.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type, class, grade, and size of aluminum-framed entrance doors. Test results based on use of downsized test units will not be accepted.
- E. Manufacturer's Installation Requirements: Indicate special installation requirements.
- F. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware. Comply with the provisions of Section 08 70 00 – Hardware.
- G. Samples:
 1. Submit five samples 6 inches long of each actual extrusion to be used in the system, and five sets of samples of the manufactures standard colors range of the specified finish applied to the extrusion material for the final color selection by the Owner's Representative.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: A minimum of five years experience in the manufacture and fabrication of aluminum-framed entrance doors and storefronts that meet or exceed the performance requirements specified herein.
- B. Installer Qualifications: Acceptable to the manufacturer with a minimum of three (3) years experience installing the same or similar type units specified for this Project, and having successful experience with other projects of similar size and scope.
- C. Single Source: Obtain aluminum-framed entrance doors and storefront system through one source from a single manufacturer.
- D. Pre-installation Conference: Conduct conference at Project site in accordance with the provisions of Division 01.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of aluminum-framed storefront openings by field measurements before fabrication and indicate field measurements on shop drawings prior to submittal to the Owner's Representative for approval.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

1.8 WARRANTY

- A. Manufacturer's Warranty: The manufacturer of the aluminum-framed entrances and storefronts shall provide a standard two year warranty from date of Notice of Completion, covering the materials and equipment installed as part of this Work against defects in material and workmanship.
- B. Installer's Warranty: The installer of the aluminum-framed entrances and storefronts shall provide a standard one year warranty from date of Notice of Completion, covering the installation of the Work against defects in workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. (Basis of Design) Kawneer Company Inc.:

1. Storefront System: "EnCORE" Shear Block Type-B System: Front Glazing Plane; 1-3/4" x 4-1/2" Framing System with Thermal Break.
2. Entrances: 350 Tuffline; 3-1/2" Stile and Top Rail; 10" min. ADA Bottom Rail.
3. Glazing Pockets: For 1" insulated glazing as specified in Section 08 80 00 - Glazing.

B. Oldcastle BuildingEnvelope.

C. U.S. Aluminum: C.R. Laurence Co., Inc.

D. Or equal.

2.2 MATERIALS

A. Aluminum Extrusions:

1. Storefront System: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.
2. Entrances: Alloy and temper recommended by sliding aluminum-framed glass door manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.090" wall thickness at any location for the main frame and sash members.
 - a. Major portions of the door members to be 0.188" (4.8mm) nominal in thickness and glazing molding to be 0.05" (1.5mm) thick.
 - b. Glazing gaskets shall be either EPDM elastomeric extrusions or a thermoplastic elastomer.
 - c. Provide adjustable glass jacks to help center the glass in the door opening.

B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window and door members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

- E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.
- F. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.
- G. Storefront Framing:
 - 1. Storefront framing to be 1-3/4" x 4-1/2" system with thermal break utilizing Polymer glazing clips.
 - 2. Non-Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.
 - 3. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials. Where exposed shall be stainless steel.
 - 4. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

2.3 FABRICATION

A. Storefront System:

- 1. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 - a. Profiles that are sharp, straight, and free of defects or deformations.
 - b. Accurately fit joints; make joints flush, hairline and weatherproof.
 - c. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 - d. Physical and thermal isolation of glazing from framing members.
 - e. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - f. Provisions for field replacement of glazing.
 - g. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- 2. Storefront Framing: Fabricate components for assembly using manufactures standard installation instructions.
- 3. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

B. Storefront Entrances:

- 1. Fabricate aluminum-framed glass entrance doors in sizes indicated. Include a complete system for assembling components and anchoring doors.

2. Fabricate aluminum-framed glass doors that can be re-glazed without dismantling perimeter framing.
 - a. Door corner construction shall consist of mechanical clip fastening, SIGMA deep penetration plug welds and 1-1/8" (29 mm) long fillet welds inside and outside of all four corners. Glazing stops shall be hook-in type with EPDM glazing gaskets reinforced with non-stretchable cord.
 - b. Accurately fit and secure joints and corners. Make joints hairline in appearance.
 - c. Prepare components with internal reinforcement for door hardware.
 - d. Arrange fasteners and attachments to conceal from view.
3. Weatherstripping: Provide weatherstripping locked into extruded grooves in door panels or frames as indicated on manufactures drawings and details.

2.4 GLAZING

- A. Glass and Glazing Materials: As specified herein, and in accordance with the provisions of Section 08 80 00 - Glazing.
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
- D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
- E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows
 1. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
 - a. Color: Black
 2. Weather-seal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
 - a. Color: Matching structural sealant

2.5 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 07 90 00 - Joint Protection.
- B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil (0.762 mm) thickness per coat.

2.6 ENTRANCE HARDWARE

- A. General: As specified herein, as indicated in the Hardware Group Schedule on the Drawings, and in accordance with the provisions of Section 08 70 00 - Hardware.
 - 1. Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely aluminum-framed entrance doors.
- B. Weatherstripping: Meeting stiles on pairs of doors shall be equipped with an adjustable astragal utilizing wool pile with polymeric fin. The door perimeter weatherstripping on a single acting offset pivot or butt hung door and frame (single or pairs) shall be comprised of a thermoplastic elastomer weathering on a tubular shape with a semi-rigid polymeric backing.
- C. Sill Sweep Strips / Door Shoe: EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners (Necessary to meet specified performance tests). Comply with 2016 California Building Code (CBC) Chapter 11B.
- D. Threshold: Extruded aluminum, one piece per door opening, with ribbed surface. Comply with 2016 California Building Code (CBC) Chapter 11B.
- E. Hinges: As recommended by the storefront entrance manufacturer for heavy traffic door use rating.
- F. Door Closers: Comply with 2016 California Building Code (CBC) Chapter 11B.
- G. Exit Devices: Concealed vertical rod panic exit device with lever handle exterior trim.
- H. Cylinders: In accordance with the provisions of Section 08 70 00 – Hardware.
- I. Other Hardware Items: Provide as required to complete the intended installation in accordance with the provisions of Section 08 70 00 – Hardware.

2.7 FINISHES

- A. General: Comply with AAMA-AFPA "Anodic Finishes/Painted Aluminum" for recommendations for applying and designating finishes.
 - 1. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Finish; AA Standard AA-M12C22A42: Class 1, anodized finish, color as selected by the Owner's Representative.
- C. Concealed Steel Items: Galvanized in accordance with ASTM A153/A153M to 2.0 oz/sq ft.

- D. Apply one coat bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather-tight installation.
- B. Verify that conditions are satisfactory for the installation of the Work.
- C. Verify wall openings and field dimensions are as indicated on shop drawings.
- D. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install aluminum-framed entrances and storefront systems, hardware, accessories, and other components in compliance with the Drawings, approved Shop Drawings, and the manufacturer's written instructions.
- B. Install aluminum-framed entrances and storefront systems level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- C. Set entrance threshold and storefront sill members in bed of sealant or with gaskets, as indicated, for weather-tight construction.
- D. Install aluminum framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within sliding door to the exterior.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- F. Where priming is required, apply the priming before the storefront system is installed.
- G. Install perimeter sealant in accordance with the manufacturer's installation instructions and the provisions of Section 07 90 00 - Joint Protection to achieve a weather-tight seal.
- H. Give special attention to the proper cleaning of surfaces in contact with sealant.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide periodic site visit by manufacturer's field service representative at beginning of the installation and as further requested by the Owner's Representative.

3.4 ADJUSTMENT, CLEANING, AND PROTECTION

- A. Clean aluminum surfaces immediately after installing aluminum-framed entrances and storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 08 70 00

HARDWARE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Builders hardware for doors and frames.
 - 2. Thresholds.
 - 3. Gasketing.
 - 4. Related accessories and components.

- B. Related Documents and Sections:
 - 1. Section 08 11 00 - Metal Doors and Frames.
 - 2. Section 08 14 16 - Flush Wood Doors
 - 3. Section 08 31 13 - Access Doors and Frames: Hardware associated with access doors.
 - 4. Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.
 - 5. Division 26 - Security System.

1.2 REFERENCES

- A. ICC/ANSI A117.1 – Standard on Accessible and Usable Buildings.
- B. NFPA 80 – Standard for Fire Doors and Fire Windows.
- C. ANSI/BHMA A156.13 - Mortise Locks and Latches.
- D. ASTM A307– Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- E. BHMA - Builders' Hardware Manufacturers Association.
- F. SDI - Steel Door Institute.
- G. UL - Underwriters' Laboratories, Inc.
- H. CCR - California Code of Regulations, Title 24 - 2016 California Building Code (CBC).

1.3 COORDINATION

- A. Coordinate Work of this Section with other affected Sections involving manufacturer of internal reinforcement for door hardware.
- B. Coordinate installation with finishing operations.

1.4 DEFINITIONS

- A. Finish Hardware Installer: Shall be the Contractor or a sub-contractor under the Contractor, and shall be responsible for the installation of the equipment specified in this Section.
- B. Door Control System Installer: Shall be the Building Security System Installer in accordance with the provisions of Division 26.

1.5 QUALITY ASSURANCE

- A. Finish Designations and Standards: BHMA Standard 130.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Indicate locations and mounting heights of each type of hardware.
- C. Product Data: Include data for all hardware items.
- D. Shop Drawing Hardware Schedule:
 - 1. Indicate complete hardware schedule by door number indicated on drawings, including complete list of products, model numbers, and ANSI or BHMA number.
- E. Samples: When substitutions are proposed, submit samples of both specified item and proposed item for comparison.
- F. Operating and Maintenance Data: Include data on operating hardware, lubrication requirements, inspection procedures related to preventative maintenance, parts catalog, and keying records.
- G. Submit manufacturer's certificate that products meet or exceed specified requirements, and bear UL label where required.
- H. Submit sample of each lock and lock function without operators.
- I. Manufacturer's installation instructions.
 - 1. Include instructions for handling, storage, and protection of each product.
- J. Warranty: Special warranty specified in this Section.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery:
 - 1. Inspect all components for damage upon receipt, and remove and replace (or repair if authorized by the Owner's Representative) damaged items prior to delivery.
- B. Tag or package each item. Indicate for each item:
 - 1. Building, room, and door number as shown on drawings and schedules.
 - 2. Hardware size, handing, and type.
 - 3. Template.

- C. Keys:
 - 1. The Owner's Representative will be responsible for key issue during construction.

- D. Protect finishes by temporary coverings as required.

1.8 SEQUENCING, SCHEDULING, AND COORDINATION

- A. Where items specified under this Section is to be built into work specified under other Sections, provide those items to such other Sections and in a timely fashion to avoid delay of work. Coordinate placement; verify accurate locations and correct installation.
- B. Coordinate the Work of this Section with other Sections affecting or affected by the Work of this Section.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard or custom form in which manufacturer, Installer, and Contractor jointly and severally agree to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of operators and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. The warranty shall be signed by officers of each company.
 - 3. Warranty Period: Two (2) years from date of Project completion except as follows:
 - a. Exit Devices: Ten (10) years from date of Project completion.
 - b. Manual Closers: Ten (10) years from date of Project completion.

1.10 MAINTENANCE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

1.11 SPARE PARTS

- A. Provide hardware, including spares, as indicated on the drawings and as specified herein.
- B. Furnish 3 sets of lock tools.
- C. Deliver spare parts and lock tools, boxed and identified, to the Owner's Representative.

PART 2 PRODUCTS

2.1 LOCKSETS AND LATCHSETS

A. Lever Handle Lock Devices:

1. Manufacturers:
 - a. Schlage; D Series with #17 lever trim.
 - b. Or equal.
2. Description; Locksets and latchsets with latch bolt providing a 3/4 inch throw; 1 inch throw deadbolt where applicable; 2 3/4 inch backset. Provide with strikes appropriate to location and function.
3. Function of locks as per lock type indicated on drawings.
4. At doors with intrusion/access alarm system additionally provide:
 - a. Electromechanical latch retraction function to Schlage D Series lock; fail safe or fail secure as indicated on the Hardware Group Schedule.
 - b. Frame to door power transfer: Von Duprin EPT Electric Power Transfer device or Stanley "CE" concealed electric hinge, as indicated on the Hardware Group Schedule.
 - e. Other components not specified, but required to provide a fully functional security system as specified in Division 26 - Security System.

B. Cylinders:

1. Manufacturers:
 - a. Schlage; 30-001 cylinder.
 - b. Or equal.
2. Manufacturer's standard cylinder body with cylinder plug removable only by removal of cylinder body from lock case.
3. Cylinder Plug: Open at rear to allow clearing of obstructions.
4. Key Cutting, Cylinder Maintenance, Re-keying: Possible using industry standard equipment. Cylinders requiring manufacturer specific equipment will not be accepted.
5. Interchangeable cores removable by use of special change key will not be accepted.

2.2 LOCK PROTECTORS

A. Manufacturers:

1. Lock Protector: Glynn Johnson LP Series as required to suit lock trim, stainless steel.
2. Or equal.

2.3 DOOR CLOSERS

A. Closer:

1. Manufacturers:
 - a. LCN; 4041 Series.
 - b. Or equal.
2. Description:
 - a. Adjustable; concealed in head.
 - b. Provide back check on closers at exterior doors swinging out.

- B. Power Closer:
 - 1. Manufacturers:
 - a. Stanley; D-4990 Low Energy Operator.
 - b. Or equal.
 - 2. Provide two (2) push plate activating switches (for mounting one high and one low) for each door installation. Equal to Precision Hardware Model CL2216; 6 inch diameter stainless steel round push plate with accessibility logo and "Push to Open" text.
 - a. Provide all accessories necessary to provide for a hard-wire activation switch installation and switch interface with electric latch retraction devices.
 - 3. Provide PS-490 24VDC, 0.5A power supply mounted within the D-4990 Low Energy Operator housing.
 - 4. Description:
 - a. May be used with electric latch retraction exit devices, electric strikes, and other electric locking systems. A time delay function is built into the control system eliminating the need for supplemental relays or controls.
 - b. Upon receipt of an activation signal, the operator will power open the door from the closed position. The door may be held in the open position up to 28 seconds (compliance with ANSI/BHMA A156.19 requires the door to remain in the open position for a 5 second minimum). "Hold-open" switch is provided to hold the door open for extended periods.

2.4 HINGES

- A. Description: Clear swing.
- B. Size hinges to door size and weight, to clear trim, and allow 170 degree minimum door swing.
- C. Butt Hinges at Exterior Openings:
 - 1. Manufacturers:
 - a. Stanley FBB 199.
 - b. Hager Co. BB 1199.
 - c. Or equal.
 - 2. Description:
 - a. Finish: Stainless steel with stainless steel pin.
 - b. Five Knuckle Full mortise, ball bearing. Non-rising removable pin with button tip and plug
 - 3. At doors with intrusion/access alarm system provide as indicated on the Hardware Group Schedule:
 - a. Stanley "CE" concealed electric hinge.
 - b. Five Knuckle Full mortise, ball bearing. Non-rising removable pin with button tip and plug.
- D. Butt Hinges at Interior Openings:
 - 1. Manufacturers:
 - a. Stanley FBB 191.
 - b. Hager Co. BB 1191.
 - c. Or equal.

2. Description:
 - a. Finish: Stainless steel with stainless steel pin.
 - b. Five Knuckle Full mortise, ball bearing. Non-rising removable pin with button tip and plug.
3. At doors with intrusion/access alarm system provide as indicated on the Hardware Group Schedule:
 - a. Stanley "CE" concealed electric hinge.
 - b. Five Knuckle Full mortise, ball bearing. Non-rising removable pin with button tip and plug.

2.5 DOOR STOPS

- A. Wall Stops:
 1. Manufacturer:
 - a. Ives; WS402CCV (402-1/2) Wall Bumper; concave rubber bumper which avoids damage to locks with projecting buttons; with screw and drywall anchor.
 - b. Or equal.
- B. Floor Stops:
 1. Manufacturer:
 - a. Ives; FS13 Dome Stop (no threshold); FS17 Dome Stop (doors with threshold).
 - b. Or equal.

2.6 EXIT DEVICES

- A. Exit Devices:
 1. Manufacturer:
 - a. At single doors: Von Duprin 98 Series (hex key dogging); mortise lock; Schlage 30-001 cylinder; lever trim.
 - b. At door pairs: Von Duprin 98 Series (hex key dogging); concealed vertical rod or surface mounted vertical rod latching device as indicated on the Hardware Group Schedule; Schlage 30-001 cylinder; lever trim.
 2. Provide breakaway lever trim at exterior doors where lever trim is used.
 3. At doors with intrusion/access alarm system additionally provide:
 - a. Von Duprin ALK Alarm Kit option.
 - b. Von Duprin QEL Quiet Electric Latch Retraction option; fail safe or fail secure as indicated on the Hardware Group Schedule.
 - c. Von Duprin RX2 Double Request to Exit feature utilizing two (2) RX switches.
 - d. Frame to door power transfer: Von Duprin EPT Electric Power Transfer device or Stanley "CE" concealed electric hinge, as indicated on the Hardware Group Schedule.
 - e. Other components not specified, but required to provide a fully functional security system as specified in Division 26 - Security System

2.7 BOLTS AND COORDINATORS

- A. Automatic Flush Bolts:
 1. Manufacturers:
 - a. Ives; FB31P top and bottom bolts (pair) for metal doors.

- b. Ives: FB41P top and bottom bolts (pair) for wood doors.
- 2. Provide Ives DPI strike at door head and DP2 dustproof strike at floor.
- 3. Or equal.

- B. Manual Flush Bolts:
 - 1. Manufacturers:
 - a. Ives; FB457 top or bottom bolts (2 required) for metal doors.
 - b. Ives: FB358 top or bottom bolts (2 required) for wood doors.
 - 2. Provide Ives DPI strike at door head and DP2 dustproof strike at floor.
 - 3. Or equal.

- C. Door Coordinators:
 - 1. Manufacturers:
 - a. Glynn Johnson; COR Series.
 - b. Or equal.

2.8 THRESHOLDS, WEATHERSTRIPPING, AND SMOKE GASKETS

- A. Thresholds:
 - 1. Manufacturers:
 - a. Pemko; Models as indicated on Drawings and Schedule.
 - 2. Description:
 - a. Mill Finish Aluminum.
 - b. Set thresholds in mastic and fasten with flat head security screws on six inch centers.
 - c. Provide required bolt cutouts.

- B. Weatherstripping:
 - 1. Manufacturers:
 - a. Pemko; Model S88D.
 - 2. Description:
 - a. Surface applied on stop with pressure sensitive adhesive:
 - 1) At jambs and head attached to frame.
 - 2) At meeting center edge of exterior door pairs attached to in-active door leaf.

- C. Combination Fire / Hot Smoke Seal:
 - 1. Manufacturers:
 - a. Pemko; Model HSS2000xS88D (at jambs and head).
 - b. Pemko; Model HSS2000 (at meeting center edge of wood door pairs).
 - 2. Description:
 - a. Surface applied with pressure sensitive adhesive per manufacturer's instructions:
 - 1) At jambs and head attached to door frame.
 - 2) At meeting center edge of wood door pairs provide HSS2000 attached to in-active door leaf; dado into door edge to flush-out even with surface.
 - 3) Provide combination fire / hot smoke seal on all fire-labeled doors.

- D. Door Shoe – 211APK:
 - 1. Manufacturers:
 - a. Pemko; Model 211APK.
 - b. Or equal.

2. Description:
 - a. Door shoe with seal.
- 2.9 MISCELLANEOUS ITEMS
- A. Door Rain Drip Cap:
 1. Manufacturers:
 - a. National Guard Products: Model 16AD and 16DKB
 - b. Or equal.
 - B. Door Kickplate:
 1. Manufacturers:
 - a. Trimco
 - b. Or equal.
 2. Stainless steel; .064 inch thick; minimum 10 inches high by width of door leaf less 1 inch; countersunk attachment holes to provide for flush finished surface to conform to accessibility requirements.
 3. Install on push side of door, unless indicated in Hardware Group Schedule for both sides.
- 2.10 FASTENERS AND ADHESIVES
- A. Fasteners:
 1. Exposed Screws, Bolts, Nuts; ASTM A307: Grade A.
 2. Screw Thread Adhesive Sealant; Loctite No. 271.
 3. Exposed screws shall match hardware finish or, if exposed in surfaces of other work, match finish of other work.
 - B. Adhesives:
 1. Epoxy; minimum 2300 psi.
 2. Manufacturers:
 - a. Hilti; C100.
 - b. Or equal.
- 2.11 MANUFACTURED UNITS
- A. Provide hardware for fire rated openings in compliance with UL and NFPA 80.
 - B. Furnish items of hardware for proper door swing.
 - C. On doors which might prove dangerous to visually impaired persons, provide knurling on knobs or lever handles. Doors include, but are not limited to, doors to mechanical rooms, electrical closets, loading platforms or stairs.
- 2.12 FINISHES
- A. Provide US26D / ANSI/BHMA 626 finish on all hardware, unless otherwise indicated.

2.13 KEYING

- A. Construction Keying:
 - 1. Furnish four construction master keys.
 - 2. The Owner's Representative will be responsible for key issue during construction.
- B. Permanent Keying:
 - 1. Furnish four permanent master keys.
 - 2. Key in accordance with Key Schedule to be provided by the Owner's Representative.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions are suitable for installation of the Work of this Section.
- B. Do not begin installation until unsatisfactory conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings.
- B. Use the templates provided by hardware item manufacturer.
- C. Protect hardware from final painting and finishing operations.
- D. Permanently install hardware after finishing operations are complete.
- E. Unless otherwise indicated:
 - 1. Use SDI mounting heights for hardware; in accordance with CCR, Title 24, Part 2, 2016 CBC Section 11B-404.2.7 for hand activated locking and latching devices.
 - 2. Door hardware shall comply with CCR, Title 24, Part 2, 2016 CBC Sections 11B-309.4, 11B-404.2.5, 11B-404.2.7, 11B-404.2.8, 11B-404.2.9, 11B-404.2.10, and 11B-404.2.11.
 - 3. Automatic and/or power-assisted door hardware shall comply with CCR, Title 24, Part 2, 2016 CBC Section 11B-404.3.
 - 4. On pairs of doors, active leaf shall be right side as viewed from the push side of doors.
- F. Install floor mounted door stops using epoxy in pre-drilled holes in concrete.

3.3 ADJUST AND CLEAN

- A. Adjust doors for smooth and balanced movement through full swing (170 degrees):
 - 1. Maximum effort to manually operate doors shall not exceed 5 pounds for exterior and interior doors; such pull or push effort being applied at right angles to hinged doors and at the center plane of sliding doors with all hardware installed.
 - 2. The maximum effort required to operate fire rated doors may be increased to 15 pounds maximum when allowed by the appropriate administrative authority (SFM).

- B. Adjust and check each operating item of hardware to ensure proper operation or function:
 - 1. Lubricate moving parts with lubricant recommended by manufacturer.
 - 2. Replace units which cannot be adjusted and lubricated to operate smoothly.
- C. When hardware is installed more than one month prior to final acceptance, during week prior to acceptance, check and adjust all hardware items.

3.4 SCHEDULE

- A. Refer to Hardware Group Schedule provided on the Drawings.
- B. The Contractor and hardware supplier shall confirm field measurements and field conditions necessary to facilitate the Work of this Section prior to making the hardware submittal. The Contractor and hardware supplier shall be responsible for doing their own take-off independent of the Hardware Group Schedule. Hardware for a complete installation is required, whether or not the items are specifically mentioned in the Hardware Group Schedule or specified in this Section. Any discrepancies shall be brought to the attention of the Owner's Representative via notation at the front of the hardware submittal. Refer to the door schedule and/or floor plans and/or sill details in the Drawings for threshold types, door protection, and additional hardware related information.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass and glazing for doors, and windows.

B. Related Sections:

1. Section 07 90 00 - Joint Protection.
2. Section 08 11 00 - Metal Doors and Frames.
3. Section 08 14 16 - Flush Wood Doors.
4. Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.

1.2 REFERENCES

- A. ANSI Z97.1 - Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- B. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks and Spacers.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- D. ASTM C1036 - Standard Specification for Flat Glass.
- E. ASTM C1048 - Standard Specification for Heat Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
- F. ASTM D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
- G. ASTM D2240 - Standard Test Method for Rubber Property - Durometer Hardness.
- H. Consumer Product Safety Commission, CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- I. ASTM E783 - Field Measurement of Air Leakage through Installed Exterior Windows and Doors.
- J. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Wall by Uniform or Cyclic Static Air Pressure.
- K. American Architectural Manufacturers Association (AAMA) - AAMA 502-08 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
- L. CCR - California Code of Regulations, Title 24 - 2016 California Building Code (CBC).

- M. ASTM E 119 - Fire Tests of Building Construction Materials.
- N. ASTM E 2010 - Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.
- O. ASTM E 2074 - Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
- P. ASTM F 1915 - Standard Test Methods for Glazing for Detention Facilities
- Q. CSFM - Fire Tests for Doors and Window Assemblies.
- R. GANA - Glazing Manual.
- S. GANA - Sealant Manual.
- T. GANA PCR for Flat Glass: UN CPC 3711 Product Category Rule for Environmental Product Declarations.
- U. ISO 14025 Environmental labels and declarations, -Type III environmental declarations - principles and procedures.
- V. ISO 21930 Buildings and constructed assets, -Sustainability in building construction - Environmental declaration of building products.
- W. ISO 14040 series of standards, Environmental management - Life cycle assessment.
- X. ISO 15686-1 Buildings and constructed assets - Service life planning - Part 1: General principle.
- Y. ISO/DIS 15686-8 Buildings and constructed assets - Service life planning - Part 8: Reference service life.
- Z. NFPA 80 - Fire Doors and Windows.
- AA. NFPA 251 - Fire Test for Fire Endurance of Building Construction and Materials.
- BB. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
- CC. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies.
- DD. UL 9 - Fire Tests of Window Assemblies.
- EE. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
- FF. UL 10B - Fire Tests of Door Assemblies.
- GG. UL 263 - Fire Resistance Ratings.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data: Manufacturer's information on glass and glazing materials, special handling instructions, and installation instructions.
 - 1. For adhesives and sealants used inside of the weatherproofing system, include printed statement of VOC content.
- C. Shop Drawings: Show full size glazing details for each type of framing condition.
- D. Samples: Three 12 inch by 12 inch examples of each glass type specified.
- E. Manufacturer's Certificates: Certifications which indicate that materials meet specified requirements.
- F. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

- A. Materials, as applicable, shall conform to ANSI Z97.1 and CPSC 16 CFR 1201.
- B. Verify that glass thickness specified are appropriate for the applications indicated, and meet applicable regulatory requirements.
- C. Exterior and interior glass and glazing shall contain a minimum of 25 percent recycled content.
- D. Glazing Standards: GANA Glazing Manual and Sealant Manual.
- E. Fire Rated Glass: Each lite shall bear a permanent, non-removable label of Underwriters Laboratories and/or Intertek Testing Services (Warnock-Hersey) certifying it for use in tested and rated fire protective assemblies

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions.
- B. Deliver, store and handle glass with manufacturer's labels intact. Do not remove labels until time of final cleaning.
- C. Ship and store panels with edges protected by cushioned tape.
- D. Keep glass free from contamination by materials capable of staining and otherwise damaging glass.

1.6 PROJECT CONDITIONS

- A. Perform glazing on dry surfaces only.
- B. Apply sealants within temperature range recommended by manufacturer.

1.7 FIELD MEASUREMENTS

- A. Fabricate glass only to field measurements of actual frame openings.

1.8 WARRANTY

- A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating glass manufacturer agrees to replace insulating glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
1. Warranty Period: Ten (10) years from date of Project Completion.

PART 2 PRODUCTS

2.1 GLASS TYPES

- A. Type I - "Tempered": Clear tempered glass; ASTM C1048: Kind FT, Condition A, Type I, Class 1, 1/4 inch thick, unless otherwise indicated.
1. Each pane of safety glazing installed in a hazardous location shall be identified in accordance with CCR, Title 24, Part 2, 2016 CBC Section 2406.3.
- B. Type II - "Tinted": Same as Type I, except light reducing in tint color as selected by the Owner's Representative from manufacturer's standard range of tint colors; light transmittance of nominal 66 percent, shading coefficient of nominal 0.51.
- C. Type III - "Float"; Clear float glass; 1/4 inch thick, unless otherwise indicated.
- D. Type IV - "Insulating Glass": Weathertight units fabricate from one pane of 1/4 inch thick Type II glazing on the exterior side and one pane of 1/4 inch thick Type I glazing on the interior side, separated by 1/2 inch sealed airspace; conforming to ASTM C1249, Class C; butyl primary seal, silicone secondary seal, metal spacer with bent corners. Provide Low-E coating on #2 surface.
- E. (NOT USED) Type V - "Fire-Rated Glass": Provide fire and safety-rated glazing for use in fire rated door and window assemblies of the following designations, appropriate to the use as indicated on the Drawings for each particular fire-rated glazing panel:
1. Designation D-20:
 - a. Each lite shall be labeled with a permanent logo including the name of product, manufacturer, testing laboratory, fire rating period and safety glazing standards.
 - b. Fire Rating: 20 minutes as scheduled on the Drawings.
 - c. Tempered where required by code or as otherwise scheduled on the Drawings.
 2. Designation OH-20:
 - a. Each lite shall be labeled with a permanent logo including the name of product, manufacturer, testing laboratory, fire rating period and safety glazing standards.
 - b. Fire Rating: 20 minutes as scheduled on the Drawings.
 - c. Tempered where required by code or as otherwise scheduled on the Drawings.
 3. Designation OH-45:
 - a. Each lite shall be labeled with a permanent logo including the name of product, manufacturer, testing laboratory, fire rating period and safety glazing standards.

- b. Fire Rating: 45 minutes as scheduled on the Drawings.
- c. Tempered where required by code or as otherwise scheduled on the Drawings.
- 4. Designation D-H-OH-45:
 - a. Each lite shall be labeled with a permanent logo including the name of product, manufacturer, testing laboratory, fire rating period and safety glazing standards.
 - b. Fire Rating: 45 minutes as scheduled on the Drawings.
 - c. Tempered where required by code or as otherwise scheduled on the Drawings.

2.2 MANUFACTURERS

- A. PPG Industries, Inc.
- B. Viracon.
- C. Pilkington.
- D. SAFTI, a Division of O’Keeffe’s, Inc.
- E. Or equal.

2.3 MANUFACTURERS - FIRE-RATED GLASS (NOT USED)

- A. Vetrotech - Fire-Rated Glass & Systems. (www.vetrotechusa.com)
- B. Technical Glass Products (TGP). (<http://www.fireglass.com>)
- C. SAFTI, a Division of O’Keeffe’s, Inc. (<http://safti.com>)
- D. SCHOTT North America, Inc. (<http://www.us.schott.com>)
- E. Or equal.

2.4 GLAZING ACCESSORIES

- A. Glazing Sealant:
 - 1. General: Provide products of type indicated, complying with the following requirements:
 - a. ASTM C920, color selected by the Owner’s Representative.
 - b. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Manufacturers:
 - a. G. E.; Silicone Construction 1200 Sealant.
 - b. Tremco; 440.
 - c. Dow Corning; 795.
 - d. Sonneborn.
- B. Setting Blocks, and Spacers: G.E. Type II preformed silicone rubber, of ASTM C864 Shore “A” Durometer hardness within the ranges specified below to suit the specific installation conditions:
 - 1. Setting Blocks: 80-90 shore “A” Durometer hardness, anti-walk type, of length required for size and weight of glass.
 - 2. Spacers: 50-80 Shore “A” Durometer hardness.

- C. Glazing Tape: As recommended by glazing manufacturer for the specific installation conditions.
- D. Fillers; ASTM D1056: Closed cell neoprene sponge.
 - 1. Manufacturers:
 - a. Tremco; CCN Sponge.
 - b. Williams Products Inc.; Neoprene: Type NN1.
 - c. Norton Norseel.
 - d. Sonneborn.
- E. Primers: Type recommended by glazing material manufacturer.
- F. Adhesive: Epoxy type recommended by mirror manufacturer for intended application, compatible with backing.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are satisfactory for the installation of glazing materials. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.
- B. Verify that glazing channels are free of burrs, irregularities, debris, and coatings that could adversely affect the execution and quality of work.
- C. Verify that sash frames are watertight, fabrication intersections and corners sealed.
- D. Verify that rabbets at sills weep to the outside.
- E. Verify that rabbets are of sufficient depth and width to receive the glazed panel and provide the required overlap.
- F. Verify setting surfaces of sash and frame are prime painted.
- G. Verify that glass is free of edge damage and face imperfections.
- H. Verify that glazing channels contain no deviations beyond allowable tolerances for the installation of sealant.

3.2 PREPARATION

- A. Preparation of Surfaces:
 - 1. Remove protective coatings from surfaces to be glazed.
 - 2. Clean glass and glazing surfaces to remove dust, oil, and other contaminants, and wipe dry.

3.3 INSTALLATION

- A. Install glass in accordance with manufacturer recommendations and approved shop drawings.

- B. Install glass to be watertight and airtight.
- C. Each installation shall withstand normal temperature changes and wind loading without failure, including loss and breakage of glass, failure of sealants to remain watertight and airtight, deterioration of glazing materials, and other defects.
- D. Comply with GANA (Glass Association of North America) Glazing Manual, except as otherwise indicated, specified, or recommended by the manufacturers of the glass, glazing materials, and frames.
- E. Do not field cut, nip, or abrade glass.
- F. Provide 3/16 inch head clearance.
- G. Apply 3/16 inch by 1/4 inch sealant bead on exterior sides of exterior windows.
- H. Force sealant beads into channel to eliminate voids and to ensure complete wetting and bond of sealant to glass and channel surfaces.
- I. Tool exposed surfaces of glazing sealants to provide a substantial "wash" away from glass. Clean and trim excess glazing materials from glass, stops, and frames promptly after installation to eliminate stains and discolorations.
- J. Unify appearance of each series of lights by setting each piece to match others, as nearly as possible, with pattern, draw, and bow oriented in the same direction.
- K. Tempered glass shall have lights within each series tempered by the same method.
- L. Glass tempered by the tong method shall have tong marks at the head of the light.

3.4 FIELD QUALITY CONTROL

- A. Perform field testing under provisions of Division 01.
- B. Perform field water test on exterior window assemblies in accordance with AAMA 502-08.
 - 1. Perform test as soon as practical after the window assemblies have been fully installed.
 - 2. The Field Water Test Pressure (WTP) shall not be not less than 140 Pa (2.9 psf).
 - 3. Inspect for water intrusion. No water MA-5 penetration shall occur as defined in Section 4.3.4 of AAMA 502-08.
 - 4. Correct identified defects and irregularities and repeat test.
 - 5. If the source of the water cannot be determined, a forensic evaluation using the procedures outlined in AAMA 511 shall be performed.
 - 6. Repeat Item 4 and Item 5 until window assembly installation is accepted by the Owner's Representative.

3.5 CLEANING

- A. Wash and polish both faces of glass; leave labels in place until time of final cleaning.
- B. Remove debris from Project site.

3.6 PROTECTION OF COMPLETED WORK

- A. Protect and identify installed glass by use of streamers attached to framing and held away from glass.
- B. Do not apply markers or other materials to glass surfaces other than specifically permitted by glass manufacturer.
- C. Replace glass damaged by accidents, vandalism, and natural causes during construction period.

3.6 SCHEDULE

- A. Refer to Opening Schedule provided on the Drawings.

END OF SECTION

SECTION 09 22 36

LATH

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal lathing for wet plaster finish.
 - 2. Metal accessories and miscellaneous materials.
- B. Related Sections:
 - 1. Section 06 10 00 - Rough Carpentry.
 - 2. Section 06 16 00 - Sheathing.
 - 3. Section 09 24 00 - Portland Cement Plastering

1.2 REFERENCES

- A. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. to 0.112 inch in Thickness.
- B. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- C. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement Based Plaster.
- D. FS-UU-B-790a - Federal Specification Building Papers.
- E. CCR - California Code of Regulations, Title 24. 2016 California Building Code (CBC), Chapter 25.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data: For each type of product indicated.
 - 1. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products and materials in original unopened packages, containers, or bundles with manufacturer's label intact and legible.
- B. Remove items delivered in broken, damaged, rusted, or unlabeled condition from Project site immediately.

- C. Protect metal lath, metal suspension materials, and metal accessories from moisture and other sources of damage.
- D. Store metallic materials and accessories indoors, off the floor.

1.5 PRE-INSTALLATION CONFERENCE

- A. Attend a pre-installation conference in accordance with the provisions of Division 01.
- B. Review installation procedures, materials to be used, submittals, schedules, and all related work required under this section. Finalize construction schedule and confirm availability of materials, equipment, contractor's personnel, and facilities needed to complete work as planned.
- C. Record discussions of conference, including decisions and agreements reached. Furnish copy of record to each party attending. If disagreements exist at the conclusion of the conference, determine how disagreements will be resolved, and set a date for reconvening conference.

PART 2 PRODUCTS

2.1 LATH

- A. Materials: Copper bearing steel; coated with rust inhibitive paint after cutting, or cut from zinc-coated steel sheets.
 - 1. Recycled Content: Provide steel products with average recycled content such that postconsumer recycled content plus one half of preconsumer recycled content is not less than 25 percent.
- B. 3/8 inch Rib Lath for Plaster Ceilings: 3.4 pounds per square yard, fabricated in herringbone mesh pattern with 3/8 inch deep ribs.
- C. Lath with Membrane: K Lath Keymesh Type SFB woven steel wire with 1 1/2 inch openings and weight of 2.2 pounds per square yard laminated between high wet strength suction paper or Class D Breather paper.

2.2 FASTENERS

- A. Provide galvanized fasteners in size and type to suit application, and in compliance with applicable codes and regulations.
- B. Screws:
 - 1. Type:
 - a. ASTM C1002, corrosion resistant, for attachment to metal framing 25 gauge and lighter.
 - b. ASTM C954 for attachment to metal framing 20 gauge and heavier.
 - 2. Thread and head designs and lengths as recommended by manufacturer for uses and materials involved.
- C. Hanger and Bracing Wire Fasteners; ITT Phillips Drill Div.: "Red Head Sleeve Anchor," No. TW - 1614.

- D. Tie Wire: Galvanized Steel, 18 gauge minimum.

2.3 METAL ACCESSORIES

- A. Manufacturer: Member of Metal Lath/Steel Framing Association (ML/SFA).
- B. Corner Beads, Casing Beads and Plaster Stops: 0.017 inch thick zinc alloy with expanded metal wings.
- C. Control Joints: 0.017 inch thick zinc alloy with expanded metal wings; Style No. 15 for flat surfaces; Style No. 30 for corners.
- D. Channel Screed (Reveal): Extruded Aluminum, Fry Reglet; PCS 100-100, clear anodized finish.
- E. Ventilating Screeds: Superior; SRS Superior Reveal Screed, 24 ga. galvanized.
- F. Drip Screed: Superior; SET Superior Soffix Corner, 24 ga. galvanized.
- G. Weep Screed: Superior; SWS Superior Weep Screed, 24 ga. galvanized, with weep holes.
- H. Strip Reinforcement: 6 inch wide strip of galvanized steel expanded metal lath; minimum 1.75 pounds per square yard.

2.4 MISCELLANEOUS MATERIALS

- A. Underlayment:
 - 1. Moisture Barrier: Two (2) layers Grade D Kraft Building Paper.
- B. Provide additional components and materials required for a complete installation.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are satisfactory for the installation of lathing.
- B. All pipe, conduit, and similar materials shall have been installed, inspected, and approved prior to commencing installation of lath.
- C. Do not commence the installation until unsatisfactory conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 INSTALLATION - UNDERLAYMENT

- A. Install underlayment over areas to receive lath. Install underlayment with long dimension of sheets perpendicular to supports. Install horizontally with each course shingled (weather lapped) 2 inches over layer below.

3.3 INSTALLATION - METAL LATH

- A. Install metal lath with long dimension of sheets perpendicular to supports.
- B. Tie ends of lapped sheets not occurring over supports. Tie at 6 inches on center.
- C. Installation of metal lath shall be in accordance with applicable provisions of CCR, Title 24, Part 2, 2016 CBC Chapter 25.

3.4 INSTALLATION - LATH WITH MEMBRANE

- A. Install one layer of underlayment over areas to receive lath with membrane. Install horizontally with each course shingled (weather lapped) 2 inches over layer below.
- B. Install lath with membrane in accordance with manufacturer's instructions.

3.5 INSTALLATION - METAL ACCESSORIES

- A. Fasten in place as required to prevent dislodging or misalignment by subsequent operations.
- B. Fasten at both ends and at a maximum of 12 inches on center along sides.
- C. Bring grounding edge of accessories to true lines, plumb, level, and straight.
- D. Install accessories to provide required depth of plaster and to bring plaster surface to required plane.
- E. Connect lengths of accessories as recommended by the manufacturer to assure a continuous line.
- F. Install casing beads to provide a minimum 1/8 inch clearance between structural units and termination points of surfaces to receive plaster finish.
- G. Attach control joints directly to base lath, spaced on 15 feet on center, both ways, unless otherwise indicated on the Contract Documents. Provide 14 gauge galvanized steel backing plate at each control joint.
- H. Provide special screeds at locations as indicated on the Contract Documents.
- I. Use single length of metal beads wherever length of run does not exceed longest standard stock length available; miter or cope corners.
- J. Set beads level, plumb, and true to line. Shim as required and align joints with concealed splices or tie plates.
- K. Provide casing beads at the following locations:
 - 1. Where plaster abuts dissimilar construction.
 - 2. At perimeter of openings where edges of plaster will not be concealed by other Work.

END OF SECTION

SECTION 09 24 00

PORTLAND CEMENT PLASTERING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Portland cement plaster system.
 - 2. Finish coat system.
- B. Related Sections:
 - 1. Section 07 90 00 - Joint Protection.
 - 2. Section 09 22 36 - Lath.

1.2 REFERENCES

- A. ASTM C35-01- Standard Specification for Inorganic Aggregates for use in Gypsum Plaster.
- B. ASTM C150/C150M- Standard Specification for Portland Cement.
- C. ASTM C206- Standard Specification for Finishing Hydrated Lime.
- D. ASTM C631- Standard Specification for Bonding Compound for Interior Gypsum Plastering.
- E. ASTM C897 - Standard Specification for Aggregate for Job Mixed Portland Cement Based Plasters.
- F. ASTM C926- Standard Specification for Application of Portland Cement-Based Plaster.
- G. ASTM C932- Standard Specification for Surface-Applied Bonding Agents for Exterior Plastering.
- H. ASTM C1002- Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- I. ASTM C1063- Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Plaster.
- J. ASTM C1328- Standard Specification for Plastic (Stucco) Cement.
- K. ASTM E119- Standard Test Methods for Fire Tests of Building Construction and Materials.
- L. PCA – Portland Cement Association, Portland Cement Plaster/Stucco Manual.
- M. ACI - American Concrete Institute, Publication 524R-04 Guide to Portland Cement-Based Plaster.

- N. BC Wall & Ceiling Association (BCWCA) - Portland Cement Plaster Stucco Resource Guide.
- O. UL - Underwriters Laboratories, Inc. Fire Resistance Directory.
- P. CCR - California Code of Regulations, Title 24. 2016 California Building Code (CBC), Chapter 25.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data: For each type of product indicated.
 - 1. Provide manufacturer's data sheets and current ICC ES-Evaluation Report.
 - 2. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 3. For sealants include printed statement of VOC content.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver manufactured materials in original unopened packages or containers with manufacturer's label intact and legible.
- B. Keep cement and lime dry, stored off ground, under cover, and away from damp surfaces.
- C. Remove wet and deteriorated materials from Project site.
- D. Protect metallic materials and accessories from moisture and other sources of damage.
- E. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.5 FIELD SAMPLES

- A. Provide field samples in accordance with Division 01.
- B. Construct field sample panel to minimum 5 foot by 8 foot size, illustrating surface finish.
- C. Locate where directed.

1.6 PRE-INSTALLATION CONFERENCE

- A. Attend a pre-installation conference in accordance with the provisions of Division 01.
- B. Review installation procedures, materials to be used, submittals, schedules, and all related work required under this section. Finalize construction schedule and confirm availability of materials, equipment, contractor's personnel, and facilities needed to complete work as planned.

- C. Record discussions of conference, including decisions and agreements reached. Furnish copy of record to each party attending. If disagreements exist at the conclusion of the conference, determine how disagreements will be resolved, and set a date for reconvening conference.

1.7 PROJECT CONDITIONS

- A. Provide sufficient heat and ventilation at enclosed areas where Work of this Section is being performed to allow cement plaster to properly cure.
- B. Take precautionary measures necessary to assure that excessive temperature changes do not occur. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
- C. Do not apply plaster when substrate or ambient air temperature is less than 40 degrees F nor more than 80 degrees F.
- D. Maintain minimum 40 degrees F ambient temperature from 48 hours prior to application, during application, and continuously after application.
- E. Protect cement plaster from uneven and excessive evaporation during hot, dry weather.
- F. Factory Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 PRODUCTS

2.1 BASE-COAT MATERIALS

- A. Portland Cement: ASTM C150: Type I or Type II.
- B. Type S Lime: ASTM C206
- C. Aggregates: ASTM C897.
 - 1. Gradation Base (Scratch and Brown) Coats:
 - a. Percent Retained by weight (+/- 2 percent)

<u>U.S. Standard Sieve</u>	<u>Minimum</u>	<u>Maximum</u>
No.8	0	10
No.16	10	40
No.30	30	65
No.50	70	90
No.100	90	100
- D. Bonding Agent: ASTM C631; type recommended for bonding plaster to concrete and concrete masonry surfaces.
- E. Admixture: 1/2 inch alkaline resistant chopped glass fibers.
 - 1. Manufacturer:
 - a. Cem-FIL Corporation.
 - b. Or Equal. Substitute under provisions of Division 1.

- F. Water: Clean, potable, and free from substances harmful to plaster.

2.2 FINISH COAT MATERIALS

- A. Manufacturer:
 - 1. (Basis of Design) BMI Products; BMI 690 Plaster; ICC Evaluation Report ESR-2535.
 - 2. Or equal.
- B. Factory prepared product containing all materials required for finish coat, except water.
- C. Finish: Smooth finish.

2.3 MIXING

- A. For plaster mix products having a current ICC ES-Evaluation Report, mix and apply products in accordance with the Research Report.
- B. Accurately proportion materials for each plaster batch with measuring devices of known value.
- C. Size batches for complete use within one hour maximum after mixing.
- D. Re-temper plaster stiffened from evaporation, but do not use or re-temper partially hydrated plaster.
- E. Do not use caked or lumping materials, and remove such materials from Project size immediately.
- F. Mix factory prepared plaster in accordance with the manufacturer's written instructions.
- G. Use moist, loose sand in mix proportions.
- H. Withhold 10 percent of mixing water until mixing is almost complete, then add as needed to produce necessary consistency.
- I. Hand Mixing: Do not hand mix, unless authorized by the Owner's Representative.
- J. Mechanical Mixing:
 - 1. Clean mixer of set or hardened materials before loading for new batch.
 - 2. Maintain mixer in continuous operation while adding materials.
 - 3. Conform to mixing sequence, cycle of operations, and time recommended by manufacturer of plaster materials.
- K. Mix Proportions by Volume:
 - 1. Scratch Coat: Four parts aggregate to one part cement, by volume.
 - 2. Brown Coat: Five parts aggregate to one part cement, by volume.
 - 3. Hydrated lime in an amount not exceeding 20 pounds per sack of Portland cement may be added to mix using Type I or Type II Portland cement; do not add hydrated lime to mixes containing plastic cement.
 - 4. Finish Coat: In accordance with the manufacturer's instructions.
 - 5. Admixture: 1/2 of 1 percent at exterior applications only.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and ready to receive Work. Examine areas and substrates, with Installer present, and including welded hollow metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work. Notify the Owner's Representative, in writing, of any conditions requiring corrective action.
- B. Verify that surfaces to be plastered are free of dust, loose particles, oil, and other foreign matter which would affect bond of plaster coats. Verify joints in masonry are cut flush. Verify concrete surfaces are flat and honeycomb is filled flush.
- C. Verify items and services within walls have been installed, tested as required, and approved.
- D. Examine construction, grounds, and accessories to ensure that finished plaster surfaces will be true to line, level, and plumb, without requiring additional thickness of plaster.
- E. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Beginning application means acceptance of existing conditions.

3.2 PREPARATION

- A. Cover building openings in areas adjacent to plastering work with plastic film.
- B. Protect finished surfaces installed prior to plastering by covering with a suitable non-staining material. Cover window and curtain wall frames with plastic film.
- C. Maintain protection in place until completion of plastering work.
- D. Dampen masonry surfaces to reduce excessive suction.
- E. Clean concrete surfaces of foreign matter. Clean surfaces using acid solutions, solvents, or detergents; wash with clear water.
- F. Roughen smooth concrete surfaces and apply bonding agent. Apply bonding agent in accordance with manufacturer's instructions.

3.3 INSTALLATION

- A. Installation of Accessories: Specified in Section 09 22 36 - Lath.
- B. Provide three coat application over metal lath.
- C. Apply plaster by hand or machine spray.
- D. Interrupt plaster coat only at junctions of plaster planes, at openings, or at control joints.
- E. Apply scratch coat over lath with sufficient material and pressure to fully keys through and embed metal base. When firm, score in one direction.

- F. Apply brown coat to scratch coat or masonry or concrete substrate, bringing out to grounds, flat to true surface, and free of imperfections which would reflect in finish coat.
- G. Reconsolidate brown coat by floating, and roughen to assure bond with finish coat.
- H. Fire Resistance Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on the Contract Documents.
- I. Acoustical Sealant: Where required, seal joints between edges of plasterwork and adjacent construction with acoustical sealant.
- J. Apply finish coat in accordance with manufacturer's instructions.
- K. Nominal Plaster Thickness:
 - 1. Scratch Coat: 3/8 inch, minimum, measured from face of Lath.
 - 2. Brown Coat: 3/8 inch.
 - 3. Finish Coat: 1/8 inch, minimum.
 - 4. Total Thickness: 7/8 inch, minimum over lath; 1/2 inch minimum over solid cementitious substrate unless otherwise indicated on the Contract Documents.

3.4 CURING

- A. Maintain moist conditions by fine fog spraying.
- B. Cure scratch coat for a minimum of 48 hours, and maintain a minimum of 48 hours between application of scratch coat and brown coat.
- C. Cure brown coat for a minimum of 48 hours, and maintain a minimum of 7 days between the application of the brown coat and finish coat.
- D. Cure finish coat in accordance with the manufacturer's instructions.

3.5 COMPLETION

- A. Remove temporary protection and enclosure of other Work. Promptly remove plaster from door frames, windows, and other surfaces not indicated on the Contract Documents to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.
- B. Upon completion of application, point up plaster around trim and other locations where plaster meets dissimilar materials.
- C. Cut out and patch defective or damaged plaster.
- D. Match patching or defective or damaged plaster to existing Work in form and texture.
- E. When complete, plaster surfaces shall be flat; true to plane; and free from scaffold and tool marks, stains, or other damage or defects and shall be uniform in color and texture throughout the Work.

3.6 TOLERANCES

- A. Allowable Tolerance of Finished Surface: Maximum deviation from true plane shall not exceed 1/8 inch as measured from the line of a 10 foot straightedge placed at any location on the surface.

3.7 CLEANING

- A. Remove plaster and protective materials from control and expansion joints, perimeter beads, and adjacent surfaces.
- B. Remove stains that would adversely affect subsequent finishes on plaster.

END OF SECTION

SECTION 09 28 13

CEMENTITIOUS BACKING BOARDS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cementitious backer board.
 - 2. Related accessories.
- B. Related Sections:
 - 1. Section 09 21 16 - Gypsum Board Assemblies.
 - 2. Section 09 30 13 - Ceramic Tiling.

1.2 REFERENCES

- A. ANSI A118.4 - Latex Portland Cement Mortar.
- B. ANSI A118.6 - Ceramic Tile Grouts.
- C. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing.
- D. ASTM C1396/C1396M - Standard Specification for Gypsum Board.

1.3 SYSTEM DESCRIPTION

- A. Cementitious glass mesh mortar board for use as the primary substrate under ceramic wall tile installations.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Samples:
 - 1. Board: Two samples, 12 inches by 12 inches size.
 - 2. Tape: Two samples, 12 inches length.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver with manufacturer's labels intact and without change.
- B. Protect panels from weather exposure and other conditions detrimental to product. Provide adequate ventilation.

1.6 PROJECT CONDITIONS

- A. Install backer board only when ambient temperature is 55 degrees Fahrenheit or above.

PART 2 PRODUCTS

2.1 COMPONENTS

- A. Cementitious Backer Board: High density, cementitious, glass fiber reinforced, 5/8 inch thick; meet or exceed ANSI 118.9.
 - 1. Acceptable Manufacturers:
 - a. USG; Durock: Cement Board.
 - b. National Gypsum; PermaBase Cement Board
 - c. Fin-Pan Inc.; Util-A-Crete.
- B. Joint Reinforcing Tape: Coated glass fiber mesh tape, minimum 2 inch width.
- C. Fasteners:
 - 1. 1 1/4 inches S-12, flat, wafer head; countersunk ribs; protective finish equal to Climaseal.
- D. Dry-Set Grout; ANSI A118.6: White Dry Non-Sanded Grout.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions are satisfactory for installation.
- B. Verify metal studs are accurately placed, plumb, and true to line.
- C. Verify metal studs to receive backer board are spaced not more than 16 inches on center and are 20 gauge minimum thickness.
- D. Verify mechanical and electrical items to be concealed are in place and have been inspected.
- E. Verify reinforcing and backing required for attachment of items specified under other Sections is in place, accurately located and solidly attached.
- F. Verify openings required for recessed items specified in other Sections are provided.
- G. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Beginning installation constitutes acceptance of existing conditions.

3.2 INSTALLATION

- A. Attach panels to studs in accordance with panel manufacturer's instructions; maximum 8 inch fastener spacing.
- B. Fill joints solid with Dry-Set or latex Portland cement mortar.
- C. Tape each horizontal and vertical joint, including corners, with 2 inches glass fiber mesh tape; embed in mortar.

3.3 CLEANING

- A. Leave installation clean and ready to receive applied finish.

END OF SECTION

SECTION 09 30 13

CERAMIC TILING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceramic wall and floor tile.
2. Porcelain floor tile.
3. Installation of thin set and thick set tiles.
4. Grout.
5. Waterproofing Membrane.
6. Marble Thresholds.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete.
2. Section 07 90 00 - Joint Protection.
3. Section 09 28 13 - Cementitious Backing Boards.
4. Section 09 61 00 - Flooring Treatment.
5. Section 09 65 00 - Resilient Flooring.
6. Section 09 68 00 - Carpeting.
7. Section 10 28 00 - Toilet Accessories.
8. Division 22 – Plumbing, floor drains and plumbing fixtures.

1.2 REFERENCES

- A. ANSI A108 Series (A108.01, .02, .1A, .1B, .1C, .4, .5, .6, .8, .9, .10, .11, .12, .13, .14, .15, .16, and .17) - Installation of Ceramic Tile.
- B. ANSI A118.1 - Dry-Set Portland Cement Mortar.
- C. ANSI A118.3 - Chemical Resistant Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive.
- D. ANSI A118.4 - Latex Portland Cement Mortar.
- E. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
- F. ANSI A137.1–2012 - American National Standards Specifications for Ceramic Tile - Version 2013.1.
- G. ANSI A138.1-2011 - Green Squared American National Standard Specifications for Sustainable Ceramic Tiles, Glass Tiles, and Tile Installation Materials.
- H. ASTM C144 - Aggregate for Masonry Mortar.

- I. ASTM C150 - Portland Cement.
 - J. ASTM C171 - Sheet Materials for Curing Concrete.
 - K. ASTM C206 - Finishing Hydrated Lime.
 - L. ASTM C207 - Hydrated Lime for Masonry Purposes.
 - M. ASTM D226 - Asphalt Saturated Organic Felt Used in Roofing and Waterproofing.
 - N. The Tile Council of North America - TCNA Handbook for Ceramic, Glass, and Stone Tile Installation, Latest Edition.
 - O. CCR - California Code of Regulations, Title 24 - 2016 California Building Code (CBC).
 - P. CCR - California Code of Regulations, Title 24, Part 11 - 2016 California Green Building Code.
- 1.3 SUBMITTALS
- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - B. Product Data: Manufacturer's literature for tile and grout, waterproofing membrane, and marble threshold, and miscellaneous accessories as may be required.
 - 1. For adhesives and sealants include printed statement of VOC content.
 - C. Samples:
 - 1. Submit tile and grout samples for color selection from manufacturer's full range of price groups.
 - 2. Submit sample panels representative of tile pattern and color variations, and joint size and grout color variations.
 - a. Glazed Wall Tile: Panel for each pattern and color, with minimum of four tiles per sample panel.
 - b. Ceramic Mosaic Floor Tile: Panel for each pattern and color; minimum sample panel size shall be 8 inches by 8 inches.
 - c. Porcelain Floor Tile: Panel for each pattern and color, with minimum of four tiles per sample panel.
 - d. Marble Threshold: Panel for each pattern and color, with minimum of four 8 inch (min.) long pieces per sample panel.
 - 3. Trim Shapes: Each color, type, and shape, upon request.
 - D. Master Grade Certificate conforming to ANSI A137.1, issued and signed by the manufacturer when tile is shipped. State therein kind of tile, identification marks for tile packages, and name and location of Project.
 - E. Upon completion of ceramic tile work, two copies of tile manufacturer's recommended maintenance products and procedures.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver tile in manufacturer's original cartons, grade-sealed by manufacturer, and with grade seals unbroken.
- B. Deliver dry-set mortar in moisture proof containers.
- C. Manufactured mortars and grouts shall contain hallmarks certifying compliance with referenced TCNA standards and shall be recommended by tile manufacturer for the application intended.
- D. Store materials in accordance with manufacturer's directions and under cover in manner to prevent damage or contamination.
- E. Handle materials carefully to avoid chipping and breakage.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in the manufacture of products of the type specified in this Section with minimum five (5) years experience.
- B. Ceramic and Porcelain tile furnished for installation on floors shall have a minimum wet DCOF AcuTest value of 0.42 when tested in accordance with ANSI A137.1-2012.

1.6 PROJECT CONDITIONS

- A. Ambient Temperature: At least 50 degrees Fahrenheit and rising, when setting and grouting with Portland Cement mortar.
- B. Follow manufacturer's requirements for ambient temperature when setting and grouting with other than Portland Cement mortar.
- C. Moisture Conditions: In accordance with tile and installation materials manufacturer's requirements.

1.7 EXTRA MATERIALS

- A. Furnish additional tile for replacement and maintenance, at the rate of approximately 2 percent to the next full carton, for each size, color, pattern, and type installed.
- B. Furnish 10 percent of each type of trim and 2 percent of external corners for each size, color, shape, and type installed.
- C. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 PRODUCTS

2.1 MATERIALS

A. Ceramic Tile, General:

1. Manufacturer:
 - a. (Basis of Design) Dal-Tile Corp.
 - b. American Olean Corp.
 - c. Or equal.
2. Patterns and colors will be selected by the Owner's Representative from manufacturer's full range of price groups..
3. Units shall be factory made. Provide bases, caps, stops, returns, trimmers, and other shapes for a complete installation. Vertical internal corners shall be butted, external corners shall be bullnosed, and bases shall be coved; color and finish shall match that of wall tile, except base shall match floor tile.

B. Ceramic Tile Types:

1. Glazed Tile:
 - a. Style: Plain face, cushion edges with spacers, ribbed back.
 - b. Nominal Size:
 - 1) Flat Tile: Nominal 4 1/4 inches by 4 1/4 inches by 5/16 inch thick.
 - 2) Trim Units: As indicated on the Contract Documents and as required, 5/16 inch thick.
 - c. Use: Walls.
2. Ceramic Mosaic Tile:
 - a. Style: Unglazed, plain face, cushion edges.
 - b. Nominal Size:
 - 1) Flat Tile: Nominal 2 inches by 2 inches by 1/4 inch thick.
 - 2) Trim Units: As indicated on the Contract Documents and as required, 1/4 inch thick.
 - c. Mounting: Factory mounted uniformly by means of paper secured to face side, or as otherwise accepted; joints shall be approximately 1/16 inch wide.
 - d. Use: Floor and coved base at Men #131 and Women #132.

C. Porcelain Tile, General:

1. Manufacturer:
 - a. (Basis of Design) Dal-Tile Corp.
 - b. American Olean Corp.
 - c. Or equal.
2. Patterns and colors will be selected by the Owner's Representative from manufacturer's full range of price groups.
3. Units shall be factory made. Provide bases, caps, stops, returns, trimmers, and other shapes for a complete installation. Vertical internal corners shall be butted, external corners shall be bullnosed, and bases shall be coved; color and finish shall match that of the floor tile.

- D. Porcelain Tile Types:
1. Glazed and Unglazed Tile:
 - a. Style: As selected by the Owner's Representative.
 - b. Nominal Size:
 - 1) Flat Tile: 12 inches by 12 inches by 1/4 inch thick.
 - 2) Base: Coved: 6 inches by 12 inches by 1/4 inch thick.
 - 3) Trim Units: As indicated on the Contract Documents and as required, 1/4 inch thick.
 - c. Use: Floor and coved base at Men #108 and Women #109.
- E. Installation Materials for Thin Set and Thick Set Tile:
1. Concrete Primer: As recommended by waterproofing membrane manufacturer.
 2. Adhesive:
 - a. Floors and Base:
 - 1) Compatible with waterproofing membrane.
 - 2) Manufacturers:
 - a) Laticrete International Inc: Laticrete 15 Premium Mastic.
 - b) Mapei Corporation: Ultramastic ECO.
 - c) Or equal.
 - b. Walls: Latex Portland cement mortar, in conformance with ANSI A118.4.
 - c. Use adhesives that have a VOC content of 65 g/L or less when calculated according to 40 CFR 59 - Subpart D (EPA Method 24).
 3. Grout:
 - a. Epoxy; color white, unless otherwise selected by the Owner's Representative.
 - b. Manufacturers:
 - 1) Laticrete International Inc.: Latapoxy SP-100.
 - 2) Bostik; Hydroment Color poxy.
 - 3) Mapei Corporation: Kerpoxy.
 4. Waterproofing Membrane:
 - a. Floors: Liquid applied, flexible elastomeric waterproof membrane suitable for direct application of thin set tile; conform to ANSI A118.10; "Red Gard" as manufactured by Custom Building Products, or equal.
 - b. Walls: Liquid applied, flexible elastomeric waterproof membrane suitable for direct application of thin set tile; conform to ANSI A118.10; "Red Gard" as manufactured by Custom Building Products, or equal.
 - c. Cleavage Membrane: Same as waterproofing membrane.
- F. Miscellaneous Accessories:
1. Marble Thresholds:
 - a. Size: 2" wide x 5/8" high x 36" long or as otherwise indicated on the Drawings.
 - 1) Compatible with waterproofing membrane.
 - 2) Manufacturers:
 - a) (Basis of Design) American Olean Corp.: Natural Stone Series.
 - b) Or equal.
 - b. Patterns and colors will be selected by the Owner's Representative from manufacturer's full range of price groups.
 2. Miscellaneous accessories as may be required to complete the various installations specified herein.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are satisfactory for the installation of ceramic tile. Notify Owner's Representative, in writing, of any conditions requiring corrective action.
- B. Do not commence the installation until unsatisfactory conditions have been corrected. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Prior to commencing tile work, protect surfaces adjoining those to receive tile.
- B. Grounds, anchors, plugs, hangers, and electrical and mechanical work which will be in or behind tile in the completed Work shall have been installed and inspected prior to tile installation.
- C. Surfaces on which ceramic tile will be installed shall be firm, dry, clean, and free of oily or waxy films, curing compounds, sealants, and foreign matter.

3.3 INSTALLATION

- A. General:
 - 1. Install tile and waterproofing membranes in accordance with the requirements of the specified TCNA Method from the TCNA "Handbook for Ceramic, Glass, and Stone Tile Installation" appropriate to the tile and surface specified herein.
 - 2. Joint Width: Approximately 1/16 inch.
 - 3. Set tile in a manner to produce solid bedding, smooth even surfaces, and uniform joints, accurately aligned and symmetrically arranged. Avoid use of tile less than half size. Cut tile neatly, grind rough exposed edges. Terminate tile (with termination strips at thinset tile) at center lines of doors, unless otherwise indicated.
 - 4. Establish lines of borders where applicable, prior to spreading setting bed, centering field work in both directions. Lay tile from center line of wall or floor surface outward, with adjustments made at junction with other floor or wall surfaces.
 - 5. Do not start floor tile operations occurring in spaces requiring both floor and wall tile until wall tile setting has been completed.
 - 6. Omit tile where floor or wall area is covered by permanently built-in equipment such as toilet fixtures and recessed accessories.
 - 7. Lay tile to edges of expansion and construction joints.
 - 8. Do not permit tile, mortar, grout, or other products to enter floor drains and sewers.
- B. Thin Set Floor Tile: Install in conformance with ANSI A108.5, using TCNA Method F113A.
- C. Thin Set Floor Tile over Waterproofing Membrane: Install in conformance with ANSI A108.5, using TCNA Method F122A.
- D. Thick Set Floor Tile over Waterproofing Membrane: Install in conformance with ANSI A108.5, using TCNA Method B414. Slope to drain. Keep drains free of mortar, grout, dirt, and other materials which could inhibit drainage

- E. Thick Set Wall Tile over Waterproofing Membrane: Install in conformance with ANSI A108.5, using TCNA Method B221.
- F. Wall Tile: Install in conformance with ANSI A108.4, using TCNA Method W244F.
- G. Waterproofing Membrane: Install in conformance with ANSI A108.10, with manufacturer's written instructions, and with ICC-ES Evaluation Report ESR-1413. In accordance with TCNA Method B421, apply the waterproofing membrane to floor and extend the waterproofing membrane up the walls full height of the tile assembly. Waterproofing membranes shall be tested and proved to be watertight prior to being covered by other tile installation materials
- H. Expansion and Control Joints: Provide expansion and control joints in tile work where indicated. Where joint locations are not indicated, provide joints spacing in accordance with TCNA Handbook. Submit plan showing location of joints for approval. Construct joints in accordance with TCNA Handbook and as follows:
 - 1. Before grouting, keep joints open and clean by stuffing with paper or other material to prevent filling with dirt, grout, or mortar.
 - 2. After tile is grouted and completely dry, remove paper or other temporary filler material; brush joints clean and fill with back-up material, or bond breaker tape, and sealant as specified in Section 07 90 00 - Joint Protection.
- I. Grout: Apply grout in accordance with ANSI A108.10. Force a maximum of grout into joints. Grouted joints shall be full and integral with setting bed. Before grout sets, strike or tool the joints of cushion edge tile to depth of cushion, filling gaps; and with square edged tile, fill joints flush with their surface.

3.4 CLEANING

- A. Clean surfaces after installation as recommended by tile manufacturer.
- B. Use no acid, metal cleaning tools or harsh abrasive on tile.
- C. Replace damaged surfaces before time of final acceptance.

3.5 PROTECTION

- A. Keep floors free from traffic for a minimum of three (3) days after tile has been installed.
- B. If use of newly tiled floors is unavoidable, provide board walkways for use for a minimum of three (3) days.

END OF SECTION

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Acoustical ceiling tile.
 - 2. Suspended metal grid ceiling system, materials and fastening.
 - 3. Trim, clips, adhesives, and other related accessories.
- B. Related Sections:
 - 1. Section 08 31 13 - Access Doors and Frames.

1.2 REFERENCES

- A. ASTM A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
- B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
- D. ASTM D1779 - Standard Specification for Adhesive for Acoustical Materials.
- E. ASTM D5116 - Standard Guide for Small Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- G. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- H. ASTM E488 - Standard Test Method for Strength of Anchors in Concrete and Masonry Elements.
- I. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.
- J. ASTM E1190 - Standard Test Methods for Strength of Power Actuated Fasteners Installed in Structural Members.
- K. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.
- L. Forest Stewardship Council (FSC).

- M. California Department of General Services, Division of the State Architect (DSA), Interpretation of Regulations (IR) Manual, IR 25-2.13, Metal Suspension Systems for Lay-In Panel Ceilings: 2016 CBC.
- N. CCR - California Code of Regulations, Title 24 - 2016 California Building Code (CBC).
- O. CCR - California Code of Regulations, Title 24, Part 11 - 2016 California Green Building Code.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings: Indicate panel layout; show locations of mechanical grills, lighting, access panels, sprinkler heads, and other items affecting ceiling installation.
- C. Product Data: Indicate components specified in this Section.
 - 1. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
 - 2. For adhesives include printed statement of VOC content.
 - 3. For acoustical panels include printed statement of VOC content and ASTM D 5116 emission test results.
- D. Samples:
 - 1. Submit full range of manufacturer's standard colors for color selection.
 - 2. Submit 12 inch square samples for each type and size acoustical unit required.
 - 3. Submit sample of suspension system; 12 inches long.
- E. Manufacturer's installation instructions for suspended grid system and adhesives.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Provide factory wrapping, packaging, and other means necessary to prevent damage or deterioration during shipment, handling, and storage.
- B. Maintain protective coverings in place and in good repair until removal is necessary for the Work.
- C. Store products inside enclosed storage facilities or closed building, supported above grade and slabs on grade.
- D. Maintain storage spaces and products in dry condition, and within temperature extremes recommended by manufacturer.
- E. Follow special instructions of manufacturer.

1.5 PROJECT CONDITIONS

- A. Building shall have been entirely enclosed, with temperature and humidity closely approximating the conditions that will exist during occupancy, for not less than 10 days before start of installation.
- B. Before installation, acoustical units shall have been stored within the spaces where they are to be used, for at least 3 days with cartons opened and stripped sufficiently to permit units to stabilize to ambient conditions.

1.6 EXTRA MATERIALS

- A. In addition to acoustical units required for installation, furnish additional units in typical field sizes for each type of unit used in the Work.
- B. Deliver extra materials to project premises just prior to final acceptance and store at location directed by the Owner's Representative.
- C. Furnish extra units from production lots or color runs the same as for units used in the Work, and furnish in factory packaged and labeled cartons.
- D. Identify cartons with Contents and Project Name as follows:
 - 1. Extra Type __ Ceiling Panels, Tile, Country Day School, Chico.
- E. Furnish in quantities equal to or less than three percent of total installed area of each type of unit or greater to furnish in full carton lots for each type, except not less than one full carton for each type of unit.
- F. Furnish written certification that extra materials supplied have been inspected and reconfirmed to be the same as those used in the Work.

PART 2 PRODUCTS

2.1 ACOUSTICAL TILE

- A. Acoustical Panels, General:
 - 1. Description: Wet-formed mineral fiber with an anti-microbial treatment that shall provide a guaranteed resistance against growth of mold/mildew and Gram-positive and Gram-negative odor/stain-causing bacteria for 30 years.
 - 2. Recycled Content: Provide acoustical panels with recycled content such that postconsumer recycled content plus one half of preconsumer recycled content constitutes a minimum of 50 percent by weight.
 - 3. Sustainability Requirements: Provide acoustical as follows:
 - a. Zero-emitting: Acoustic panels tested according to ASTM D 5116 and shown to emit less than $3 \mu\text{g}/\text{m}^3$ (2 ppb) formaldehyde.
 - b. Or Low Emitting: Acoustic panels tested according to ASTM D 5116 and shown to emit less than $14 \mu\text{g}/\text{m}^3$ (11.5 ppb) formaldehyde.

B. Manufacturers:

1. (Basis of Design) Armstrong World Industries Inc.:
 - a. 2 x 2 Tile: Dune.
 - b. 2 x 4 Tile: Dune Second Look II.
 - c. 2 x 4 Tile at Food Service: KitchenZone. (NOT USED)
2. USG Interiors.
3. Or Equal.

C. Panels:

1. Field Size: 2 x 2 feet, 5/8 inch thick.
 - a. Product Line Series: Dune; Item 1772.
 - b. Surface Texture: Fine Fissured.
 - c. Edge Profile: Angled Tegular.
 - d. Noise Reduction Coefficient (NRC) Rating: 0.50.
 - e. Ceiling Attenuation Class (CAC) Rating: 30.
 - f. Light Reflectance: 0.83
2. Field Size: 2 x 4 feet, 3/4 inch thick.
 - a. Product Line Series: Dune Second Look II; Item 2712.
 - b. Surface Texture: Fine Fissured.
 - c. Edge Profile: Angled Tegular.
 - d. Noise Reduction Coefficient (NRC) Rating: 0.50.
 - e. Ceiling Attenuation Class (CAC) Rating: 35.
 - f. Light Reflectance: 0.83.
3. Field Size: 2 x 4 feet, 5/8 inch thick (NOT USED)
 - a. Product Line Series: KitchenZone; Item 672.
 - b. Surface Texture: Smooth; washable; meets USDA/FSIS guidelines for use in food processing areas.
 - c. Edge Profile: Square Lay-In.
 - d. Noise Reduction Coefficient (NRC) Rating: (not rated).
 - e. Ceiling Attenuation Class (CAC) Rating: 33.
 - f. Light Reflectance: 0.89.
4. ASTM E84 Classifications: Class A; Flame Spread 0-25; Smoke Developed 50 or less.
5. Finish and Color: Factory-applied vinyl latex paint, washable, in manufacturer's standard white color.

2.2 SUSPENDED GRID SYSTEM

A. General

1. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Manufacturers

1. (Basis of Design) Armstrong Industries; Prelude XL 15/16" Exposed Tee System.
2. USG Interiors, Inc.
3. Or equal.

C. Type: Direct suspension, supported and braced by connections to overhead structures; non fire-rated, exposed steel grid system.

- D. Structural Classification: Heavy duty, meeting requirements of ASTM C635, and as specified.
- E. Components:
 - 1. Factory fabricated, punched, and otherwise prepared to facilitate rapid installation with minimum field Work for typical conditions.
 - 2. Items of like type and size shall be readily interchangeable without modification.
- F. Grid Runners:
 - 1. Type: Bulb tee section, double-web type, formed from electro-galvanized steel strip in thickness required to meet specified duty classification, 24 gauge minimum.
 - 2. Main Runners: 15/16-inch wide flange, 1-1/2-inch high web.
 - 3. Cross Runners: 15/16-inch wide flange, 1 1/8-inch high web.
- G. Exposed-grid Accessories:
 - 1. Perimeter angles, reveals, and other items detailed; roll formed from electro-galvanized steel strip to sizes indicated or required for Project conditions, and as accepted.
 - 2. For fixed connection of runner ends to wall angles, 1/8-inch diameter pop rivets; head color to match exposed grid.
- H. Finish: Manufacturer's standard low-gloss sheen baked enamel, color as selected by Owner's Representative.
- I. Panel Hold-Down Clips:
 - 1. (Basis of Design) Armstrong World Industries; Hold Down Clip 7878.
 - 2. USG Industries Inc.
 - 3. Or equal.
- J. Removable Panel Hold-Down Clips:
 - 1. (Basis of Design) Armstrong World Industries; Hold Down Clip, Model 425.
 - 2. USG Industries Inc.
 - 3. Or equal.

2.3 SUSPENSION MATERIALS AND FASTENINGS

- A. Wire
 - 1. General: ASTM A641, galvanized double-annealed steel, regular coating, soft temper; factory pre-straightened units.
 - 2. Hanger and Safety Wires: 12 gauge, unless otherwise indicated.
 - 3. Ceiling and Partition Bracing Wires: 10 gauge, unless otherwise indicated.
- B. Turnbuckles: As required for leveling grid assemblies, of adequate size, electroplated.
- C. Wire Connections to Overhead Structures
 - 1. In accordance with DSA Interpretation of Regulations IR 25-2.13, Section 6, and applicable drawings and details at the end of the IR.
 - 2. Bolts or screws of adequate size, in types appropriate for conditions and materials involved, and made of corrosion-resistant materials or coated as accepted.

- D. Fastenings for Accessories
 - 1. Bolts or screws of adequate size, in types appropriate for conditions and materials involved, and made of corrosion-resistant materials or coated as accepted. Concealed only, unless otherwise indicated or accepted.

2.4 DECORATIVE WOOD CEILING PANEL SYSTEM (NOT USED)

- A. Manufacturers:
 - 1. (Basis of Design) Armstrong World Industries Inc; WOODWORKS Grille Series.
 - 2. Or Equal
- B. Panels:
 - 1. Product: WOODWORKS Grille; vertical blade configuration.
 - 2. Description: Wood slats mounted on wood dowel ceiling panel system supported by the panel manufacturer's suspended metal grid system.
 - 3. Species/Finish: As selected by the Owner's Representative from the manufacturer's full range of standard product offerings.
 - 4. Nominal Slat Size: 5/8 inch wide x 2-1/4 inch high.
 - 5. Nominal Dowel Size: 15/16 inch diameter.
 - 6. Surface Texture: Smooth.
 - 7. Panel Size (nominal): 4 x 8 feet, 4 x 12 feet, and 8 x 8 feet as indicated on the Drawings
 - 8. Panel Perimeter Trim: 2-1/4 inch End Cap.
 - 9. Panel Attachment Method to Suspension System: Dowel Clips.
 - 10. NRC Range: 0.75 to 0.85; ASTM C 423.
 - 11. Sustainability Requirements: Forest Stewardship Council (FSC) certified.
 - 12. ASTM E84 Classifications: Class C; Flame Spread Index 200 or less; Smoke Developed Index 450 or less.
 - 13. Panel Accessories, Clips, and Trims: As required for each installation area to provide a completed assembly.
- C. Suspension System:
 - 1. Product: Prelude XL System for WOODWORKS Grille; 15/16" Exposed Tee System as specified in Paragraph 2.2 of this Section.
 - 2. Color: Black.
 - 3. Structural Classification, Components, and Grid Runners: As specified in Paragraph 2.2 of this Section.
 - 4. Suspension Materials and Fastenings: As specified in Paragraph 2.3 of this Section.
 - 5. Accessories, Clips, and Trims: As required for each installation area to provide a completed assembly.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are satisfactory for the installation of acoustical ceiling systems.
- B. Verify that wet work such as plastering and painting has been completed and is thoroughly dry, and that rough mechanical and electrical Work has been completed in the area above which the ceiling will be installed.

- C. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Installation shall be in accordance with the manufacturer's printed instructions, the requirements of DSA Interpretation of Regulations IR 25-2.13, ASTM C636, these Specifications, and as indicated.
- B. Hanger Wires:
 - 1. Provide for main runners and cross runners within 8 inches of ceiling perimeter and breaks in ceiling plane.
 - 2. Provide counterbraced wires for hanger wires more than 1 to 6 out of plumb.
 - 3. Secure hanger wires with three tight turns within 3 inches maximum length.
 - 4. Attachment of Bracing Wires to Wood Framing: In accordance with DSA Interpretation of Regulations IR 25-2.13, Section 6, applicable drawings and details at the end of the IR.
 - 5. Attachment of Bracing Wires to Wood Framing with Gypsum Board: Submit proposed attachment detail to Owner's Representative for approval in accordance with DSA Interpretation of Regulations IR 25-2.13, Article 8.4.
 - 6. Separate hanger and bracing wires from unbraced ducts, pipes, etc.
- C. Bracing-Wire Assemblies:
 - 1. Provide hanger and four-way bracing wire sets for each 96 square feet of ceiling area, located and spaced in accordance with referenced standards.
 - 2. Bracing Wires: Provide set of four of splay wires at a maximum of 45 degrees unless other specifically designed and detailed bracing is provided. Provide first set of splay wires at 48 inches from walls.
 - a. Wires: Taut without causing ceiling to lift.
 - b. Secure bracing wires with four tight turns for 12 and 10 gauge and three tight turns for 8 gauge within 1-1/2 inches maximum length.
 - 3. Attachment of Bracing Wires to Wood Framing: In accordance with DSA Interpretation of Regulations IR 25-2.13, Section 6, applicable drawings and details at the end of the IR.
 - 4. Attachment of Bracing Wires to Wood Framing with Gypsum Board: Submit proposed attachment detail to Owner's Representative for approval in accordance with DSA Interpretation of Regulations IR 25-2.13, Article 8.4.
- D. Ceiling Grid:
 - 1. Installation shall be in accordance with DSA Interpretation of Regulations IR 25-2.13, Sections 3, 4, and 5.
 - a. At Exitways and Corridors the ceiling grid must additionally conform to the provisions of DSA Interpretation of Regulations IR 25-2.13, applicable drawings and details at the end of the IR.
 - 2. Ceiling grid members shall be attached to two (2) adjacent walls per ASTM E580, Section 5.2.3. Ceiling grid members shall be at least 3/4 inch clear of other walls. If walls run diagonally to ceiling grid system runners, one end of main and cross runners should be free, and a minimum of 3/4 inch clear of wall.
 - 3. The width of the perimeter supporting closure angle shall be not less than two inches. Grid systems with specialty or proprietary angles and support clips must conform to the

provisions of DSA Interpretation of Regulations IR 25-2.13, Section 3, applicable drawings and details at the end of the IR.

4. At the perimeter of the ceiling area, where main or cross runners are not connected to the adjacent wall, provide interconnection between the runners at the free end to prevent lateral spreading. A metal spreader strut or a #16 gage wire with a positive mechanical connection to the runner may be used and placed within eight (8) inches of the wall. Where the perpendicular distance from the wall to the first parallel runner is eight (8) inches or less, this interlock is not required.
5. Unless otherwise indicated, center system on room axis leaving equal border units greater than one half panel width on each side.

E. Installation Tolerances:

1. Bottom surface plane of each assembly shall be within plus-or-minus 1/8 inch of ceiling height required.
2. Bottom surface plane of each assembly shall be level and true to plane within 1/8 inch in 12 feet.

3.3 MECHANICAL AND ELECTRICAL WORK

- A. For locating safety wires, obtain layouts and/or instructions specified to be furnished as part of the Work of Divisions 22, 23, and 26.
- B. Secure light fixtures to ceiling grid to resist horizontal force equal to weight of fixture.
 1. Flush or Recessed Light Fixtures, Air Terminals, and Services: Independently support by not less than four taut 12-gauge wires capable of supporting four times load.
 2. Surface Mounted Light Fixtures: Support with at least two positive clamped devices made of minimum 14-gauge steel surrounding ceiling runner and supported from structure above with 12-gauge wire. Rotational spring clips not allowed.
 3. Pendant Mounted Light Fixtures: Support directly to structure above with hanger wires through each pendant capable of supporting four times load.

3.4 PERIMETER TRIM

- A. Trim shall be of same material, finish, and color as that of suspension system, unless otherwise specified, and of size and configuration indicated.
- B. Provide in longest lengths available and combinations of lengths to minimize number of joints required.
- C. Pieces shorter than 48 inches will not be permitted.
- D. Miter joints at corners.
- E. Install to neatly close with adjoining vertical surfaces.

3.5 INSTALLATION OF ACOUSTIC PANELS

- A. Install acoustic panels using hold-down clips; minimum 4 clips per panel. Install panels loose, without hold-down clips, where specifically indicated.

3.6 INSTALLATION OF DECORATIVE WOOD CEILING PANELS (NOT USED)

- A. Installation of the decorative wood ceiling panels and supporting grid structure shall be in accordance with the manufacturer's printed instructions.

3.7 FIELD QUALITY CONTROL

- A. When complete, grid members of each assembly shall be mutually parallel/square, accurately aligned to positions intended, with joints neatly formed, closely fitted and aligned flush; and each assembly shall be securely anchored and braced to structure to prevent movement.
- B. Acoustical units installed in grids shall rest uniformly on their supporting members and shall be flat and free from twist and warp.
- C. Joints of adhesive installed acoustical units shall be accurately aligned, straight, and free from gaps and offsets across adjoining units.

3.8 CLEANING

- A. Exposed surfaces of grids and acoustical units shall be clean and free from scratches, dents, tool marks, stains, discoloration, fingerprints, and other defects and damage.

END OF SECTION

SECTION 09 61 00
FLOORING TREATMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Clear floor sealer.
 - a. Scope of Work: To be applied to the entire building floor slab.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete.
2. Section 09 30 13 - Ceramic Tiling.
3. Section 09 65 00 - Resilient Flooring.
4. Section 09 68 00 - Carpeting.
5. Section 09 90 00 - Painting and Coating: Standard paint coatings and finishes.

1.2 REFERENCES

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- C. FS TT-C-550C NOT 1 - (Federal Specification) Coating System, Glaze, High Performance, (Solvent Base) for Interior Surfaces.
- D. CCR - California Code of Regulations, Title 24, Part 11 - 2016 California Green Building Code.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Show conformance to VOC limitations specified herein.
- C. Product Data:
 1. Indicate manufacturer, product, and conformance with specified requirements.
 2. Provide manufacturer's product data sheets.
 3. For coatings include printed statement of VOC content and chemical components.
- D. Manufacturer's application instructions.

1.4 QUALITY ASSURANCE

- A. Applicator: Company approved by floor sealer manufacturer.

1.5 PROJECT CONDITIONS

- A. Ensure adequate illumination, ventilation, and dust free environment during application and curing of materials.

PART 2 PRODUCTS

2.1 GENERAL

- A. VOC Content of Field Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Floor Coatings: VOC not more than 100 g/L.
 - 2. Materials shall comply with Bay Area Air Quality Management District (BAAQMD) Regulations for low volatile organic compounds (VOCs).
- B. Chemical Components of Field Applied Interior Paints and Coatings:
 - 1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing 1 or more benzene rings).
 - 2. Restricted Components: Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.
 - j. 1,2-dichlorobenzene.
 - k. Diethyl phthalate.
 - l. Dimethyl phthalate.
 - m. Ethylbenzene.
 - n. Formaldehyde.
 - o. Hexavalent chromium.
 - p. Isophorone.
 - q. Lead.
 - r. Mercury.
 - s. Methyl ethyl ketone.
 - t. Methyl isobutyl ketone.
 - u. Methylene chloride.
 - v. Naphthalene.
 - w. Toluene (methylbenzene).
 - x. 1,1,1-trichloroethane.
 - y. Vinyl chloride.

2.2 MANUFACTURER

- A. Euclid Chemicals; Euco #512 Epoxy Sealer.
- B. Sonneborn; Kure-N-Seal.
- C. Synthetics International; Synthetic10.
- D. 3M; Concrete Protector and Restorer (CPCR).
- E. Creteseal; CS2000.
- F. Or equal.

2.3 MATERIALS

- A. Sealer: Low viscosity, transparent acrylic sealer for protection of concrete surfaces.
- B. Accessory Materials: Fillers, thinners, and other materials of type recommended by sealer manufacturer for intended application.
- C. Fire Hazard Classification: Class A in accordance with ASTM E84.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions are suitable to receive the Work of this Section.
- B. Do not begin application until unsuitable conditions have been corrected. Beginning application means acceptance of existing conditions.

3.2 PREPARATION

- A. Remove or protect items not required to be coated.
- B. Clean and prepare substrate surfaces in accordance with manufacturer's instructions.
- C. Remove dust, dirt, loose and foreign materials.
- D. Fill hairline cracks, holes, and similar defects with filler compatible with finish treatment.

3.3 APPLICATION

- A. Mix and apply sealer in accordance with manufacturer's instructions, using brush, roller, or spray.
- B. Apply at coverage rate recommended by manufacturer.
- C. Edges abutting other materials and colors shall be sharp and clean without overlapping.

D. Finish surfaces shall be uniform in finish and color.

3.4 CLEANING

A. During progress of the Work, and upon completion, clean adjacent surfaces and materials of spills, splatters, spills, and stains resulting from application. Remove using methods recommended by manufacturer and approved by the Owner's Representative, exercising care to prevent damage to finish surfaces and materials.

B. Touch up damaged surfaces before final acceptance.

END OF SECTION

SECTION 09 65 00

RESILIENT FLOORING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Luxury Vinyl Tile, Vinyl Plank Series.
 - 2. Resilient Bases.
 - 3. Related accessories.
- B. Related Sections:
 - 1. Section 09 30 13 - Ceramic Tiling.
 - 2. Section 09 61 00 - Flooring Treatment.
 - 3. Section 09 68 00 - Carpeting.

1.2 REFERENCES

- A. ASTM D2047- Standard Test Method for Static Coefficient of Friction of Polish Coated Flooring Surfaces as Measured by the James Machine.
- B. ASTM E648 - Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. ASTM F1066- Standard Specification for Vinyl Composition Floor Tile.
- E. ASTM F1303- Standard Specification for Sheet Vinyl Floor Covering with Backing.
- F. ASTM F1700- Standard Specification for Solid Vinyl Floor Tile.
- G. ASTM F1861- Standard Specification for Resilient Wall Base.
- H. ASTM F1869- Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- I. ASTM F1913- Standard Specification for Sheet Vinyl Floor Covering without Backing.
- J. ASTM F2170- Standard Test Method for Determining Relative Humidity in Concrete floor Slabs Using in situ Probes.
- K. FS L-F-1641 - Floor Covering, Translucent or Transparent Vinyl Surface, with Backing.
- L. FS L-F-475 - Floor Covering, Vinyl Surface (Tile and Roll), with Backing.
- M. FS SS-W-40 - Wall Base: Rubber and Vinyl Plastic.

- N. ADA Accessibility Guidelines for Buildings and Facilities (ADAAG).
- O. CCR - California Code of Regulations, Title 24 - 2016 California Building Code (CBC).
- P. CCR - California Code of Regulations, Title 24, Part 11 - 2016 California Green Building Code.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data: For each type of product indicated.
 - 1. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 2. For adhesives, sealants, and chemical-bonding compounds include printed statement of VOC content.
 - 3. For resilient flooring include documentation of FloorScore™ Certification.
- C. Samples:
 - 1. Submit samples of manufacturer's full line of patterns and colors for selection by the Owner's Representative.
 - 2. Submit for each type, pattern, and color of resilient flooring material selected.
 - 3. Accessories shall be 9 inches long, minimum.
- D. Manufacturer's installation instructions.
- E. Manufacturer's instructions for maintenance and stain removal.

1.4 QUALITY ASSURANCE

- A. Slip Resistance: Where required for conformance to accessibility standards, flooring shall conform to a minimum coefficient of friction of 0.5 when tested in accordance with ASTM D2047.
- B. Minimum recycled content 50 percent post consumer of vinyl and 90 percent of rubber base.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original unopened containers with labels indicating brand names, colors and patterns, and quality designations legible and intact.
- B. Do not remove markings until materials have been inspected and accepted.
- C. Store and protect accepted materials in accordance with manufacturer's printed instructions.
- D. Store materials in the original containers at not less than 70 degrees Fahrenheit for a minimum of 48 hours immediately prior to installation.

1.6 PROJECT CONDITIONS

- A. Maintain the temperature in spaces to receive resilient flooring materials between 70 and 90 degrees Fahrenheit for a minimum of 48 hours prior to installation, during installation, and 48 hours after installation. Thereafter, maintain a minimum temperature of 55 degrees Fahrenheit.

1.7 EXTRA MATERIALS

- A. Provide resilient flooring materials for replacement and maintenance.
- B. Clearly identify each carton as to contents. Indicate Project, Building and Room numbers.
- C. Include materials of each size, color, pattern and type incorporated in the Work.
- D. Seamless Flooring: Provide one percent of total installed area for each type, pattern, and color of sheet vinyl and seamless flooring installed.
- E. Accessories: Provide one percent of each type of accessory and trim for each size, color and type installed.

1.8 WARRANTY

- A. Manufacturer's Warranty: The manufacturer of the resilient flooring products shall provide a standard five (5) year warranty for Light Commercial use from date of substantial completion, covering the materials installed as part of this Work against defects in material and workmanship.
- B. Installer's warranty: The installer of the resilient flooring products shall provide a standard one (1) year warranty from date of substantial completion, covering the installation of the Work against defects in workmanship.

PART 2 PRODUCTS

2.1 LUXURY VINYL TILE, VINYL PLANK SERIES

- A. Manufacturer:
 - 1. (Basis of Design) Armstrong: Luxury Vinyl Tile, Luxe Vinyl Plank Series.
 - 2. Mannington Mills, Inc.
 - 3. Tarkett Inc.
 - 4. Congoleum Corp.
 - 5. Or equal.
- B. Type: Composition of vinyl resins and fiber fillers, conforming to ASTM F1066: Type IV, Composition 1.
- C. Pattern and Color: As selected by the Owner's Representative from manufacturer's full range of price groups.

- D. Size: Mix of pieces 6 inches wide x 36 inches long and 6 inches wide and 48 inches long.
- E. Thickness: 0.110" (2.79 mm), 0.135" (3.43 mm), or 0.110" (2.79 mm) depending on the price group selected by the Owner's Representative.
- F. Luxury Vinyl Tile shall contain minimum of 25 percent recycled content.
- G. The floor covering system have a Class 1 rating as specified in NFPA Life Safety Code 101, and conform to ASTM E648 with a Class 1 Critical Radiant Flux of 0.45 Watts per Square Cm. or greater.

2.2 VINYL COMPOSITION TILE (NOT USED)

- A. Manufacturer:
 - 1. (Basis of Design) Armstrong; Standard Excelon Series.
 - 2. Azrock Floor Products Div.
 - 3. Tarkett Inc.
 - 4. Or equal.
- B. Type: Composition of vinyl resins and fiber fillers, conforming to ASTM F1066: Type IV, Composition 1.
- C. Pattern and Color: As selected by the Owner's Representative from manufacturer's standard range.
- D. Size: 12 inch square, 1/8 inch thick.
- E. Vinyl Composition Tile shall contain minimum of 25 percent recycled content.
- F. The floor covering system have a Class 1 rating as specified in NFPA Life Safety Code 101, and conform to ASTM E648 with a Class 1 Critical Radiant Flux of 0.45 Watts per Square Cm. or greater.

2.3 SHEET VINYL (NOT USED)

- A. Manufacturer:
 - 1. (Basis of Design) Armstrong; Safeguard.
 - 2. Johnsonite; Optima IQ.
 - 3. Congoleum; Specifications.
 - 4. Or equal.
- B. Type: In conformance with ASTM F1303, Type II, Grade 1 having a backing suitable for adhesive application above, on and below grade.
- C. Slip Resistance: Product shall have a static coefficient of friction of 0.5 minimum under wet conditions in accordance with ASTM D2047.
- D. Thickness: 0.080 inch, minimum.

- E. Pattern and Color: As selected by the Owner's Representative from manufacturer's standard range.
- F. Base: Self-coved. Provide wood cove backing.
- G. The floor covering system have a Class 1 rating as specified in NFPA Life Safety Code 101, and conform to ASTM E648 with a Class 1 Critical Radiant Flux of 0.45 Watts per Square Cm. or greater.

2.4 RUBBER BASE

- A. Acceptable Manufacturers:
 - 1. Burke Flooring Products.
 - 2. Roppe Rubber Corp.
 - 3. Johnsonite.
 - 4. Or equal.
- B. Base: FS SS-W-40, Type I rubber; coved; 6 inches high; 1/8 inch thick.
- C. Base Accessories: Pre-molded end stops, internal corners, and external corners of same material, size, and color as base.
- D. Color: As selected by the Owner's Representative from manufacturer's standard range.
- E. Resilient base shall contain minimum of 25 percent recycled content.
- F. The floor covering system have a Class 1 rating as specified in NFPA Life Safety Code 101, and conform to ASTM E648 with a Class 1 Critical Radiant Flux of 0.45 Watts per Square Cm. or greater.

2.5 ACCESSORIES

- A. Material: Rubber or vinyl.
- B. Reducer Strips: ASTM F1066, Type II, tapered edge style, of thickness to suit abutting floor covering material.
- C. Cap Strip: Round style, minimum 3/4 inch size.
- D. Color: To be selected by the Owner's Representative from the manufacturer's standard range.
- E. Thickness: Matching, or compatible with, thickness of abutting flooring material.

2.6 INSTALLATION MATERIALS

- A. Installation materials shall be of the types and brands recommended by the flooring material manufacturer for the specific installation conditions, and include:
 - 1. Adhesives: Water resistant type recommended by floor covering manufacturer for products and substrates indicated.
 - a. For VCT flooring use adhesives that have a VOC content of not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Primer.
3. Crack filler and leveling compound; Industrial Products, Inc. (Vi-Tex Leveling Compound), Armstrong Floor Div. (Underlayment S-180), or equal.
4. Cove backing.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are satisfactory for the installation of resilient flooring materials.
- B. Verify surfaces are smooth and flat.
- C. Perform moisture test series to determine volume of vapor emission by standard anhydrous calcium chloride crystal test. Test results shall be expressed in pounds of emission within 1,000 square feet during 24 hours.
- D. Verify that concrete floors exhibit negative alkalinity, and do not exhibit carbonization or dusting, at the time of application of flooring.
- E. Correct all unsatisfactory conditions prior to the installation of resilient flooring materials.

3.2 PREPARATION

- A. Remove dirt, oil, grease, and other foreign matter from surfaces to receive resilient flooring materials.
- B. Fill cracks to provide a level surface for application of resilient flooring.
- C. Prohibit traffic from area until filler is cured.
- D. Vacuum substrate clean.
- E. Prime surfaces, if recommended by resilient flooring adhesive manufacturer.
- F. Seal concrete surfaces to receive resilient flooring with a topical vapor emissions membrane or sealer which is compatible with the adhesive and/or flooring if the vapor emissions rate from the concrete exceeds the recommendations of the flooring and/or adhesive manufacturer.

3.3 APPLICATION OF ADHESIVES

- A. Mix and apply adhesives in accordance with the manufacturer's printed instructions, except as specified.
- B. Provide safety precautions during mixing and applications as recommended by adhesive manufacturer.
- C. Apply adhesives uniformly over surfaces.

- D. Apply no more adhesive at any time than can be covered by resilient flooring material within manufacturer's recommended working time of the adhesive.
- E. Remove adhesive which dries or films over.
- F. Do not soil walls or adjacent areas with adhesive.
- G. Promptly remove spillage.

3.4 INSTALLATION – LUXURY VINYL TILE, VINYL PLANK SERIES

- A. Install vinyl plank flooring in accordance with manufacturer's written instructions.
- B. Mix vinyl plank flooring pieces from container to ensure shade variations are consistent.
- C. Randomly install 36 inch long and 48 inch long pieces. Install vinyl plank flooring pieces with joints staggered.
- D. Cut border vinyl plank flooring pieces neatly and accurately to fit within 1/64 inch of abutting surfaces.
- E. Fit vinyl plank flooring pieces neatly and tightly into breaks and recesses, around pipes and penetrations, under saddles or thresholds, and around permanent cabinets and equipment.
- F. At door openings where the vinyl plank flooring pieces and other floor materials meet, make joinings under center of doors.

3.5 INSTALLATION - VINYL COMPOSITION TILE (NOT USED)

- A. Install tile in accordance with manufacturer's instructions.
- B. Mix tile from container to ensure shade variations are consistent.
- C. Install tile to square grid pattern with joints aligned.
- D. Do not lay tile less than one half width of a field tile, except where accepted by the Owner's Representative for irregularly shaped rooms or spaces.
- E. Cut border tile neatly and accurately to fit within 1/64 inch of abutting surfaces.
- F. Fit tile neatly and tightly into breaks and recesses, around pipes and penetrations, under saddles or thresholds, and around permanent cabinets and equipment.
- G. At door openings where tile and other floor materials meet, make joinings under center of doors.

3.6 INSTALLATION - SHEET VINYL (NOT USED)

- A. Install sheet vinyl in accordance with manufacturer's instructions.
- B. Cut sheet material in lengths and sizes required.

1. Cut for minimum number of seams and for pattern match between adjacent abutting edges.
 2. Double cut, if required.
 3. Lay cut sheets flat and allow to acclimate to room temperature prior to installation.
- C. Work out wrinkles and air pockets.
- D. Roll material in two directions, starting at center of sheet.
- E. Butt edges of adjoining sheets.
- F. Heat weld joints thoroughly.
- G. Self-coved Base:
1. Cut, fit, and miter sheet material at interior and exterior corners to form integral bases 6 inches high, unless otherwise indicated.
 2. Install fillet member to ease transition at intersection between floor and wall.
 3. Apply heavy coat of adhesive to vertical wall surfaces where sheet vinyl will be applied.
 4. Mask upper wall surface to avoid excessive adhesive above contact line.
 5. Install cap strip.
- H. Fit sheet vinyl neatly and tightly into breaks and recesses, around pipes and penetrations, under saddles or thresholds, and around permanent cabinets and equipment.
- I. At door openings where sheet vinyl and other floor materials meet, make joinings under center of doors.

3.7 INSTALLATION - REDUCER STRIPS

- A. Apply adhesive and bond securely to substrate in straight, true lines.
- B. Provide where floor covering terminates exposing the edge of the covering.
- C. Center edge strips under doors where floor covering terminates at a door opening.
- D. Cut ends to fit edges of door frames and abutting surfaces; fit edges to adjoining floor coverings.
- E. Top of strips shall be flush with top of resilient flooring material.

3.8 INSTALLATION - RESILIENT BASE

- A. Install base in lengths as long as practical to minimize the number of joints and suit installation conditions.
- B. Install with tight butt joints. Fit joints tight and vertical.
- C. Install on solid backing. Bond tight to wall surfaces.
- D. Press down so that bottom edge follows floor profile.

- E. Use pre-molded units at exposed ends and external corners; miter internal corners.
- F. Scribe and fit to door frames and other interruptions.

3.9 INSTALLATION - MISCELLANEOUS ACCESSORIES

- A. Install accessories in accordance with manufacturer's instructions.

3.10 CLEANING AND PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Not less than four days following completion of installation of resilient flooring, clean surfaces with a neutral cleaner recommended by the flooring materials manufacturer for the type of material installed. Remove excess adhesive without damaging surfaces.
- C. For flooring materials requiring waxing, apply two coats of nonslip wax or other finish recommended by the flooring materials manufacturer following cleaning of flooring materials, and buff to a sheen.
- D. Protect completed installation from traffic and damage with a covering of heavy Kraft paper, taped at edges.

3.11 SCHEDULE

Luxury Vinyl Plank Flooring Schedule per Room Finish Schedule on the Drawings shall be equal to the following Basis of Design:

- A. Type 1: Mohawk Group; Matuto Plus Stone Collection; #915A Frostbite Stone.
- B. Type 2: Mohawk Group; Matuto Plus Stone Collection; #927A Sonic Silver Stone.

END OF SECTION

SECTION 09 68 00

CARPETING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Modular Carpet Tile; glue down method.
 - 2. Accessories.
- B. Related Sections
 - 1. Section 09 30 13 - Ceramic Tiling.
 - 2. Section 09 61 00 - Flooring Treatment.
 - 3. Section 09 65 00 - Resilient Flooring.

1.2 REFERENCES

- A. AATCC - American Association of Textile Chemists and Colorists.
- B. AATCC 934 - Electrostatic property of carpets.
- C. ASTM D2646 - Test Methods for Backing Fabric Characteristics of Pile Yarn Floor Coverings.
- D. ASTM D3936 - Test Method for Resistance to Delamination of the Secondary Backing of Pile Yarn Floor Covering.
- E. ASTM D5116 - Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
- F. ASTM D5848 - Test Method for Mass per Unit Area of Pile Yarn Floor Coverings.
- G. ASTM D1335 - Tuft Bind of Pile Yarn Floor Coverings.
- H. ASTM D6859 - Test Method for Pile Thickness of Finished Level Pile Yarn Floor Coverings.
- I. ASTM E84 - Surface Burning Characteristics of Building Materials.
- J. ASTM E648 - Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
- K. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
- L. ASTM E1354 - Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter.

- M. ASTM F710 - Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.
- N. CCR - California Code of Regulations, Title 24 - 2016 California Building Code (CBC).
- O. CCR - California Code of Regulations, Title 24, Part 11 - 2016 California Green Building Code.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data: Provide product data for each product indicated, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
 - 1. For carpet, documentation indicating compliance with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.
 - 2. For carpet cushion, documentation indicating compliance with testing and product requirements of Carpet and Rug Institute's "Green Label" program.
 - 3. For installation adhesive include printed statement of VOC content.
- C. Shop Drawings:
 - 1. Indicate layout and location of seams and carpet indicating pile or pattern directions.
 - 2. Indicate walls, columns, doorways, casework, and built-in items.
 - 3. Indicate type, color, and location of edge, transition, and other accessory strips.
 - 4. Indicate transition details to other flooring materials.
- D. Samples: For selection by the Owner's Representative, submit samples of manufacturer's products, showing full range of color, texture, and pattern variations expected. Prepare samples from same material to be used for the Work. Submit the following:
 - 1. 12-inch-square samples of each type of carpet materials required.
 - 2. 12-inch-long samples of each type exposed edge stripping and accessory item.
 - 3. Sample mock-up of carpet seam as it would be installed for each type of carpet.
 - 4. Label each sample with manufacturer's name, material description, color, pattern, and designation indicated on the Drawings and as specified herein.
- E. Compatibility: Submit letter from each carpet manufacturer that the carpet and adhesive are compatible with each other and compatible with moisture vapor preventative concrete admixtures or concrete sealers that may be specified elsewhere within these Specifications.
- F. Test Reports: Submit certified test reports evidencing compliance with requirements specified for the materials of this Section and including but not limited to the following characteristics
 - 1. Fire Performance Characteristics:
 - a. Flammability / Flame Spread / Smoke Developed.
 - b. Surface Burning Characteristics.
 - c. Critical Radiant Flux.
 - 2. Physical Properties:
 - a. Sound Absorption.
 - b. Fade Resistance.
 - c. Static Resistance.
 - d. Permanent Stain Resistance.

- G. Certification: Submit manufacturer's certificate stating that materials furnished comply with specified requirements. Include supporting certified laboratory testing data indicating that material meets specified test requirements.
- H. Maintenance Data: For carpet to include in maintenance manuals, include the following:
 - 1. Manufacturers recommended methods for cleaning, care, and maintaining carpet including manufacturer's recommended frequency for maintaining carpet.
 - 2. Precautions for cleaning materials and methods that could be detrimental to finishes and performance. Include cleaning and stain-removal products and procedures.
 - 3. Deliver carpet manufacturers register numbers to the Owner's Representative.
- I. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Commercial Carpet: Carpet intended for use in commercial and public spaces, with construction, fire ratings, static control and appearance appropriate for this use and in accordance with the requirements of the 2016 California Building Code.
- B. Carpet Surfaces Burning Characteristics: Provide carpet identical to that tested for the following fire performance characteristics, per test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify carpet with appropriate markings of applicable testing and inspecting organization.
 - 1. Test Method: DOC FF 1-70.
 - 2. Rating: Pass.
- C. Manufacturer Qualifications: Company (material producer) with not less than five (5) years minimum of production experience, and having published literature that clearly indicates general compliance of their products with the requirements of this Section.
- D. Installer Qualifications: Company approved by the carpet manufacturer, and specializing in carpet installation with not less than five (5) years minimum experience in installation of carpeting similar to that required for this Project.
- E. Single Source Responsibility: Provide carpet material produced by a single manufacturer, and from a single dye lot, for each carpet type. Carpet shall be one manufacturer and shall be of first quality; no seconds or imperfections will be accepted.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. General: comply with the "storage and handling" recommendations from the Carpet and Rug Institute.
- B. Deliver materials to project site in original factory wrappings and containers, labeled with identification of manufacturer, brand name, and lot number.
- C. Store materials in original undamaged packages and containers, inside well ventilated area protected from weather, moisture, soilage, extreme temperatures, and humidity. Lay flat, blocked off ground.

- D. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements.

1.6 SEQUENCING AND SCHEDULING

- A. Sequence carpet installation with other work to minimize possibility of damage and soiling during remainder of construction period.
- B. Do not commence carpet installation until painting and finish work is complete, and ceiling and overhead work has been completed, tested, and approved.

1.7 PROJECT CONDITIONS

- A. Store materials for three days prior to installation in area of installation to achieve temperature stability.
- B. Maintain minimum 70 degrees Fahrenheit ambient temperature three days prior to, during, and 24 hours after installation of materials.
- C. Environmental Limitations: Do not install carpet and carpet cushion until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- D. Do not install carpet and carpet cushion over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.
- E. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.
- F. Provide sufficient lighting for installation, but in no case less than that which will be provided in the completed Project.

1.8 WARRANTY

- A. Replace or correct carpet that is defective, including but not limited to the following:
 - 1. High or low tufts, rows or bands.
 - 2. Stop marks or wire marks.
 - 3. Off-color tufts, rows or bands.
 - 4. Missing tufts or rows.
 - 5. Visually apparent mend lines.
 - 6. Visually apparent yarn splices.
 - 7. Uneven shearing.
 - 8. Excessive bowing in either length or width.
 - 9. Mixed dye lots.
 - 10. Persistent latex or chemical odors.
 - 11. Excessively stiff backing.

- B. Contractor shall provide a five (5) year manufacturer installation warranty from the specified carpet manufacturer. Contractor shall provide a lifetime non prorated warranty against edge-ravel, delamination, permanent stain resistance and tuft bind defects.
- C. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below, before installation begins, 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 for each type indicated, not less than 5-percent of the amount installed under provisions of Division 01.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Carpet: Commercial Grade, Modular Carpet Tile; conform to the following characteristics (Basis of Design: Mohawk Group):
 - 1. Face Fiber: Colorstrand SD Nylon
 - 2. Face Construction: Tufted, Level Patterned Loop
 - 3. Gauge: 1/10 inch
 - 4. Size: 24 inch x 24 inch
 - 5. Nominal Pile Height: .160" average
 - 6. Face Yarn Weight: 16 ounces per square yard
 - 7. Backing Materials: EcoFlex Matrix; Fiberglass Reinforced Thermoplastic Composite
 - 8. Fiber Technology: EcoSentry Plus Stain Protection; EcoSentry Soil Protection
 - 9. Dye Method: Solution Dyed
 - 10. Static: 3.0 KV
 - 11. Foot Traffic Rating: Heavy
 - 12. Color: As selected by the Owner's Representative from manufacturer's full range.
 - 13. Pattern: As selected by the Owner's Representative from manufacturer's full range.
 - 14. Product: As selected by the Owner's Representative from manufacturer's full range.
 - 15. Flame Radiant Panel Test: Must meet NFPA Class I (ASTM E-648)
 - 16. Surface Flammability: Must pass DOC FF-1-70
 - 17. Smoke Developed: Less than 450 maximum (ASTM E648)
- B. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

2.2 MANUFACTURERS

- A. Mohawk Group Carpet.
- B. Lees Carpet.
- C. Or equal.

2.3 ACCESSORIES

- A. Carpet Reducer Strip: Rubber; tapered edge style; in thickness to suit adjacent materials. Color to be selected by the Owner's Representative from manufacturer's full range of colors.
- B. Sub-Floor Filler: Type recommended by carpet manufacturer.
- C. Primers and Adhesives: Waterproof; of types recommended by carpet manufacturer.
 - 1. VOC Limits: Provide primers and adhesives that comply with VOC content limitations.
- D. Miscellaneous Materials: As recommended by carpet manufacturer, and as selected by Installer to meet Project circumstances and requirements.

2.4 COLORS, TEXTURES, AND PATTERNS

- A. As selected by the Owner's Representative from the manufacturers full range of colors, textures, and patterns.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate surfaces are smooth and flat with maximum variation of 1/8 inch in 10 feet and are ready to receive work.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer.
 - 2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the work signifies that the Contractor accepts the substrate, surfaces and conditions, and any subsequent problem with the Work related to the substrate shall be repaired to the satisfaction of the Owner's Representative without additional cost to the Owner

3.2 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.
- B. Apply, trowel, and float filler to leave smooth, flat, hard surface.
- C. Prohibit traffic until filler is cured.
- D. Broom and vacuum floor surface to be covered immediately before installing carpet.

3.3 INSTALLATION

- A. Apply carpet and adhesive in accordance with manufacturers' instructions.
- B. Verify carpet match before cutting to ensure minimal variation.
- C. Double cut carpet, to allow intended seam and pattern match. Match cuts straight, true, and unfrayed.
- D. Lay carpet on floors with run of pile in same direction as anticipated traffic.
- E. Locate change of color or pattern between rooms under door centerline.
- F. Cut and fit carpet around interruptions.
- G. Fit carpet tight to intersection with vertical surfaces without gaps.
- H. Do not bridge building expansion joints with carpet.

3.4 CLEANING AND PROTECTING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean and vacuum carpet, with method as recommended by carpet manufacturer, immediately after adhesive has dried at completion of installation, and again not less than 4 days prior to the date of Substantial Completion Walkthrough.
- C. Prohibit traffic from carpet areas for 24 hours after installation.
- D. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of the construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

3.5 SCHEDULE

Modular Carpet Tile Schedule per Room Finish Schedule on the Drawings shall be equal to the following Basis of Design:

- A. Type 1: Mohawk Group Art Intervention Collection – Central Point; #569 Lapis.
- B. Type 2: Mohawk Group Art Intervention Collection – Central Point; #263 Electric.
- C. Type 3: Mohawk Group Art Intervention Collection – Central Point; #659 Mint.
- D. Type 4: Mohawk Group Art Intervention Collection – Central Point; #439 Amethyst.
- E. Type 5: Mohawk Group Art Intervention Collection – Central Point; #989 Carbon.
- F. Type 6: Mohawk Group Art Intervention Collection – Central Point; #939 Platinum.
- G. Type 7: Mohawk Group Art Intervention Collection – Central Point; #149 Sunglow.

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Chico, California, 95928

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H. Type 8: Mohawk Group Art Intervention Collection – Central Point; #259 Flame.

END OF SECTION

SECTION 09 77 33

FIBERGLASS REINFORCED POLYESTER (FRP) PANELS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fiberglass reinforced polyester (FRP) panels.
 - 2. Adhesive accessories.

1.2 REFERENCES

- A. ASTM C1178 - Glass Mat Water-Resistant Gypsum Backing Panel.
- B. ASTM C1396 - Gypsum Board.
- C. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impresser.
- D. ASTM D5319 - Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristic of Building Materials.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data: Manufacturer's literature for each type of product indicated including FRP panels and accessories. Include pictorial information on full line of patterns and colors for selection by the Owner's Representative.
 - 1. For adhesives include printed statement of VOC content and chemical components.
 - 2. For laminating adhesive used in factory-laminated plastic panels include documentation indicating that product contains no urea formaldehyde.
- C. Samples: Submit for each type, pattern, and color of FRP panels selected. Samples shall be 12 inch by 12 inch, and accessories shall be 9 inches long, minimum. Include samples of trim.
- D. Submit manufacturers' instructions for installation and use of products specified.

1.4 QUALITY ASSURANCE

- A. Provide panels, adhesives, and accessories produced by a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original unopened containers with labels indicating brand names, and colors and patterns designations legible and intact.
 - 1. Deliver adhesive in sealed containers.
 - 2. Do not remove markings until materials have been inspected and approved.
- B. Store, handle, and protect materials in accordance with manufacturer's printed instructions.
- C. Allow panels to acclimate for a minimum of 24 hours in temperature and humidity conditions approximating the operating environment of the finished room.
- D. Protect surface of panels during handling and installation.

1.6 PROJECT CONDITIONS

- A. During installation and for not less than 48 hours before installation, maintain room temperature required for adhesive being used.
- B. Provide ventilation to disperse fumes during application of adhesive. Allow no containers of adhesive to be opened until all potential sources of flame or spark have been shut down or extinguished and until warning signs have been posted.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers
 - 1. Glasteel; Glasliner Series.
 - 2. McClarin Plastics.
 - 3. Or equal.

2.2 MATERIALS

- A. Panels: Fiberglass reinforced plastic (FRP); impact and stain resistant.
 - 1. Size: 0.090 inch thick by 8 feet high x widths required (one piece at each wall surface).
 - 2. Finish: As selected by the Owner's Representative from manufacturer's standard range.
 - 3. Color: As selected by the Owner's Representative from manufacturer's standard range.
 - 4. Flame-Spread Index less than 200; Smoke-Developed Index less than 450 as determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate marking of applicable testing agency.
- B. Adhesive: Contact type as recommended by manufacturer.
 - 1. VOC Content: 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- C. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements of Section 07 90 00 - Joint Protection.
 - 1. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Accessories: Provide panels complete with matching trim pieces for joints, corners and terminations.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are satisfactory for the installation of FRP panels, in accordance with manufacturer's instructions.
- B. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Clean wall and panel surfaces of contaminants detrimental to adhesive and panel performance.

3.3 INSTALLATION

- A. Install panels in accordance with manufacturer's instructions, using adhesive application method.
- B. Adhesive: Comply with manufacturer's instructions regarding materials, method of application, spread rate, drying time, open time and temperature and humidity limitations.
- C. Joints: Finish snugly, neatly, and as inconspicuously as possible using manufacturer's materials for the purpose.
- D. Trim: Apply at seams, corners and terminations as indicated on Drawings. Exposed edges not allowed.

3.4 CLEANING

- A. Immediately remove any adhesive from face of panels using solvent recommended by adhesive manufacturer. Keep faces clean during application.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Paint materials.
 - 2. Surface preparation.
 - 3. Interior and Exterior Painting and Finishing Schedules.
- B. Related Sections:
 - 1. Painting and coatings used in conjunction with building components as indicated in all Divisions.

1.2 REFERENCES

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
- B. Paint: Paint system materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.
- C. Exposed: Visible in the completed Work.
- D. Unexposed: Concealed in the completed Work.

1.3 SYSTEM DESCRIPTION

- A. Surface preparation and finish painting of interior and exterior surfaces and miscellaneous components.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Samples:
 - 1. Samples of manufacturer's standard colors for color selection.
 - 2. Samples of Selected Colors and Finishes:
 - a. Three sets of samples, using materials accepted for the Project, of each color and paint finish selected by the Owner's Representative.
 - b. Prepare on 8 inch by 10 inch hardboard panels in a stair step manner so all required coats show.
 - c. Label and identify each sample as to location and application.
 - 3. Resubmit samples as required until required sheen, color, and texture are achieved.
 - 4. Acceptance of samples for color, gloss, and texture shall in no way waive material quality requirements.

- C. Product Data: For each type of product indicated.
 - 1. For paints include printed statement of VOC content and chemical components.
 - D. For consideration of products of manufacturers other than those named, in addition to the information required to be submitted for substitutions under the provisions of Division 01, for each product submit current (within the last 6 months) test data from a recognized independent testing laboratory, accompanied by a letter stating that the proposed products are equal to or better than those specified.
 - E. Manufacturer's application instructions.
- 1.5 QUALITY ASSURANCE
- A. Paint materials not otherwise specified shall be products of one manufacturer regularly producing materials of types specified.
- 1.6 FIELD SAMPLES
- A. Provide field samples in accordance with the provisions of Division 01.
 - B. Construct field sample for each type of finish on each substrate.
 - C. Paint a sample panel for each color selected.
 - D. Large Surface Areas, More than 40 sf: Apply to entire surface in one plane, terminating only at corners.
 - E. Small surface Areas, 40 sf or less: Apply to minimum 4 sf.
 - F. Construct field sample using surface preparation method, material, and application of material as specified.
 - G. Review:
 - 1. Request in writing the Owner's Representative's review after permanent lighting is in operation where field sample has been constructed.
 - 2. At the option of the Owner's Representative, temporary lighting providing illumination of the same intensity, color, and character may be utilized for review of field samples.
 - 3. The Owner's Representative will review field sample no later than 4 days following receipt of request.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Deliver paints and stains ready mixed in labeled, tightly covered containers to the Project site.
 - B. Store materials on pallets or skids in clean, dry, well ventilated areas, away from heat, sparks, flame, and direct rays of sunshine; maintain storage areas free from fire hazard.
 - C. Remove used rags and hazardous waste materials at end of work each day, unless properly stored in metal containers with tightly fitting metal covers.
 - D. Frequently remove accumulated waste materials.

1.8 PROJECT CONDITIONS

- A. Comply with manufacturer's recommendations for environmental conditions under which paint and paint systems shall be applied.
- B. Ensure adequate ventilation during interior painting.
- C. Do not apply exterior paint in rain, snow, fog or mist, when temperature is below 45 degrees Fahrenheit, or when relative humidity is above 50 percent.

1.9 WARRANTY

- A. Provide warranty in accordance with the provisions of Division 01.
- B. Colors of surfaces painted as part of the work of this Section shall, at the end of one year, have remained free from serious fading.
- C. Paint shall have its original adherence at the end of one year and there shall be no evidence of blisters, running, peeling, scaling, chalking, streaks, or stains at the end of this period.
- D. Washing with alkali-free soap and water shall remove surface dirt from painted surfaces without producing deteriorating effects.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturer:
 - 1. Dunn-Edwards Paint Co.
 - 2. Fuller O' Brien Paint Company.
 - 3. ICI Paints.
 - 4. Frazee.

2.2 MATERIALS - GENERAL DESCRIPTION

- A. Wood Filler: Paste filler recommended by manufacturer for wood type used, in color according to color of stain finish scheduled or selected.
- B. Cementitious Filler: Non-shrink formulation; white portland cement with fine silicate aggregate, zinc-oxide pigment, and reinforcing chemical binder as approved.
- C. General Purpose Filler: Standard spackling compound or gypsum wallboard joint compound or latex patching compound; for patching plaster, gypsum wallboard, and wood surfaces to receive opaque paint finishes.
- D. Thinner: As recommended by each manufacturer for their respective product.
- E. Equipment: Provide scaffolding, staging, drop cloths, covers, brushes, rollers, and spraying and other equipment of the type, grade, and size required for proper execution of the Work.

2.3 MISCELLANEOUS SURFACE PREPARATION MATERIALS

- A. Concrete Cleaner (for the removal of grease and oils):
 - 1. Concrete Wash, #17.
 - 2. Concrete Saver, 108 Cleaning and Etching Solution.
 - 3. UGL Concrete, Etch, and Clean.
- B. Galvanized Metal Chemical/Acid Etch:
 - 1. Supreme Chemical Metal Clean & Etch ME01 or equal.

2.4 PAINT MATERIALS

- A. General:
 - 1. VOC Content of Field Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - a. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - b. Non-flat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 - c. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - d. Floor Coatings: VOC not more than 100 g/L.
 - e. Shellacs, Clear: VOC not more than 730 g/L.
 - f. Shellacs, Pigmented: VOC not more than 550 g/L.
 - g. Stains: VOC not more than 250 g/L.
 - h. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
- B. Chemical Components of Field Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - 1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 - 2. Restricted Components - Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.
 - j. 1,2-dichlorobenzene.
 - k. Diethyl phthalate.
 - l. Ethylbenzene.
 - m. Formaldehyde.

- n. Hexavalent chromium.
 - o. Isophorone.
 - p. Lead.
 - q. Mercury.
 - r. Methyl ethyl ketone.
 - s. Methyl isobutyl ketone.
 - t. Methylene chloride.
 - u. Naphthalene.
 - v. Toluene (methylbenzene).
 - w. 1,1,1-trichloroethane.
 - x. Vinyl chloride.
- C. Primer/sealer for interior and exterior concrete masonry, shall contain or have properties which are equivalent to the following:
- 1. Vehicle: Acrylic and epoxy resins, water and additives.
 - 2. Pigments: Titanium dioxide and reinforcing pigments.
 - 3. Solids by Volume: 34 percent minimum.
 - 4. Solvent Type: Waterborne.
 - 5. Resin Type: Acrylic/epoxy.
- D. Primer for interior and exterior non-ferrous metal shall contain or have properties which are equivalent to the following:
- 1. Alkyd Option:
 - a. Vehicle: Epoxy ester resins, thinners and additives.
 - b. Pigments: Titanium dioxide and reinforcing pigments.
 - c. Solids by Volume: 49 percent minimum.
 - d. Solvent Type: Paint thinner.
 - e. Resin Type: Epoxy ester.
 - 2. Acrylic Option:
 - a. Vehicle: Acrylic resins, water and additives.
 - b. Pigments: Titanium dioxide, reinforcing, and corrosion inhibiting pigments.
 - c. Solids by Volume: 38 percent minimum.
 - d. Solvent Type: Waterborne.
 - e. Resin Type: 100 percent acrylic.
- E. Block filler for interior and exterior concrete masonry shall contain or have properties which are equivalent to the following:
- 1. Exterior (medium aggregate):
 - a. Vehicle: Acrylic resins, water and additives.
 - b. Pigments: Titanium dioxide and reinforcing pigments.
 - c. Solids by Volume: 50 percent minimum.
 - d. Solvent Type: Waterborne.
 - e. Resin Type: 100 percent acrylic.
 - 2. Interior (smooth aggregate):
 - a. Vehicle: Acrylic resins, water and additives.
 - b. Pigments: Titanium dioxide and reinforcing pigments.
 - c. Solids by Volume: 50 percent minimum.
 - d. Solvent Type: Waterborne.
 - e. Resin Type: Modified co-polymer.

- F. Primer for interior and exterior precast and cast-in-place concrete, and interior concrete masonry receiving an alkyd enamel paint finish, shall be two component, and shall contain or have properties, which are equivalent to the following:
 - 1. Vehicle: Epoxy and polyamine resins, water and additives.
 - 2. Pigments: Titanium dioxide and reinforcing pigments.
 - 3. Solids by Volume: 40 percent minimum.
 - 4. Solvent Type: Waterborne.
 - 5. Resin Type: Epoxy.

- G. Primer for interior and exterior ferrous metal shall contain or have properties which are equivalent to the following:
 - 1. Vehicle: Alkyd resins and oils, thinners and additives.
 - 2. Pigments: Titanium dioxide, rust inhibitive and reinforcing pigments.
 - 3. Solids by Volume: 42 percent minimum.
 - 4. Solvent type: Water.
 - 5. Resin Type: Waterborne Alkyd.

- H. Primer for interior wood surfaces and for gypsum wallboard surfaces receiving an epoxy coating, shall contain or have properties which are equivalent to the following:
 - 1. Vehicle: Acrylic resins, water and additives.
 - 2. Pigments: Titanium dioxide and reinforcing pigments.
 - 3. Solids by Volume: 45 percent minimum.
 - 4. Solvent Type: Waterborne.
 - 5. Resin Type: 100 percent acrylic.

- I. Sealer for interior gypsum board receiving an acrylic paint finish shall contain or have properties which are equivalent to the following:
 - 1. Vehicle: Vinyl acrylic resins, water and additives.
 - 2. Pigments: Titanium dioxide and reinforcing pigments.
 - 3. Solids by Volume: 34 percent minimum.
 - 4. Solvent Type: Waterborne.
 - 5. Resin Type: Acrylic copolymer.

- J. Gloss paint for interior and exterior ferrous and non-ferrous metals shall be formulated for interior and exterior applications and shall contain or have properties which are equivalent to the following:
 - 1. Vehicle: Acrylic resins, water and additives.
 - 2. Pigments: Titanium dioxide.
 - 3. Solids by Volume: 36 percent minimum.
 - 4. Solvent Type: Waterborne.
 - 5. Resin Type: 100 percent acrylic.

- K. Semi-gloss paint for interior and exterior ferrous and non-ferrous metals, and interior wall and ceiling surfaces where indicated, shall be formulated for interior and exterior applications and shall contain or have properties which are equivalent to the following:
 - 1. Vehicle: Acrylic resins, water and additives.
 - 2. Pigments: Titanium dioxide.
 - 3. Solids by Volume: 36 percent minimum.
 - 4. Solvent Type: Waterborne.

5. Resin Type: 100 percent acrylic.
- L. Flat paint for exterior concrete, concrete masonry, and cement plaster wall surfaces shall be formulated for exterior applications and shall contain or have properties which are equivalent to the following:
1. Vehicle: Acrylic resins, water and additives.
 2. Pigments: Titanium dioxide and reinforcing pigments.
 3. Solids by Volume: 41 percent minimum.
 4. Solvent Type: Waterborne.
 5. Resin Type: 100 percent acrylic.
- M. Line striping coating for exterior asphalt and concrete roads, walkways, curbs, parking lots, and other areas as indicated, shall be formulated for exterior applications and shall contain or have properties which are equivalent to the following:
1. Vehicle: Acrylic and epoxy resins, water and additives.
 2. Pigments: Titanium dioxide and reinforcing pigments.
 3. Solids by Volume: 62 percent minimum.
 4. Solvent Type: Waterborne.
 5. Resin Type: 100 percent acrylic.
- N. Eggshell paint for interior wall and ceiling surfaces where indicated, and miscellaneous interior wood components where indicated shall be formulated for interior applications and shall contain or have properties which are equivalent to the following:
1. Vehicle: Acrylic resins, water and additives.
 2. Pigments: Titanium dioxide and reinforcing pigments.
 3. Solids by Volume: 36 percent minimum.
 4. Solvent Type: Waterborne.
 5. Resin Type: 100 percent acrylic.
- O. Eggshell paint for interior ferrous and non-ferrous metals, and interior wall and ceiling surfaces where indicated, shall be formulated for interior and exterior applications and shall contain or have properties which are equivalent to the following:
1. Vehicle: Acrylic resins, water and additives.
 2. Pigments: Titanium dioxide and reinforcing pigments.
 3. Solids by Volume: 36 percent minimum.
 4. Solvent Type: Waterborne.
 5. Resin Type: 100 percent acrylic.
- P. Semi-gloss paint for interior wall and ceiling surfaces where indicated, and miscellaneous interior wood components where indicated shall be formulated for interior applications and shall contain or have properties which are equivalent to the following:
1. Vehicle: Acrylic resins, water and additives.
 2. Pigments: Titanium dioxide.
 3. Solids by Volume: 36 percent minimum.
 4. Solvent Type: Waterborne.
 5. Resin Type: 100 percent acrylic.
- Q. Latex flat enamel for interior wall and ceiling surfaces where indicated shall be formulated for interior applications and shall contain or have properties which are equivalent to the following:

1. Vehicle: Vinyl acrylic resins, water and additives.
 2. Pigments: Titanium dioxide and reinforcing pigments.
 3. Solids by Volume: 40 percent minimum.
 4. Solvent Type: Waterborne.
 5. Resin Type: Acrylic copolymer.
- R. Gloss enamel paint for interior wall and ceiling surfaces where indicated, and for mechanical and electrical equipment and/or enclosures, shall be formulated for interior and exterior applications and shall contain or have properties which are equivalent to the following:
1. Vehicle: Alkyd resins, thinner and additives.
 2. Pigments: Titanium dioxide.
 3. Solids by Volume: 50 percent minimum.
 4. Solvent Type: Paint thinner.
 5. Resin Type: Alkyd.
- S. Gloss and semi-gloss epoxy coatings for interior wall and ceiling surfaces shall be two component, and shall contain or have properties which are equivalent to the following:
1. Vehicle: Epoxy and polyamine resins, water and additives.
 2. Solids by Volume: 50 percent minimum.
 3. Solvent Type: Waterborne.
 4. Resin Type: Epoxy.
- T. Fire Retardant Alkyd Semi-Gloss Enamel for telecommunications terminal backboard (TTB):
1. Vehicle: Alkyd resins, thinner and additives.
 2. Pigments: Titanium dioxide (TiO₂) and reinforcing pigments.
 3. Solids by Volume: 55 percent +/- 2 percent minimum.
 4. Solvent Type: Paint thinner.
 5. Resin Type: Alkyd.
- U. Additional surface preparation and paint materials required by other Sections and not listed herein shall be manufacturer's best quality for the intended purpose.

2.5 PAINT MATERIALS FOR EXTERIOR USE

A. Primers and Undercoats:

<u>Product</u>	<u>Dunn-Edwards</u> <u>Product / Number</u>
Acrylic Masonry Primer/Sealer	Eff-Stop ESPR00
Acrylic Multi-Purpose Primer	Ultra-Grip UGPR00
Acrylic Wood Primer (Exterior)	E-Z Prime EZPR00
Concrete Block Filler, Medium	Blocfil SBPR00
Galvanized/Aluminum Primer	Ultra-Grip UGPR00
White Waterborne Alkyd Corrosion Inhibitive Primer	Bloc Rust BRPR00-1
	Carboline
Two Component Waterborne Epoxy Masonry Primer	Carboguard 954 HB

B. Paint Finish Coats:

<u>Product</u>	Dunn-Edwards <u>Product / Number</u>	
100 percent Acrylic Gloss Paint (Int./Ext.)	Spartashield	SSHL-60
100 percent Acrylic Low Sheen Paint (Exterior)	Spartashield	SSHL40
100 percent Acrylic Semi-Gloss Paint (Int./Ext.)	Spartashield	SSHL50
100 percent Acrylic Wood and Masonry Flat Paint (Ext.)	Spartashield	SSHL10
Line Striping Coating	Vin-L-Stripe	W 801-1

C. Concrete Masonry Clear Transparent Waterproof Finish Coating / Penetrating Sealer:

1. (Basis of Design) Moxie International: Moxie 1400 Block & Stucco Sealer.
2. The Quikrete Companies: Quikrete Concrete & Masonry Waterproofing Sealer.
3. Radon Mitigation & Concrete Waterproofing Company: RadonSeal Deep-Penetrating Concrete Sealer.
4. Or equal.

2.6 PAINT MATERIALS FOR INTERIOR USE

A. Primers and Undercoats:

<u>Product</u>	Dunn-Edwards <u>Product / Number</u>	
Acrylic Enamel Undercoater (Interior)	Interkote	IKPR00
Acrylic Masonry Primer Sealer	Eff-Stop	ESPR00
Acrylic Multi-Purpose Primer	Ultra-Grip	UGPR00
Acrylic Pigmented Sealer (Interior)	Eff-Stop	ESPR00
Concrete Block Filler, Smooth	Blocfil	SBPR00
Galvanized/Aluminum Primer	Galv-Alum	GAPR00
Pigmented Sealer (Interior)	Vinylastic	VNSL00
White Waterborne Alkyd Corrosion Inhibitive Primer	Bloc Rust	BRPR00-1
	Carboline	
Two Component Waterborne Epoxy Masonry Primer	Carboguard	954 HB

B. Paint Finish Coats:

<u>Product</u>	Dunn-Edwards <u>Product / Number</u>	
100 percent Acrylic Eggshell Paint (Interior)	Spartazero	SZRO30
100 percent Acrylic Eggshell Paint (Int./Ext.)	Spartashield	SSHL30
100 percent Acrylic Gloss Paint (Interior/Exterior)	Spartashield	SSHL60
100 percent Acrylic Semi-Gloss Paint (Interior)	Spartazero	SZRO50
100 percent Acrylic Semi-Gloss Paint (Int./Ext.)	Spartashield	SSHL50
Latex Flat Enamel (Interior)	Suprema	SPMA20
Quick-Dry Water-based Gloss Enamel	Syn-Lustro	W10

C. Epoxy Coatings:

<u>Product (distributed by Dunn-Edwards)</u>	Dunn-Edwards <u>Product / Number</u>	
Gloss Waterborne Epoxy	Sierra Epoxy	S60

D. Fire Retardant Coatings:

Product (distributed by Dunn-Edwards)
Flamort Fire-retardant Paint

Dunn-Edwards
Product / Number
N/A

2.7 COLORS

- A. The Owner's Representative will select the finish colors and textures and determine the basic colors of surfaces to be painted or stained.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are satisfactory for the application of paint and stain finishes.
- B. Before commencing paint applications, have an authorized representative of paint manufacturer inspect work areas and report his findings.
- C. If unsatisfactory conditions exist, do not commence the application until such conditions have been corrected.
- D. Application of first coat of finish constitutes acceptance of surface conditions and responsibility for ultimate finish.

3.2 PREPARATION

- A. Rooms and spaces shall be broom clean before commencement of paint application.
- B. Surfaces to be finished shall be dry, clean, smooth, and free from rust, scale, oil, grease, grit, frost, sap, and other foreign matter. Shellac and seal marks which might bleed through surface finish.
- C. Protect nameplates, switch plates, instruments, gauges, stainless steel, aluminum, and other surfaces which are not to be painted by masking or other means.
- D. Hardware, hardware accessories, lighting fixtures, and similar items in place shall be sufficiently protected or removed prior to painting, and replaced upon completion of painting of each space.
- E. Disconnect heating and other equipment adjacent to walls, and move to permit wall surfaces to be painted. Following completion of painting, replace and reconnect equipment.
- F. Locate and install scaffolding and staging to avoid interference with the Work of other Sections.
- G. Wood:
1. Clean soiled surfaces. Sand smooth and dust clean. Neatly fill nail holes, cracks, and depressions with filler. When dry, sand flush and smooth.

2. Before finishing, exposed portions shall have handling marks or effects of exposure to moisture removed with a thorough, final sanding over surfaces of the exposed portions, using at least 150 grit or finer sandpaper, and shall be cleaned before applying sealer or finish.
- H. Gypsum Wallboard:
1. Fill narrow, shallow cracks and small holes with general purpose filler.
 2. Rake deep, wide cracks and deep holes. Fill with thin layers of general purpose filler.
 3. Allow fill material to dry.
 4. Sand smooth after drying. Do not raise nap of paper on wallboard.
- I. Metals:
1. Remove mill scale, rust, corrosion, and other foreign matter by wire brushing, scraping, sandblasting, or solvent, as required to produce a clean, smooth surface.
 2. Clean oil, grease, and dust from surfaces using mineral spirits.
 3. Touch up chipped or abraded areas in shop primer using primer compatible with existing.
 4. Pre-treat galvanized metal with phosphoric acid etch or vinyl wash. Apply primer within four hours of acid etching.
- J. Concrete:
1. Clean concrete surfaces with a solution of tri-sodium phosphate or as recommended by the paint system manufacturer.
 2. Remove grease and oils.
 3. Grout clean interior concrete surfaces receiving alkyd paint or epoxy coating, in accordance with Section 03 30 00.
 4. Prime interior concrete surfaces to be painted. When primer is dry, fill holes, depressions, and pits with cementitious filler. Spot prime filler, when dry, with an additional coat of primer.
- K. Cement and/or Gypsum Plaster: Using the PH pencil test for surface alkalinity, verify that the PH of the surface to be painted is within manufacturer's recommended PH range prior to application. Correct unsatisfactory conditions per paint manufacturer's recommendations.

3.3 APPLICATION

- A. Do not apply initial coating until moisture content of surface, as tested with a moisture meter, is within limitations recommended by the coating manufacturer.
- B. Apply coatings in accordance with manufacturer's printed instructions.
- C. Methods of Application: Brush (B), Roller (R) or Spray (S) application shall be used in accordance with the following schedule:

<u>Surface</u>	<u>1st Coat</u>	<u>2nd Coat</u>	<u>3rd Coat</u>
Ferrous Metal			
Primed	----	B, R, S	B, R, S
Unprimed	B, S	B, R, S	B, R, S
Non-Ferrous Metal*			
Primed	----	B, R, S	B, R, S
Unprimed	B, S	B, R, S	B, R, S

Masonry*	R, S	R, S	R, S
Gypsum Wallboard	R, S	R, S	R, S
Wood*			
Primed	---	B	B
Unprimed	B	B	B
Concrete and Concrete			
Masonry Units	R, S	R, S	R, S
Cement Plaster	R, S**	R, S	R, S

* Does not apply to large wall surfaces. Use sheepskin daubers to reach surfaces which are inaccessible to brushes.

** Back roll first coat when using a spray application.

D. Coats:

1. Apply coats and undercoats in accordance with the manufacturer's recommendations. A uniform and opaque painted finish utilizing at least three coats is the minimum requirement. More coats of paint may be required to obtain a finish acceptable to the Owner's Representative.
2. Tint pigmented undercoats to approximately the same shade as the final coat. Perceptibly increase the depth of shade in successive coats.
3. Allow each coat to thoroughly dry before application of succeeding coat; comply with manufacturer's recommendations for drying time between coats.
4. Sand and dust between each coat to remove defects visible from a distance of 5 feet.
5. Finish coats shall be smooth, even and free from brush marks, streaks, laps and pile-up of paints, and skipped and missed areas.
6. Finish mill and shop primed items with materials compatible with prime coat.
7. Paint surfaces of galvanized steel drip moldings, reveal joints and trim, and casing beads that will be exposed in the finished Work.

E. Leave parts of moldings and ornaments clean and true to details with no undue amount of paint in corners and depressions.

F. Edges of paint adjoining other materials and colors shall be clean and sharp with no overlapping.

G. Refinish whole surfaces where portion of finish is not acceptable.

H. Pre-treatment of Existing Surfaces: Unless specified first coat is suitable for materials and conditions encountered, apply one additional coat of surface conditioner as recommended by paint manufacturer.

I. Priming:

1. Wood
 - a. Prime or stain and seal wood surfaces.
 - b. Apply prime coat to edges, ends, face, underside, and back side of wood to be exposed in the finished Work, including telephone and electric backboards.
2. Metals:
 - a. Prime surfaces of miscellaneous iron and steel not embedded in concrete, and surfaces of ungalvanized, unprimed sheet steel.
 - b. Time lapse between priming and application of second coat shall be as short as possible to provide for proper bonding to prime coat.

- J. Spraying:
1. Spray only with airless sprayer.
 2. Apply in fine, even spray without addition of thinner.
 3. When necessary, follow by brushing to ensure uniform coverage and to eliminate wrinkling, blistering, and air holes.
 4. If spraying becomes detrimental to equipment or objectionable to personnel, brush painting will be required.
- K. Steel Framing:
1. Where structural and miscellaneous steel framing will remain concealed in completed Work, provide field applied second prime coat.
 2. Use material compatible with shop primer material.
 3. Apply after completion of steel erection, before being enclosed.
 4. Omit where steel is to be encased in concrete or to receive cementitious fireproofing.
- L. Exposed Plumbing, Mechanical, and Electrical Items:
1. Finish exposed items without factory finish to match adjacent finished surfaces, unless otherwise directed. Where adjacent surface is unfinished, color will be selected by the Owner's Representative.
 2. Finish shop primed and/or factory primed items to match adjacent finished surfaces, unless otherwise directed. Where adjacent surface is unfinished, color will be selected by the Owner's Representative.
 3. Wash exposed metal with solvent, then prime and paint as scheduled.
 4. Spray paint wherever practicable.
 5. Exposed mechanical and plumbing items that require painting include but are not limited to the following:
 - a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Tanks that do not have factory-applied final finishes.
 - e. Visible surfaces behind vents, registers, and grilles, which shall be painted flat black. When ductwork is exposed, and not otherwise required to be painted, the interior portion of ductwork behind vents, registers, and grilles is not required to be painted.
 - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
 - h. Access panels.
 6. Exposed electrical items that require painting include but are not limited to the following:
 - a. Switchgear.
 - b. Panelboards.
 - c. Electrical equipment that is indicated to have a factory-primed finish for field painting.
 - d. Conduit.
 - e. Access panels.

- M. Miscellaneous Painting: Perform as indicated or required and as directed to coordinate appearance and/or color of incidental items or surfaces with adjacent surfaces.
- N. Touch up and restore finish where damaged.
- O. When complete, painted surfaces shall be clean, uniform in appearance, and free from holidays, skips, runs, bubbles, streaks, scratches, and other damage and defects.

3.4 PROTECTION

- A. Provide barriers and post signs as necessary to protect newly applied finishes.

3.5 CLEANING

- A. Clean up spilled and spattered paint daily.
- B. Remove spilled and spattered paint, taking care not to mar surface finish of item being cleaned.
- C. Leave the Project site in a clean and orderly condition.

3.6 PAINT SYSTEMS

- A. Paint all exterior and interior surfaces not specifically excluded.
- B. Only major areas are scheduled, but all miscellaneous items and areas within the room or space shall be painted.
- C. The number of coats specified is the minimum number acceptable. If full coverage is not obtained with the specified number of coats, apply additional coats as necessary to produce the required finish at no additional cost to the Owner.
- D. Acceptance of Final Colors: Final coat of paint for both exterior and interior shall not be applied until the colors have been accepted by the Owner's Representative.

3.7 SCHEDULE - ITEMS NOT TO BE PAINTED

- A. Do Not Paint the Following Items:
 - 1. Products having factory finish (products which are shop or factory primed only shall be painted).
 - 2. Concrete floors with chemical hardener finish.
 - 3. Exterior concrete paving, curbs, gutters, and walks.
 - 4. Pre-finish or factory finished floor, wall and ceiling materials.
 - 5. Plastic laminate covered surfaces.
 - 6. Copper, stainless steel, aluminum, brass, bronze and chromium plated surfaces.
 - 7. Elastomeric materials.
 - 8. Glass, glazing compound and sealants.
 - 9. Finish hardware, unless otherwise indicated (hardware which is shop or factory primed only shall be painted).
 - 10. Roofing finishing materials.
 - 11. Sprayed fireproofing.

12. Concealed construction such as wall surfaces, mechanical and electrical systems within suspended ceiling spaces, wall shafts, chases and furred spaces.
13. Name plates.
14. UL Labels, fusible links, sprinkler heads.
15. Gauges, thermometers and other recording devices.
16. Moving parts of mechanical equipment such as shafts and valve stems.
17. Lighting fixtures.
18. Plumbing fixtures.
19. Galvanized stair treads and landings
20. Other items specifically indicated not to be painted.

3.8 SCHEDULE - EXTERIOR PAINT SYSTEMS

- A. Ferrous metal surfaces gloss finish (exposed exterior surfaces and items which are generally not visible from the ground):
 1. First Application: White alkyd corrosion inhibitive primer.
 2. Second Application: White alkyd corrosion inhibitive primer, half tinted.
 3. Third Application: Interior/exterior 100 percent acrylic gloss paint.
- B. Ferrous metal surfaces - semi-gloss finish (exposed exterior surfaces and items which are generally visible from the ground):
 1. First Application: White alkyd corrosion inhibitive primer.
 2. Second Application: White alkyd corrosion inhibitive primer, half tinted.
 3. Third Application: Interior/exterior 100 percent acrylic semi-gloss paint.
- C. Non-ferrous or galvanized metal surfaces - gloss finish (exposed exterior surfaces and items which are generally not visible from the ground):
 1. First Application: Galvanized/aluminum primer or acrylic multi-purpose primer.
 2. Second Application: Interior/exterior 100 percent acrylic gloss paint.
 3. Third Application: Interior/exterior 100 percent acrylic gloss paint.
- D. Non-ferrous or galvanized metal surfaces - semi-gloss finish (exposed exterior surfaces and items which are generally visible from the ground):
 1. First Application: Galvanized/aluminum primer or acrylic multi-purpose primer.
 2. Second Application: Interior/exterior 100 percent acrylic semi-gloss paint.
 3. Third Application: Interior/exterior 100 percent acrylic semi-gloss paint.
- E. Precast and cast-in-place concrete wall panel surfaces:
 1. First Application: Two component epoxy masonry primer.
 2. Second Application: Exterior 100 percent acrylic wood and masonry flat paint.
 3. Third Application: Exterior 100 percent acrylic wood and masonry flat paint.
- F. Concrete Masonry – Paint System:
 1. First Application: Acrylic masonry primer sealer.
 2. Second Application: Concrete block filler - medium aggregate.
 3. Third Application: Exterior 100 percent acrylic wood and masonry flat paint.
 4. Third Application: Exterior 100 percent acrylic wood and masonry flat paint.
- G. Concrete Masonry – Clear Transparent Waterproof Finish Coating / Penetrating Sealer:
 1. Apply as recommended by the manufacturer.

3.9 SCHEDULE - INTERIOR PAINT SYSTEMS

- A. Ferrous metal surfaces - gloss finish (exposed interior surfaces and items which are generally subject to wear, including grating, stair treads, risers, and stringers, pipe railings, handrails, and ladders):
 - 1. First Application: White alkyd corrosion inhibitive primer.
 - 2. Second Application: White alkyd corrosion inhibitive primer, half tinted.
 - 3. Third Application: Interior/exterior 100 percent acrylic gloss paint.
- B. Ferrous metal surfaces - semi-gloss finish (exposed interior surfaces and items which are generally not subject to wear, including hollow metal frames and doors, and exposed mechanical system piping):
 - 1. First Application: White alkyd corrosion inhibitive primer.
 - 2. Second Application: White alkyd corrosion inhibitive primer, half tinted.
 - 3. Third Application: Interior/exterior 100 percent acrylic semi-gloss paint.
- C. Ferrous metal surfaces - eggshell finish (underside of exposed metal decks):
 - 1. First Application: White alkyd corrosion inhibitive primer.
 - 2. Second Application: White alkyd corrosion inhibitive primer, half tinted.
 - 3. Third Application: Interior/exterior 100 percent acrylic eggshell paint.
- D. Non-ferrous or galvanized metal surfaces - gloss finish (exposed interior surfaces and items which are generally subject to wear, including grating (except where subject to foot traffic), stair risers and stringers, pipe railings, handrails, and ladders):
 - 1. First Application: Galvanized/aluminum primer or acrylic multi-purpose primer.
 - 2. Second Application: Interior/exterior 100 percent acrylic gloss paint.
 - 3. Third Application: Interior/exterior 100 percent acrylic gloss paint.
- E. Non-ferrous or galvanized metal surfaces - semi-gloss finish (exposed interior surfaces and items which are generally not subject to wear, including frames and doors, and mechanical system piping):
 - 1. First Application: Galvanized/aluminum primer or acrylic multi-purpose primer.
 - 2. Second Application: Interior/exterior 100 percent acrylic semi-gloss paint.
 - 3. Third Application: Interior/exterior 100 percent acrylic semi-gloss paint.
- F. Non-ferrous or galvanized metal surfaces - eggshell finish (underside of exposed metal deck):
 - 1. First Application: Galvanized/aluminum primer or acrylic multi-purpose primer.
 - 2. Second Application: Interior/exterior 100 percent acrylic eggshell paint.
 - 3. Third Application: Interior/exterior 100 percent acrylic eggshell paint.
- G. Mechanical and electrical equipment and/or enclosures - machinery enamel (including mechanical equipment, machinery and appliances, motors, starters and control equipment such as pumps, compressors, fans, unit heaters, ventilation and air conditioning units excluding machine parts, and cabinets and enclosures):
 - 1. First Application: White alkyd corrosion inhibitive primer (galvanized/aluminum primer on galvanized surfaces).
 - 2. Second Application: Quick dry alkyd gloss enamel.
 - 3. Third Application: Quick dry alkyd gloss enamel.

- H. Concrete wall, ceiling, and column surfaces not otherwise specified and not specifically excluded in wet locations, and/or indicated as gloss finish:
 - 1. First Application: Two component epoxy masonry primer.
 - 2. Second Application: Quick dry alkyd gloss enamel.
 - 3. Third application: Quick dry alkyd gloss enamel.

- I. Concrete wall, ceiling, and column surfaces indicated as epoxy painted, epoxy coated, or polyester coated surfaces:
 - 1. First Application: Prime coat(s) per epoxy coating manufacturer's recommendations.
 - 2. Second Application: Gloss or semi-gloss waterborne epoxy coating.
 - 3. Third Application: Gloss or semi-gloss waterborne epoxy coating.

- J. Concrete wall, ceiling, and column surfaces indicated as semi-gloss finish (for second and third applications in toilet rooms, and janitor rooms, apply interior/exterior 100 percent acrylic semi-gloss paint):
 - 1. First Application: Two component epoxy masonry primer.
 - 2. Second Application: Interior 100 percent acrylic semi-gloss paint.
 - 3. Third Application: Interior 100 percent acrylic semi-gloss paint.

- K. Concrete wall, ceiling, and column surfaces indicated as eggshell finish (for second and third applications in toilet rooms, and janitor rooms, apply interior/exterior 100 percent acrylic eggshell paint):
 - 1. First Application: Two component epoxy masonry primer.
 - 2. Second Application: Interior 100 percent acrylic eggshell paint.
 - 3. Third Application: Interior 100 percent acrylic eggshell paint.

- L. Concrete masonry wall surfaces indicated as gloss finish:
 - 1. First Application: Two component epoxy masonry primer.
 - 2. Second Application: Concrete block filler - smooth aggregate.
 - 3. Third Application: Quick dry alkyd gloss enamel.
 - 4. Fourth application: Quick dry alkyd gloss enamel.

- M. Concrete masonry wall surfaces indicated as epoxy painted, epoxy coated, or polyester coated surfaces:
 - 1. First Application: Concrete block filler - smooth aggregate.
 - 2. Second Application: Prime coat(s) per epoxy coating manufacturer's recommendations.
 - 3. Third Application: Gloss or semi-gloss waterborne epoxy coating.
 - 4. Fourth Application: Gloss or semi-gloss waterborne epoxy coating.

- N. Concrete masonry wall surfaces indicated as semi-gloss finish (for third and fourth applications in toilet rooms, and janitor rooms, apply interior/exterior 100 percent acrylic semi-gloss paint):
 - 1. First Application: Acrylic masonry primer sealer.
 - 2. Second Application: Concrete block filler - smooth aggregate.
 - 3. Third Application: Interior 100 percent acrylic semi-gloss paint.
 - 4. Fourth Application: Interior 100 percent acrylic semi-gloss paint.

- O. Concrete masonry wall surfaces indicated as eggshell finish (for third and fourth applications in toilet rooms, and janitor rooms, apply interior/exterior 100 percent acrylic eggshell paint):
 - 1. First Application: Acrylic masonry primer sealer.

2. Second Application: Concrete block filler - smooth aggregate.
 3. Third Application: Interior 100 percent acrylic eggshell paint.
 4. Fourth Application: Interior 100 percent acrylic eggshell paint.
- P. Gypsum wallboard wall and ceiling surfaces indicated as epoxy painted, epoxy coated, or polyester coated surfaces:
1. First Application: Interior acrylic enamel undercoater.
 2. Second Application: Gloss or semi-gloss waterborne epoxy coating.
 3. Third Application: Gloss or semi-gloss waterborne epoxy coating.
- Q. Gypsum wallboard wall and ceiling surfaces indicated as semi-gloss finish (for second and third applications in toilet rooms, and janitor rooms, apply interior/exterior 100 percent acrylic semi-gloss paint):
1. First Application: Interior pigmented sealer.
 2. Second Application: Interior 100 percent acrylic semi-gloss paint.
 3. Third Application: Interior 100 percent acrylic semi-gloss paint.
- R. Gypsum wallboard wall and ceiling surfaces indicated as eggshell finish (for second and third applications in toilet rooms, and janitor rooms, apply interior/exterior 100 percent acrylic eggshell paint):
1. First Application: Interior pigmented sealer.
 2. Second Application: Interior 100 percent acrylic eggshell paint.
 3. Third Application: Interior 100 percent acrylic eggshell paint.
- S. Exposed wood, including doors, cabinets, trim, baseboards, and miscellaneous components in areas receiving a semi-gloss finish (for second and third applications in toilet rooms, and janitor rooms, apply interior/exterior 100 percent acrylic semi-gloss paint):
1. First Application: Interior acrylic enamel undercoater.
 2. Second Application: Interior 100 percent acrylic semi-gloss paint.
 3. Third Application: Interior 100 percent acrylic semi-gloss paint.
- T. Plywood: Telecommunications terminal backboard (TTB); apply fire retardant paint system to delay ignition and flame spread:
1. First Application: Interior Fire Retardant Alkyd Enamel Undercoater.
 2. Second Application: Interior Fire Retardant Alkyd Semi-Gloss Enamel.
 3. Third Application: Same as for Second.
- U. Exposed wood including doors, cabinets, trim, baseboards, and miscellaneous components in areas receiving an eggshell finish, or which are not otherwise specified and not specifically excluded (for second and third applications in toilet rooms, and janitor rooms, apply interior/exterior 100 percent acrylic eggshell paint):
1. First Application: Interior acrylic enamel undercoater:
 2. Second Application: Interior 100 percent acrylic eggshell paint.
 3. Third Application: Interior 100 percent acrylic eggshell paint.
- V. Exposed wall and ceiling surfaces not otherwise specified and not specifically excluded:
1. First Application:
 - a. Concrete: Two component epoxy masonry primer.
 - b. Concrete Masonry: Acrylic masonry primer sealer.
 - c. Gypsum Wallboard: Interior latex flat enamel (self priming on gypsum wallboard).

2. Second Application:
 - a. Concrete, Interior latex flat enamel.
 - b. Concrete Masonry: Concrete block filler (smooth aggregate).
 - c. Gypsum Wallboard: Interior latex flat enamel.
3. Third Application:
 - a. Concrete: Interior latex flat enamel.
 - b. Concrete Masonry: Interior latex flat enamel.
4. Fourth Application:
 - a. Concrete Masonry: Interior latex flat enamel.

END OF SECTION

SECTION 10 11 00

VISUAL DISPLAY SURFACES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Tack boards.
 - 2. Marker boards.
 - 3. Tack Walls.
 - 4. Marker Walls

- B. Related Sections:
 - 1. Section 06 10 00 - Rough Carpentry.
 - 2. Section 06 20 00 - Finish Carpentry.
 - 3. Section 09 21 16 - Gypsum Board Assemblies.
 - 4. Section 09 90 00 - Painting and Coatings.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit manufacturer's product specifications.
- C. Samples: Submit samples of standard surface material, patterns, and colors for selection.
- D. Manufacturer's installation and cleaning instructions.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver display boards until spaces to receive them are clean, dry, and ready for visual display board installation. Deliver and store products suitably wrapped or packaged to protect against damage. Do not remove protective coverings until time of installation.

1.4 COORDINATION

- A. Coordinate placement of internal wall reinforcement in supporting wall construction.
- B. Do not install visual display boards until painting is complete and thoroughly dry within the rooms in which they will be installed.

1.5 REGULATORY REQUIREMENTS

- A. Fire-Test-Response Characteristics: All Visual Display Surfaces provided under this Section shall have the following surface-burning characteristics, as determined per ASTM E 84:
 - 1. Flame Spread: 25 or less.
 - 2. Smoke Developed: 450 or less

PART 2 PRODUCTS

2.1 MANUFACTURERS – TACK BOARDS AND MARKER BOARDS

- A. (Basis of Design) Claridge Products, Inc.
- B. Aarco Products, Inc.
- C. Or equal.

2.2 MANUFACTURERS – TACK WALLS AND MARKER WALLS

- A. (Basis of Design) Claridge Products, Inc.
- B. Or equal.

2.3 ACCESSORIES

- A. Miscellaneous Trim and Accessories: In a matching style of manufacturer's standard as required for complete installation.

2.4 COLOR AND FINISHES

- A. As selected by Owner's Representative from full range of manufacturer's standard colors and finishes.

2.5 DISPLAY BOARD SCHEDULE

- A. Item: Tack Board.
 - 1. (Basis of Design) Claridge Products, Inc.: Series 8.
 - 2. Display Surface: Self-healing vinyl with embossed surface laminated to 1/4 inch thick cork which is laminated to 1/4 inch hardboard; burlap backed.
 - 3. Frame: Aluminum frame with satin anodized finish.
 - 4. Unit frame size (nominal): 3 feet wide x 4 feet high unless otherwise indicated on the Drawings.
 - 5. Locations: As indicated on the Drawings.
- B. Item: Marker Board.
 - 1. (Basis of Design) Claridge Products, Inc.: Series 5.
 - 2. Display Surface: LCS-II marker board dry-erase writing surface in either #92 White or #75 Low Gloss as selected by the Owner's Representative.
 - 3. Frame: Aluminum frame with satin anodized finish.
 - 4. Unit frame sizes (nominal): 8 feet wide x 4 feet high unless otherwise indicated on the Drawings.
 - 5. Provide chalk-trough with end closures; 2-3/4 inch deep x full width of unit.
 - 6. Provide map rail with cork insert.
 - 7. Locations: As indicated on the Drawings.

C. Item: Tack Wall.

1. (Basis of Design) Claridge Products, Inc.: TW2 Tack Walls.
2. Display Surface: Self-healing vinyl with embossed surface laminated to 1/4 inch thick cork which is laminated to 1/4 inch hardboard; burlap backed.
3. Frame: 1-1/4 inch aluminum frame at top, bottom, and sides; satin anodized finish.
4. Individual panel size (nominal): 47-1/2 inches wide x 78-1/2 inches high unless otherwise indicated on the Drawings.
5. Overall frame size (nominal): Panel height plus 1-1/2 inch x overall widths indicated on the Drawings.
6. Locations: As indicated on the Drawings.

D. Item: Marker Wall.

1. (Basis of Design) Claridge Products, Inc.: LCS3 Porcelain Marker Walls.
2. Display Surface: LCS-II marker board dry-erase writing surface in either #92 White or #75 Low Gloss as selected by the Owner's Representative.
3. Frame: 1-1/4 inch aluminum frame at top, bottom, and sides; satin anodized finish.
4. Individual panel size (nominal): 47-1/2 inches wide x 78-1/2 inches high unless otherwise indicated on the Drawings.
5. Overall frame size (nominal): Panel height plus 1-1/2 inch x overall widths indicated on the Drawings.
6. Locations: As indicated on the Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are satisfactory for the installation of the Work of this Section.
- B. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected.

3.2 INSTALLATION

- A. Completely assemble and install visual display boards in accordance with manufacturer's instructions.
- B. Install display boards square, plumb and level, accurately aligned to position intended and securely anchored in place in accordance with the manufacturer's written instructions.

3.3 PROTECTION AND CLEANING

- A. Protect elements surrounding the Work of this Section from damage or disfiguration.
- B. Clean all display board surfaces in accordance with manufacturer's instructions.
- C. Exposed visual display board surfaces shall be clean and free from scratches, dents, tool marks, stains, discoloration, and other defects and damage.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior Text and Braille Signage including:
 - a. Plaque type Toilet Room Signs.
 - b. Plaque type Room Identification Signs.
 - c. Plaque type Tactile Exit Signs.
 - d. Assisted Listening System Signs.
2. Interior Signage including:
 - a. Accessible Building Entrance Signs (decal).
 - b. Room Maximum Occupancy Signs.

B. Related Sections:

1. Section 08 14 16 - Flush Wood Doors.
2. Section 09 21 16 - Gypsum Board Assemblies.
3. Section 09 90 00 - Painting and Coating.

1.2 QUALITY ASSURANCE

A. Accessibility - Perform the Work in accordance with the 2016 California Building Code (CBC), Chapter 11B, Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Funded Housing.

B. Catalog Standards:

1. Manufacturer's catalog numbers may be indicated on Drawings for convenience in identifying specified items. Unless modified by notation on Drawings or specified, catalog description for indicated number constitutes requirements for the item specified.
2. The use of catalog numbers and specific requirements set forth in Drawings and Specifications does not preclude use of any other manufacturer's products or procedures which may be equivalent. Such numbers and requirements establish standards of design and quality for materials, construction and workmanship

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00 - Submittal Procedures.

B. All items must be submitted with clear reference labels to the actual sign types specified herein. Submittals not clearly labeling each sign type identified herein will be immediately rejected. Submit the following items:

1. Product Data for each type of sign.
2. Installation Instructions and Drawings for each type of sign.
3. Samples for color selections for each type of sign.

4. Shop Drawings and Signage Schedules, including attachment methods for each sign type.
 - C. A list of room names and/or text requirements for signage will be provided by the Owner's Representative during the review of the Contractor prepared Signage Schedules.
- 1.4 DELIVERY, STORAGE, AND HANDLING
- A. Provide factory wrapping, packaging, and other means necessary to prevent damage or deterioration during shipment, handling, and storage, in accordance with the provisions of Division 01.
 - B. Maintain protective coverings in place and in good repair until removal is necessary to install the Work of this Section.
 - C. Store products inside enclosed storage facilities or inside buildings, above grade.
 - D. Maintain storage spaces and products in dry condition at all times.
 - E. Protect products against damage during field handling and installation.

PART 2 PRODUCTS

- 2.1 TEXT AND BRAILLE SIGNAGE
- A. Manufacturers:
 1. ASI Sign Systems.
 2. Nelson-Harkins.
 3. A.R.K. Ramos Manufacturing Company.
 4. Or equal.
 - B. Braille text on the sign types listed in the Schedule at the end of this Section shall be Contracted (Grade 2) California Braille complying with 2016 CBC Sections [11B-703.3](#) and [11B-703.4](#), [Table 11B-703.3.1](#), and [Figures 11B-703.3.1](#) and [11B-703.3.2](#).
 - C. Accessories:
 1. Mounting Adhesive: As recommended by manufacturer, to be compatible and appropriate for the wall surface to which the sign is to be mounted. Conform to VOC limitations.
 2. Metal Fasteners: Tamper proof stainless steel.
 - D. Colors: As selected by the Owner's Representative from the manufacturer's standard range.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are satisfactory for the installation of signs. Notify the Owner's Representative, in writing, of any conditions requiring corrective action.
- B. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Protect adjacent existing and newly placed construction and finishes as necessary to prevent damage during installation of this Work.

3.3 INSTALLATION – EXTERIOR SIGNS (NOT USED)

- A. Install site accessible parking signs as detailed on the Drawings.

3.4 INSTALLATION – INTERIOR SIGNS

- A. Install signs square, plumb and level, accurately aligned to position intended.
- B. Attach signs with both tamper resistant mechanical fastener and adhesive as recommended by manufacturer to be compatible with the door or wall surface to which the sign is to be applied. Place where indicated on the Drawings, in accordance with the referenced sections of 2016 CBC Chapter 11B, and in accordance with the accepted Shop Drawings.
 - 1. All signs shall be set in full edge bead of adhesive in addition to mechanical fasteners specified. Use caution in placing adhesive on backs of signs so that adhesive will not be visible at edges of signs. Wipe edges and wall surfaces clean of adhesive which may ooze.
 - 2. Where signage is mounted to door side lite glazed vision panel, provide and install blank sign panel of same material and color as sign on the inside face of glazing panel to conceal adhesive from view. Mount all signage at these locations with adhesive tape and silicone sealant only.
 - 3. Refer to Schedule at the end of this Section and the Drawings for individual sign mounting requirements
- C. Locations of all signs must be approved by the Owner's Representative prior to installation.

3.5 CLEANING

- A. Clean and polish.
- B. Exposed surfaces shall be clean and free from scratches, dents, tool marks, stains, discoloration, and other defects and damage.

3.6 SCHEDULE

- A. Sign Type: Women's Restroom Signs: (NOT USED)
- B. Sign Type: Men's Restroom Signs: (NOT USED)
- C. Sign Type: "Unisex" Toilet Room Signs:
 - 1. Restroom signs shall comply with [2016 CBC Section 11B-703](#).
 - 2. "Unisex" Toilet Room First Sign ("Group A" door mounted): Comply with [2016 CBC Section 11B-703.7.2.6](#) and Section 11B-703.7.2.6.3. Provide for each unisex toilet room door a circle shaped acrylic plaque, 1/4" thick x 12" diameter with a 1/4" thick equilateral triangle superimposed within the circle, with one vertex pointing up and all vertex extending to the edge of the circle. The triangle symbol shall contrast with the circle symbol, either light on a dark background or dark on a light background. The circle symbol shall contrast with the door, either light on a dark background or dark on a light background. Mount sign on the door in accordance with [2016 CBC Section 11B-703.7.2.6](#).
 - 3. "Unisex" Toilet Room Second Sign ("Group B" wall mounted): Provide for each unisex restroom. Sign shall be a 1/4" thick by 6" wide by 10" high acrylic plaque. In accordance with [2016 CBC Section 11B-703.6](#), a 1/32" raised pictogram and the International Symbol of accessibility shall be imprinted centered at the top of the sign. In accordance with [2016 CBC Section 11B-703.2](#), 1" high x 1/32" raised letter text, sans-serif upper case, shall occur below the pictogram and read either RESTROOM or UNISEX as directed by the Owner's Representative. Corresponding Grade 2 California Braille shall occur below text. Sign shall have radius corners: 3/8" minimum, 1/2" maximum. Mount sign on the wall in accordance with [2016 CBC Section 11B-703.4](#).
 - 4. Sign finish and contrast shall comply with [2016 CBC Section 11B-703.5.1](#). Sign colors shall be as selected by the Owner's Representative from the manufacturer's full range of standard colors.
 - 5. Refer to Drawings for additional sign information.
- D. Sign Type: Accessible Building Entrance Signs (ISA):
 - 1. Accessible building entrance signs shall comply with [2016 CBC Section 11B-216.6 and 11B-703.7.2.1](#).
 - 2. Provide a self-adhesive heavy grade vinyl decal, 6" square with radius corners. Decal shall display the International Symbol of Accessibility (ISA) and be white symbol on blue background. Mount on assessable building entrance doors within the Project scope, centered 36" above the finished floor unless otherwise indicated on the Drawings.
- E. Sign Type: Room Identification Signs:
 - 1. Provide room identification signs at the locations required by 2016 CBC Chapter 11B, and as indicated on the Drawings.
 - 2. Room identification signs shall comply with 2016 CBC Section 11B-703.
 - 3. Signs shall be 1/4" thick acrylic plaque type signs with 1/32" raised acrylic numbers and letters with corresponding Grade 2 California Braille below text.
 - 4. Signs shall be 3" high minimum x 9" wide minimum (wider as required to fit text length). Signs shall have radius corners: 3/8" minimum, 1/2" maximum.
 - 5. Character Style:
 - a. Number style shall be 1" high; sans-serif.

- b. Letter style shall be 1" high; sans-serif upper case.
 6. Text of each room identification sign shall be confirmed by the Owner's Representative during the submittal process.
 7. Mount sign on the wall in accordance with 2016 CBC Section [11B-703.4](#).
 8. Sign finish and contrast shall comply with 2016 CBC Section [11B-703.5.1](#). Sign colors shall be as selected by the Owner's Representative from the manufacturer's full range of standard colors.
 9. Refer to Drawings for additional sign information. ([See Detail 8/A2.3](#)).
- F. Sign Type: Tactile Exit Signs:
1. Provide tactile exit signs at the locations required by [2016 CBC Section 1013.4](#), and as indicated on the Drawings.
 2. Tactile exit signs shall comply with 2016 CBC Section [1013.4](#) and Sections [11B-216.4](#), [11B-703.1](#), [11B703.2](#), [11B-703.3](#) and [11B-703.5](#) (note [11B-703.5](#) exception).
 3. Signs shall be 1/4" thick acrylic plaque type signs with 1/32" raised acrylic numbers and letters with corresponding Grade 2 California Braille below text.
 4. Signs reading "EXIT" shall be 3" high minimum x 5" wide minimum. Signs reading "EXIT ROUTE" or other wording required by [CBC Section 1013.4](#) Item 2 shall be 5" high minimum x 8" wide minimum. Signs shall have radius corners: 3/8" minimum, 1/2" maximum.
 5. Character Style:
 - a. Number style shall be 1" high; sans-serif.
 - b. Letter style shall be 1" high; sans-serif upper case.
 6. Text of each tactile exit sign and corresponding directional arrow (if required) shall be confirmed by the Owner's Representative during the submittal process.
 7. Mount sign on the wall in accordance with 2016 CBC Section [11B-703.4](#).
 8. Sign finish and contrast shall comply with 2016 CBC Section [11B-703.5.1](#). Sign colors shall be as selected by the Owner's Representative from the manufacturer's full range of standard colors.
 9. Refer to Drawings for additional sign information. ([See Detail 9/A2.3](#)).
- G. Sign Type: Assisted Listening System Signs:
1. Provide assisted listening system signs at the locations required by 2016 CBC Chapter 11B, and as indicated on the Drawings.
 2. Tactile assisted listening system signs shall comply with 2016 CBC Section [11B-703.7.2.4](#).
 3. Verify plaque location with Owner's Representative prior to installation.
 4. Refer to Drawings for additional sign information. ([See Detail 12/A2.3](#)).
- H. Sign Type: Room Maximum Occupancy Signs: ([NOT USED](#))
1. Provide room maximum occupancy signs at the locations required by 2016 CBC and as indicated on the Drawings.
- I. Miscellaneous Signage:
1. Provide other miscellaneous signage as may be indicated on the Drawings and not otherwise specified herein.

COUNTRY DAY SCHOOL - CHICO
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Chico, California, 95928

GRA Architecture
Project #18-06

END OF SECTION

10 14 00 - 6
May 10, 2016

SECTION 10 28 13
TOILET ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grab bars, paper towel dispenser, waste receptacle, toilet paper dispenser, toilet seat cover dispenser, soap dispenser, mirrors.
2. Attachment hardware.

B. Related Sections:

1. Section 07 90 00 - Joint Protection.
2. Section 09 21 16 - Gypsum Board Assemblies.
3. Section 09 22 00 - Supports for Plaster and Gypsum Board.
4. Section 09 28 13 - Cementitious Backing Boards.
5. Section 09 30 13 - Ceramic Tiling.

1.2 REFERENCES

- A. ASTM A167 - Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- B. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- C. CCR - California Code of Regulations: Title 24, 2016 - California Building Code (CBC).

1.3 REGULATORY REQUIREMENTS

- A. Accessibility – Install the Work of this Section in accordance with the 2016 California Building Code (CBC), Chapter 11B, Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Funded Housing.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's product data and installation instructions for each toilet accessory type furnished.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Provide products of same manufacturer for each toilet accessory type unless otherwise approved by the Owner's Representative.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Provide factory wrapping, packaging, and other means necessary to prevent damage or deterioration during shipment, handling, and storage, in accordance with the provisions of Division 01.
- B. Maintain protective coverings in place and in good repair until removal is necessary to install the Work of this Section.
- C. Store products inside enclosed storage facilities or inside buildings, above grade.
- D. Maintain storage spaces and products in dry condition at all times.
- E. Protect products against damage during field handling and installation.

1.7 COORDINATION

- A. Contractor to assure framing has backing for attaching surface mounted accessories. Coordinate the placement of internal wall reinforcement for accessories, and the locations and size of rough openings for recessed accessories, with the Work of other trades.

PART 2 PRODUCTS

2.1 MANUFACTURERS - SCHEDULED ACCESSORIES

- A. Individual items and acceptable manufacturers are indicated in the Schedule at the end of this Section.
- B. Unless otherwise specified, furnish and install component units with trims and accessories necessary for a complete installation.
- C. Manufacturers:
 - 1. (Basis of Design) Bobrick.
 - 2. Bradley Corporation.
 - 3. ASI (American Specialties, Inc.).
 - 4. Or equal.

2.2 MATERIALS

- A. Stainless Steel Sheet: ASTM A167, Type 304 or 316; minimum 28 gauge.
- B. Tubing: ASTM A269, stainless steel.
- C. Fasteners, Screws, and Bolts: Hot Dip Galvanized, tamperproof.
- D. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.
- E. Grab Bar Mounting Kits:
 - 1. Concealed Mounting: Type recommended by the manufacturer of the grab bars for the surface to which bars will be mounted.

- F. Miscellaneous Accessories: As required for complete installation.

2.3 KEYING

- A. Keyed (tumbler lock) accessories shall be keyed alike with the exception of coin receiving boxes on vending equipment.
- B. Provide for each key combination, 5 keys plus 5 blanks.
- C. Deliver keys to the Owner's Representative in clearly identified sealed envelopes before Acceptance.

2.4 FABRICATION

- A. Weld and grind smooth joints of fabricated components.
- B. Form exposed surfaces from single sheet of stock, free of joints.
- C. Form surfaces flat without distortion. Maintain flat surfaces without scratches or joints.
- D. Back-paint components where contact is made with building components to prevent electrolysis.
- E. Shop assemble components and package complete with anchors and fittings.
- F. Provide steel anchor plates, adapters, and anchor components for installation.
- G. Hot Dip Galvanize exposed and painted ferrous metal and fastening devices.

2.5 FACTORY FINISHING

- A. Stainless Steel: No. 4 satin luster finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are satisfactory for the installation of accessory items.
- B. Verify that supports and reinforcements are in place and proper for accessory installation.
- C. Verify mounting locations, dimensions, and clearances of accessories are as recommended by the manufacturer, and in accordance with the 2016 California Building Code (CBC), Chapter 11B accessibility requirements.
- D. Do not begin installation until conditions are satisfactory. Beginning installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Provide templates and rough-in measurements as required.

- B. Verify exact location of accessories for installation.

3.3 INSTALLATION

- A. Install accessories in accordance with the 2016 California Building Code (CBC), Chapter 11B accessibility requirements and as recommended by the manufacturer. See mounting height schedule on Drawings.
- B. Install accessories plumb and level, accurately aligned, and securely attached to substrate.
- C. Bed components attached to walls in sealant in accordance with Section 07 90 00 – Joint Protection. Clean up extruded sealant and finish smooth and flush with edges.

3.4 ADJUST AND CLEAN

- A. Remove protective coatings and coverings in accordance with manufacturer's printed instructions. Exposed surfaces shall be clean and free from scratches, dents, tool marks, stains, discoloration, and other defects and damage. Replace damaged or defective items.
- B. Adjust accessories for proper operation.
- C. After completion of installation, clean and polish exposed surfaces.

3.5 SCHEDULE

- A. Single Accommodation Toilet Rooms:
 - 1. Grab Bars: Bobrick B-6806 Series.
 - a. 36 inches long at back of water closet.
 - b. 42 inches long at side of water closet.
 - c. 1-1/2" diameter, 18-gauge, Type 304 stainless steel tubing with satin-finish. Concealed mounting flange 1/8" thick, Type 304 stainless steel plate, 2" W, 3 1/8" H, with screw holes for concealed anchors. 3 1/4" diameter, 22-gauge, Type 304 stainless steel cover with satin finish, snaps over mounting flange. Coordinate wall backing requirements with Contractor during submittal process.
 - 2. Seat Cover Dispenser: Bobrick B-221; surface mounted.
 - a. Satin-finish stainless steel. Dispenses 250 single- or half-fold toilet seat covers. Fills from bottom. Unit 15 3/4" W, 11" H, 2" D. Allow 5" minimum clearance from bottom of dispenser to top of any horizontal projection for filling dispenser.
 - 3. Toilet Paper Dispenser: Bobrick B-3888; semi-recessed.
 - a. Satin-finish stainless steel unit and dispensing mechanism. Front of door is drawn, one-piece, seamless construction, protruding tumbler lock. Holds two rolls up to 5 1/4" diameter (1800 sheets). Extra roll drops in place when bottom roll is depleted. Theft-resistant, heavy-duty spindles. Extends 2 3/4" from wall. Rough Wall Opening: 6-1/4" W, 11-1/4" H, 3-1/8" min. depth. Mount centerline of the lower roll spindle (e.g. "outlet of the dispenser") at 19" minimum above the finished floor in compliance with 2016 CBC Section 11B-604.7.
 - 4. Soap Dispenser: Bobrick B-2111; surface mounted.
 - a. Vertical tank is satin-finish stainless steel. Capacity: 40 fluid oz., dispenses all-purpose hand soaps. Valve is operable with one hand, without tight grasping, pinching, or twisting of the wrist, and with less than 5 pounds of force to comply

with barrier-free accessibility guidelines (including ADAAG). Window indicates when refill is required. The key locked, hinged stainless steel lid opens for top filling. Concealed, vandal-resistant mounting. Unit 4 3/4" W, 8 1/8" H; wall to push-button, 3 1/2".

5. Paper Towel Dispenser / Waste Receptacle: Bobrick B-3944; semi-recessed.
 - a. Unit includes convertible folded paper towel module and 12-gallon waste receptacle module which can be interchanged with an automatic, universal or touch-free roll towel module and 18-gallon waste receptacle module, respectively. Cabinet is not replaced when changing modules. Satin-finish stainless steel. Seamless beveled flange. Dispenses 600 C-fold or 800 multifold towels. Removable waste receptacle is locked into cabinet. Receptacle is 8" deep with capacity of 12-gal.; extends 4 1/8" from wall. Rough Wall Opening: 16" W, 54 3/4" H, 4" min. depth.
6. Welded-Frame Mirror: Bobrick B-290 2436; surface mounted.
 - a. 24" W x 36" H. One-piece, roll-formed 3/4" x 3/4" angle-frame. Type 304 stainless steel angle with satin finish. Corners heliarc welded, ground and polished smooth. Beveled frame edge at mirror for improved appearance. No. 1 quality, 1/4" glass mirror; warranted against silver spoilage for 15 years. Galvanized steel back. Theft-resistant mounting to concealed wall hanger. Coordinate wall backing requirements with Contractor during submittal process.

END OF SECTION

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - a. Fire extinguishers
 - b. Fire extinguisher cabinets.
 - c. Fire extinguisher surface mounted wall brackets.
- B. Related Sections:
 - a. Section 06 20 00 - Finish Carpentry.
 - b. Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

- A. CCR - California Code of Regulations: Title 24, 2016 - California Building Code (CBC).
- B. CCR - California Code of Regulations, Title 24, Part 9 - 2016 California Fire Code (CFC).
- C. CCR - California Code of Regulations, Title 19 - Division 1, Chapter 3 – Fire Extinguishers.
- D. NFPA 10 - Portable Fire Extinguishers.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit manufacturer's product specifications indicating fire extinguisher cabinet physical dimensions and required rough in opening measurements for recessed and semi-recessed cabinets, details showing mounting methods and anchorage details, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and finish materials.
- C. Maintenance Data: Include test, refill or recharge schedules, and recertification requirements for fire extinguishers, and maintenance data.
- D. Submit manufacturer's installation and cleaning instructions.

1.4 QUALITY ASSURANCE

- A. Products provided shall be listed and approved by UL, and the California State Fire Marshal.
- B. Provide fire extinguishers, fire extinguisher cabinets, and accessories by single manufacturer. Ensure extinguishers fit inside cabinets.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver products until spaces to receive them are clean, dry, and ready for fire extinguisher cabinet installation. Deliver and store products suitably wrapped or packaged to protect against damage. Do not remove protective coverings until time of installation.
- B. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

1.6 COORDINATION

- A. Coordinate the locations and proper size of rough openings for the fire extinguisher cabinets with the Work of other trades. Coordinate the locations and proper size of metal wall backing for the fire extinguisher wall brackets with the Work of other trades

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

- A. Manufacturers:
 - 1. J. L. Industries: Cosmic 10E.
 - 2. Larsen's Manufacturing Co.: Model MP10.
 - 3. Potter-Roemer.: Model 3010.
 - 4. Amerex: Model 441.
 - 5. Or equal.
- B. Dry Chemical Type: Heavy duty steel tank, with pressure gauge, corrosion and impact resistant finish; Capacity 10-pound; UL rating 4A-80BC unless otherwise indicated.
- C. Fire Extinguishers: Conform to CCR Title 19 - Division 1, Chapter 3.

2.2 FIRE EXTINGUISHER CABINETS

- A. Manufacturers:
 - 1. J. L. Industries: Cosmopolitan Series #1837; with "Saf-T-Lok".
 - 2. Larsen's Manufacturing Co.: Architectural Series #2409-6R; with "Larsen-Loc".
 - 3. Potter-Roemer: Alta Series #7062-RR.
 - 4. Amerex: Cosmopolitan Series #1837; with "Saf-T-Lok (manufactured by J.L. Industries for Amerex fire extinguishers).
 - 5. Or equal.
- B. Fire Extinguisher Cabinets: Semi-recessed cabinet; full glazing door style with clear tempered glass and a self-adjusting roller catch; rolled radius edge trim fabricated in one piece with corners mitered, welded, and ground smooth; door and trim shall be #304 stainless steel with #4 finish; continuous piano hinge matching door and trim; door pull handle conforming to ADA accessibility requirements.
- C. Cabinet Mounting: Suitable for the following mounting conditions

1. Semi-recessed: Cabinet box (tub) partially recessed in walls of shallow depth.
2. Maximum projection of cabinet (including door pull handle) from the finished wall shall not exceed 4-inches. The cabinet installation shall comply with the accessibility requirements of 2016 CBC Sections 11B-307, 11B-308 and 11B-309.

2.3 ACCESSORIES

- A. Fire extinguisher and fire extinguisher cabinet mounting hardware: Appropriate to fire extinguisher, fire extinguisher cabinet, and mounting surface.
- B. Fire extinguisher surface mounted wall brackets: Metal wall bracket appropriate to fire extinguisher and mounting surface; factory finished.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify rough openings for cabinets are correctly sized and located.
- B. Verify servicing, charging, and tagging of fire extinguishers
- C. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's written instructions and as indicated on the approved submittal.
- B. Install fire extinguisher brackets and cabinet types as indicated, plumb and level.
 1. Fire extinguisher brackets:
Mount fire extinguisher brackets such that the top of a 21 inch high nominal 4A-80BC fire extinguisher shall be 48 inches maximum above the finished floor when installed on the fire extinguisher bracket.
 2. Fire extinguisher cabinets:
Mount fire extinguisher cabinets such that the top of a 21 inch high nominal 4A-80BC fire extinguisher shall be 48 inches maximum above the finished floor when installed in the fire extinguisher cabinet. Contractor shall verify that this requirement should place the bottom of the finished rough opening for the cabinet at 27 inches nominal above finished floor. (The finished rough opening must account for lining the interior of the rough opening framing with fire-resistive gypsum board at fire-rated wall construction.) The centerline of the cabinet door handle shall not exceed 48 inches above finished floor.
- C. Place extinguishers. Locate one extinguisher in each cabinet and on each wall bracket as indicated on the Drawings.

END OF SECTION

SECTION 10 99 00

MISCELLANEOUS SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes miscellaneous specialties indicated on Drawings including the following items:
 - 1. Miscellaneous Site Furnishings:
 - a. Flagpole.

1.2 REFERENCES

- A. CCR - California Code of Regulations: Title 24, 2016 - California Building Code (CBC).

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 – Submittal Procedures.
- B. Submit manufacturer's descriptive literature indicating conformance to specified requirements.
- C. Submit product data sheets, and other items specified in Schedule at the end of this Section.
- D. Manufacturer's installation instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Provide factory wrapping, packaging, and other means necessary to prevent damage or deterioration during shipment, handling, and storage.
- B. Maintain protective coverings in place and in good repair until removal is necessary for the Work.
- C. Store products inside enclosed storage facilities or closed building, supported above grade and slabs-on-grade.

1.5 COORDINATION

- A. Coordinate placement of structural supports for the miscellaneous specialties when required by manufacturer, or as otherwise indicated on the drawings.
- B. Do not install miscellaneous specialties until painting is complete within the rooms in which they will be installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Specialties are indicated in Schedule at the end of this Section.
- B. Unless otherwise specified, furnish and install component units with trims and accessories necessary for a complete installation.

2.2 ACCESSORIES

- A. Provide miscellaneous accessories required for complete installation.

PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that conditions are satisfactory for the installation of the work of this Section.
- B. Verify that surfaces and structural supports to receive the miscellaneous specialties are ready to receive work.
- C. If unsatisfactory conditions exist, do not commence installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Protect adjacent existing and newly placed construction and finishes as necessary to prevent damage during installation of this Work.

3.3 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. When complete, each unit shall be set square, plumb and level, accurately aligned, and securely anchored to prevent movement.

3.4 CLEANING

- A. Clean surfaces in accordance with manufacturer's instructions.
- B. Exposed surfaces shall be clean and free from scratches, dents, tool marks, stains, discoloration, and other defects and damage.

3.5 PROTECTION

- A. Protect completed work from damage during remainder of construction period.

3.6 SCHEDULE

A. Flagpole:

1. Description:
 - a. Commercial grade; fixed high dimensional; ground set; uniform conical taper; seamless tube flag pole of 6063 - T6 aluminum alloy.
 - b. Nominal Height above Finished Grade: 25 feet.
2. Related Work:
 - a. Concrete for ground set flagpole: Section 03 30 00 - Cast-In-Place Concrete.
 - b. Power and connection for flagpole illumination: Division 26 – Electrical.
3. References:
 - a. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - b. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
4. Manufacturers:
 - a. Apex Flagpoles.
 - b. Liberty Flag Pole Company.
 - c. Colonial Flag.
 - c. Or equal.
5. Fabrication:
 - a. Fabricate flagpole of ASRM B241/B241M seamless extruded aluminum tube of nominal 0.188 wall thickness; uniform conical taper from minimum 5 inch nominal butt diameter to minimum 3 inch nominal top diameter. When flagpoles are shipped in more than one section, provide self-aligning sleeves for field joint.
 - b. Base Collar and Base: ASTM B209 aluminum alloy 1100 plate, of stock design similar to that shown on the Drawings.
 - c. Finial Ball: 2 mm thick spun aluminum sphere, with seams of ball welded flush and watertight. Mount ball on threaded rod to fit truck. Diameter of ball shall be approximately the same as pole butt diameter. Reference Paragraph 3.6,A,10 - Flag Illumination Accessory in this Section.
 - d. Truck: Reference Paragraph 3.6,A,10 - Flag Illumination Accessory in this Section.
 - e. Halyards: Two sets of 3/8 inch diameter, nylon braided rope having not less than two bronze swivel snaps for each halyard.
 - f. Cleats: Two aluminum cleats of 9 inch minimum length. Secure cleats to pole with two 3/8 inch flat head aluminum machine screws.
 - g. Ground Mounting Sleeve: As recommended by the flagpole manufacturer and as indicated on the Drawings.
6. Material and Finish:
 - a. Flagpole Shaft: Anodized aluminum in finish color as selected by the Owner's Representative from manufacturer's standard color range, then heavily waxed.
 - b. Finial Ball: Gold anodized aluminum, then heavily waxed.
 - c. Base Collar, Cleats, and exposed Fastener Heads: Finish to match flagpole.
 - d. Base Plate: As recommended by the flagpole manufacturer.
 - e. Ground Mounting Sleeve: Galvanized steel, or as otherwise recommended by the flagpole manufacturer.

7. Installation:
 - a. Set flagpoles in concrete base as indicated on the Drawings. Provide galvanized, corrugated steel sleeve or tube of length shown welded to steel base plates for installation in concrete
 - b. Wrap top of sleeve with two layers of asphalt felt for distance of 2 feet downward.
 - c. Fill space between pole and metal sleeve to within two inches of top with fine dry sand and fill balance of space with waterproof compound as recommended by flagpole manufacturer.
8. Lightning Rod:
 - a. Flagpole assembly shall be grounded in strict accordance with the flagpole manufacturer's recommendations and written instructions.
 - b. Weld lightning ground rod of minimum 3/4 inch diameter galvanized steel to base plate at bottom of flagpole as indicated on the Drawings.
9. Shop Drawings: Submit shop drawings showing flagpole construction and installation details, including base, flag illumination accessory, and finial ball. Indicate dimensions, materials, components, fasteners, method of installation and assembly, and load considerations. Indicate the minimum required size of the foundation support to be provided under the provisions of Section 03 30 00 - Cast-In-Place Concrete.

END OF SECTION

SECTION 12 20 00
WINDOW TREATMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Horizontal Window Blinds.
- B. Related Sections:
 - 1. Section 12 24 13 - Roller Window Shades.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 – Submittal Procedures.
- B. Shop Drawings: Indicate operation, size, materials, components, accessories, and installation details.
- C. Product Data: Indicate manufacturer, model, product description, operation, available options.
- D. Samples:
 - 1. Submit samples of manufacturer's standard colors and finishes for selection by the Owner's Representative.
 - 2. Submit two samples 6 inches long indicating each slat material and color selected.
 - 3. Submit two samples 6 inches x 6 inches in size indicating each fabric material and color selected.
- E. Manufacturer's installation instructions.
- F. Contract Closeout Submittals:
 - 1. Operation and Maintenance Data: Include cleaning and stain removal methods and recommended cleaning materials and methods.

1.3 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum three years documented experience.
- B. Installer: Company specializing in applying the work of this Section; approved by manufacturer.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable code for flame/fuel/smoke ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 HORIZONTAL WINDOW BLINDS

A. Manufacturers:

- 1. Levelor.
- 2. Hunter Douglas.
- 3. Or Equal.

B. Description:

- 1. Slats: One inch wide, horizontal, heavy duty aluminum to resist warping and bending.
- 2. Top and Bottom Rails: Rigid and warp resistant.

C. Operation: Manual.

- 1. Slats: Tilt out and in by means of control wand; capable of being raised to the top rail by means of a draw cord.
- 2. Cord: Terminate in a plastic or nylon end.

2.2 COLORS

- A. Colors will be selected by the Owner's Representative from manufacturers' standard range.
- B. The Owner's Representative will select a maximum of two color/finish combinations for each type of window treatment.

2.3 ACCESSORIES

- A. Rope: Braided nylon jacket over glass fiber core; minimum breaking strength 200 pounds.
- B. Bead Chain: Stainless steel or nickel plated brass; minimum breaking strength 100 pounds.
- C. Fasteners: As recommended by the manufacturer.
- D. Hardware, Trim, Other Accessories: Type and size best suited for intended application.

2.4 FABRICATION

- A. Shop Assembly: Fabricate components in the shop to the greatest extent possible for field installation.
- B. Shop/Factory Finishing: Provide selected finishes.

- C. Fabricate components of non-corrosive, non-staining, non-fading materials, completely compatible with each other, not requiring lubrication during normal expected life.
- D. Fabricate units to completely fill openings indicated. For continuous window wall installation, fabricate so that ends occur only over mullions or other defined vertical separations, unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and openings are ready to receive work.
- B. Verify field measurements are as shown on approved shop drawings.
- C. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Protect elements surrounding the work of this Section from damage or disfiguration.

3.3 INSTALLATION

- A. Install window treatment in accordance with manufacturer's instructions.
- B. Install at exterior window locations at offices and as indicated on the Drawings.
- C. Isolate metal parts from concrete and mortar to prevent galvanic action.
- D. Anchor in accordance with approved shop drawings. Provide adequate clearance to permit unencumbered operation.
- E. Tolerances:
 - 1. Maximum Variation From Level: 1/4 inch per 10 feet; 1/4 inch total.
 - 2. Maximum Variation From True Alignment: 1/16 inch.

3.4 ADJUSTMENT

- A. Adjust window treatment for smooth, even operation.

3.5 CLEANING

- A. Clean window treatment immediately prior to acceptance.
- B. Protect operating mechanisms from intrusion of dirt and debris.

END OF SECTION

SECTION 12 24 13

ROLLER WINDOW SHADES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Motor controlled roller window shades.
- B. Related Sections:
 - 1. Section 12 20 00 - Window Treatments.
 - 2. Division 26 – Electrical: For power to motor operator, and motor controls.

1.2 REFERENCES

- A. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
- C. CCR - California Code of Regulations: Title 19, 2016 - Public Safety.
- D. CCR - California Code of Regulations: Title 24, 2016 - California Building Code (CBC).
- E. CCR - California Code of Regulations: Title 24, Part 3, 2016 - California Electrical Code (CEC).
- F. CCR - California Code of Regulations, Title 24, Part 11 - 2016 California Green Building Code.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures.
- B. Submit Environmental Certification and Third Party Evaluation per Article 1.4 Quality Assurance of this Section.
- C. Shop Drawings: Provide plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
- D. Window Treatment Schedule: Schedule of all roller shades to be provided using same room designations as indicated on the drawings and schedules. Include opening sizes and key to typical mounting details. Indicate operation, size, materials, components, accessories, and installation details.
- E. Product Data: Provide manufacturer's data sheets for each product to be used, including:
 - 1. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.

2. Storage and handling requirements and recommendations.
 3. Mounting details and installation methods.
 4. Typical wiring diagrams including integration of motor controllers with building management system, audiovisual and lighting control systems as applicable.
- F. Samples:
1. For each finish product specified, submit five (5) samples of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns for selection by the Owner's Representative. Mark face of fabric materials to indicate interior side face.
- G. Contract Closeout Submittals:
1. Operation and Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

1.4 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum ten (10) years documented experience in manufacturing products specified in this section.
- B. Installer: Installer trained and certified by the manufacturer with a minimum of three (3) years of experience in installing products specified in this section.
- C. Fire-Test-Response Characteristics: The shade cloth shall be flame retardant and shall have been tested as further specified in Article 1.5 - Regulatory Requirements, by a testing laboratory acceptable to the Office of the California State Fire Marshal. Materials tested shall be identical to products proposed for use and installed at the Project as part of this Work.
- D. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.
- E. Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC9645.
- F. Environmental Certification: Submit written certification from the manufacturer, including third party evaluation, recycling characteristics, and perpetual use certification as specified below. Initial submittals, which do not include the Environmental Certification, below will be rejected. Materials that are simply 'PVC free' without identifying their inputs shall not qualify as meeting the intent of this specification and shall be rejected.
- G. Third Party Evaluation: Provide documentation stating the shade cloth has undergone third party evaluation for all chemical inputs, down to a scale of 100 parts per million, that have been evaluated for human and environmental safety. Identify any and all inputs, which are known to be carcinogenic, mutagenic, teratogenic, reproductively toxic, or endocrine disrupting. Also identify items that are toxic to aquatic systems, contain heavy metals, or organohalogenes. The material shall contain no inputs that are known problems to human or environmental health per the above major criteria, except for inputs required to meet codes.

- H. Recycling Characteristics: Provide documentation that the shade cloth can and is part of a closed loop of perpetual use and not be required to be down cycled, incinerated or otherwise thrown away. Scrap material can be sent back to the mill for reprocessing and recycling into the same quality yarn and woven into new material, without down cycling. Certify that this process is currently underway and will be utilized for this project.
- I. Perpetual Use Certification: Certify that at the end of the useful life of the shade cloth, that the material can be sent back to the manufacturer for recapture as part of a closed loop of perpetual use and that the material can and will be reconstituted into new yarn, for weaving into new shade cloth. Provide information on each shade band indicating that the shade band can be sent back to the manufacturer for this purpose.

1.5 REGULATORY REQUIREMENTS

- A. Conform to applicable provisions of 2016 CBC Section 806 and NFPA 701.
 - 1. Flammability Rating: Shade cloth shall pass both the NFPA 701 “small-scale vertical burn test” (Test Method 1) and “large-scale vertical burn test” (Test Method 2).
- B. Conform to applicable provisions of CCR Title 19, 2016 - Public Safety, for drapery.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with Division 01.
- B. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on drawings and schedules.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify field measurements prior to fabrication.
- B. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.8 WARRANTY

- A. Roller Shade Hardware: Manufacturer's standard non-depreciating twenty-five (25) year limited warranty for Electro hardware and ten (10) years for Urbanshade hardware.
- B. Roller Shade Fabrics: Manufacturer’s standard non-depreciating ten (10) year limited warranty.
- C. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five (5) year warranty.
- D. Roller Shade Installation: One year from date of Notice of Completion, not including scaffolding, lifts or other means to reach inaccessible areas.

PART 2 PRODUCTS

2.1 ROLLER WINDOW SHADES

A. Manufacturers:

1. (Basis of Design) MechoShade Systems, Inc.
 - a. Motorized: ElectroShade Series.
2. Lutron Electronics Co., Inc.
3. Nysan Shading Systems.
4. Draper, Inc.
5. Or equal.

B. Description:

1. Motorized interior solar roller shades and related motor control systems at windows as indicated on the Drawings. Regular roll standard installation.

C. Shade Cloth:

1. Sunscreen Shades: Environmentally Certified Shadecloth: MechoShade Systems, Inc., EcoVeil group, 1550 Series, fabricated from TPO for both core yarn and jacket, single thickness, non-raveling 0.030 inch (0.762 mm) thick fabric.
 - a. Weave: 3 percent open 2x2 basket weave.
 - b. Color: Selected from manufacturer's standard colors.
 - c. Shadecloth shall be Cradle-to-Cradle certified TPO fabric. PVC-free alone shall not be acceptable.

D. Shade Band:

1. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.
 - a. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar for all shades in the same room.
2. Shade Band and Shade Roller Attachment:
 - a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 2.55 inches (64.77 mm) in diameter for motorize shades are not acceptable.
 - b. Provide for positive mechanical engagement with drive / brake mechanism.
 - c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on / snap-off" spline mounting, without having to remove shade roller from shade brackets.
 - d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
 - e. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

E. Shade Fabrication:

1. Fabricate units to completely fill openings from head to sill and jamb-to-jamb, unless otherwise indicated.
2. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design. Fabricate hem as follows:
 - a. With concealed hemtube.
3. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Installer shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth. Battens shall be roll-formed stainless steel or tempered steel, as required.

F. Components:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
3. Use only acetal engineered plastics, such as Delrin by DuPont, for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.

2.2 ACCESSORIES

A. Fascia and End Caps

1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
2. Fascia shall be able to be installed across two or more shade bands in one piece.
3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
4. Provide fascia and integrated, captured end caps where mounting conditions expose outside of roller shade brackets.
5. End caps attached by tape or friction fitted shall not be accepted.
6. Color: As selected by the Owner's Representative from manufacturer's standard colors.

B. Motorized Shade Hardware and Shade Brackets:

1. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel, or heavier, thicker, as required to support 150 percent of the full weight of each shade.
2. Provide shade hardware system that allows for field adjustment of motor or replacement of any operable hardware component without requiring removal of brackets, regardless of mounting position (inside, or outside mount).
3. Provide shade hardware system that allows for operation of multiple shade bands offset by a maximum of 8-45 degrees from the motor axis between shade bands (4-22.5 degrees) on each side of the radial line, by a single shade motor (multi-banded shade, subject to manufacturer's design criteria).

2.3 INTELLIGENT ENCODED ELECTRONIC DRIVE SYSTEM

- A. Electronic Drive Unit (EDU):
1. Intelligent Encoded EDU, and Control System: Tubular, asynchronous (non-synchronous) EDU's, with built-in reversible capacitor operating at 120VAC/60Hz, (230VAC/50Hz) single phase, temperature Class B, thermally protected, totally enclosed, maintenance free with line voltage power supply equipped with locking disconnect plug assembly furnished with each EDU.
 2. Quiet [42 – 46 db] (within 3 feet open air)
 3. Conceal EDU's inside shade roller tube.
 4. Maximum current draw for each shade EDU of 0.9Amps at 120VAC.
 5. Minimum lift capacity of 6 nm per EDU.
 6. Use EDU's rated at the same nominal speed for all shades in the same room.
 7. Use EDU's with minimum of 34 RPM, that shall not vary due to load / lift capacity.
 8. Total hanging weight of shade band shall not exceed 80 percent of the rated lifting capacity of the shade EDU and tube assembly.
- B. EDU System: (software, two-way communication): Specifications and design are based on the Intelligent EDU Control System, WhisperShade®IQ2® System) as manufactured by MechoSystems. Other systems may be acceptable providing all of the following performance capabilities are provided. EDU and control systems not in complete compliance with these performance criteria shall not be accepted as equal systems.
1. EDU shall support two methods of control
 - a. Local Dry Contact Control Inputs
 - 1) EDU shall be equipped with dry contact inputs to support moving the EDU/shade to the upper and lower limits, from both manufacturer switches and third-party dry-contact interface.
 - 2) EDU shall be equipped with dry contact inputs to support moving the EDU/shade to local switch preset positions.
 - 3) Shall support configuring the EDU under protected sequences so that a typical user would not change the EDU's setup. At a minimum the configuration should include setting limits, setting custom presets and configuring key modes of operation.
 2. Upper and lower stopping points (operating limits) of shade bands shall be programmed into EDU's using either a hand held removable program module / configurator or a local switch.
 3. Alignment Positions: Each EDU shall support a minimum of 133 repeatable and precisely aligned shade positions (including limits and presets).
 - a. All shades on the same switch circuit or with the same network group address with the same opening height shall align at each limit or preset (intermediate stopping position) when traveling from any position, up or down.
 - b. Shades of differing heights shall have capability for custom, aligned intermediate stop positions when traveling from any position, up or down.
 - c. Alignment of shades mechanically aligned on the same EDU shall not exceed +/- 0.125 inches (3.175mm) when commanded to the same alignment position.
 - d. Alignment of shades on adjacent EDU's shall not exceed +/- 0.25" inches (6.35mm) when commanded to the same alignment position.
 - e. Local Switch Presets: A minimum of 3 customizable preset positions shall be accessible over the local dry contact control inputs and over the network connection.

- 1) Upon setting the limits for the shade EDU these preset positions shall automatically default to 25%, 50% and 75% of the shade travel.
 - 2) These positions shall be capable of being customized to any position between and including the upper and lower limits of the shade. A removable program module / configurator or local switch shall be capable of customizing the position of these presets.
4. Operating Modes
- a. Uniform or Normal Modes of Operation:
 - 1) Uniform mode shall allow for shades to only move to defined intermediate stop positions to maintain maximum uniformity and organization.
 - 2) Normal Mode shall allow for shades to move to both intermediate stop positions, plus any position desired between the upper and lower limits as set by the installer.
 5. Wall Switches:
 - a. Shades shall be operated by, 5, 7, or 10-button low voltage standard switches, or programmable intelligent switches (IS). Standard switch shall be wired to a bus interface and the bus interface will be programmed to transmit an address for the local switch.
 - b. Sunscreen shades to operate as a single group within each room.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and openings are ready to receive work.
- B. Verify field measurements are as shown on approved shop drawings.
- C. Notify the Owner's Representative if unsatisfactory conditions exist. Do not commence the installation until such conditions have been corrected. Beginning installation means acceptance of existing conditions.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Protect elements surrounding the work of this Section from damage or disfiguration.

3.3 INSTALLATION

- A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow proper clearances for window operation hardware.
- B. Assignment of Responsibility for Motorized Interior Roller Shades:
 1. The Division 26 Contractor shall provide power panels and circuits of sufficient size to accommodate roller shade manufacturer's requirements, as indicated on the Drawings.

2. The Division 26 Contractor shall coordinate the requirements for the of roller shade system with the roller shade dealer/installer before inaccessible areas are constructed.
 3. The Division 26 Contractor shall provide and install all line and low voltage wire necessary to create a functional shade system, as well as terminating all line voltage connections (including pigtails supplied by shade subcontractor).
 4. The roller shade installer shall supply to General Contractor quick-disconnect pigtails for termination by others.
 5. The roller shade installer shall provide low-voltage switches to be installed by others.
 6. The roller shade installer shall terminate all low-voltage connections at splitter and at switches.
 7. The General Contractor shall coordinate with the Division 26 Contractor to assure that Division 26 will provide the roller shade conduits with pull wires in all areas which would not otherwise be accessible to the roller shade installer due to building design, equipment location, or the Project construction schedule and sequencing.
- C. The roller shade installer/dealer shall train the Owner's Representative and Facilities Maintenance Personnel to adjust, operate and maintain roller shade systems.
- 3.4 ADJUSTMENT
- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- 3.5 CLEANING
1. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- 3.6 PROTECTION
1. Protect installed products until completion of project.
 2. Touch-up, repair or replace damaged products before Substantial Completion.
- 3.7 DEMONSTRATION AND TRAINING
- A. Provide instruction to the Owner's Representative and Facilities Maintenance Personnel in the proper adjustment, operation, and maintenance of the roller shade systems. Coordinate the date and time of the training session with the Owner's Representative a minimum of two (2) weeks prior to the training session.

END OF SECTION

SECTION 21 05 00

AUTOMATIC FIRE PROTECTION SYSTEM

Conditions of the Contract and Division 1 apply to this Section.

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS:

- A. The requirements of the General Conditions and Division 1 apply to all work hereunder; also, applicable provisions of Section 23 05 00 Mechanical Work - General Requirements.
- B. Furnish and install all plumbing work indicated on the Drawings and described herein. Also, any incidental work not shown or specified necessary to provide the complete system.

1.02 SCOPE:

- A. The Contractor shall furnish all labor, design drawings, calculations, materials, tools and equipment to install the wet pipe automatic fire sprinkler system as hereinafter described, ready for service to the entire satisfaction of the Architect. System shall be designed for the occupancy as determined by NFPA. A hydraulic calculated system will be acceptable.
- B. It is the intent of these Specifications to provide for complete and operating fire protection automatic sprinkler system in full compliance with the standards of the National Fire Protection Association (NFPA) Pamphlet No. 13, latest edition, and CBC Standard 38-1. The work shall also be in accordance with all local or state requirements which apply.

1.03 DRAWINGS:

- A. All areas above and below the finished ceilings, exterior exposure, stairways, rooms, areaways, entry, etc., and other areas requiring sprinklers shall be adequately protected. The contractor shall thoroughly examine all architectural and other drawings as required to satisfy this requirement.
- B. The number of heads indicated on the Drawings shall not be reduced. Provide any additional heads required to obtain approvals.

1.04 APPLICABLE SPECIFICATIONS: The following publications for a part of this Specification:

- A. General: Per requirements in Section 23 05 00.
- B. Underwriters' Laboratories, Inc., (UL) Publications: List of inspected Fire Protection Equipment and Materials.

- C. National Fire Protection Association Pamphlets: Standard of the NFPA for the installation of sprinkler equipment.

1.05 SUPERVISION:

- A. Keep a competent superintendent on the job who shall coordinate the activities of the crafts and maintain the progress of the work to the satisfaction of the Architect.

1.06 SITE CONDITIONS:

- A. Verify all dimensions at the building site and check existing conditions before beginning work. Make changes which are necessary to install the work in harmony with other crafts, they shall be first approved by the Architect.

1.07 REGULATIONS:

- A. All work shall be installed in strict conformity with California Building Code (CBC), California Plumbing Code (CPC), and California Electric Codes (CEC), all Industrial Safety Orders, California Mechanical Code (CMC), National Fire Code (NFC), and any other laws and regulations of legally constituted authorities having jurisdiction.

1.08 FEES AND PERMITS:

- A. Take out all permits and pay all fees and charges of any kind required in connection with this work.

1.09 TEMPORARY CONNECTIONS:

- A. All temporary connections required to maintain services during the course of this contract shall be made without additional cost to the Owner. The normal function of the building must not be interrupted; notify the Owner seven days in advance before disturbing any service.

1.10 QUALITY ASSURANCE:

- A. Qualifications of Installer: Unless the Contractor has substantial previous experience with the class of work, the system shall be installed by a Subcontractor who specializes in this work.

1.11 SUBMITTALS:

- A. Shop Drawings and Product Data:
 - 1. Submit in accordance with the requirements of Section 01340.
 - 2. Submit shop drawings showing the location of all sprinkler heads, piping, bracing, hangers and anchors and all necessary working drawings showing complete details of piping within the building. Drawings shall be submitted for review prior to

commencement of any work. The Drawings shall be reviewed, stamped and approved by the Office of the State Fire Marshal and/or the authority having jurisdiction after review by the Engineer.

B. Operations and Maintenance Data:

1. Submit in accordance with the requirements of Division 1.

C. Installation Drawings: The Contractor shall prepare installation drawings for all piping and systems, and shall coordinate them with the Architectural reflected ceiling plans and with drawings for work of other trades. The Contractor shall obtain transparencies of reflected ceiling plans from the Engineer and shall show all head locations thereon, and shall submit these drawings with sprinkler layout drawings, to the Engineer for review. The Contractor shall then submit these drawings to the authority having jurisdiction, and obtain their approvals. After such approvals are obtained, furnish four sets of approved installation drawings to the Engineer.

PART 2 - PRODUCTS (OR MATERIALS)

2.01 GENERAL:

A. The equipment to be furnished under this specification shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the products of the same manufacturer.

2.02 MATERIALS:

- A. Unless otherwise shown on the Drawings, specified, or directed by the Architect, all materials and equipment used in the installation of the sprinkler systems shall be listed as approved by the UL and shall be the latest design of the manufacturer. The following materials shall conform to the respective specifications and other requirements specified below. All materials shall be reviewed by the Architect prior to installation.
- B. Wet sprinkler pipe above grade shall be Schedule 40 black steel, ASTM A-53, pipe with UL approved cast iron screwed sprinkler fittings. UL approved grooved fittings and couplings at the Contractor's option.
- C. Pipe below grade to 12" above shall be cast iron water pipe, AWWA C108-70, Class 150, with fittings to match. Fittings shall be cast iron pressure fittings, AWWA C111-64. Valves shall be cast iron pressure type. At the Contractor's option, J.M Blue Brut PVC Class 100, C900, pipe and fittings, UL labeled, may be used underground, outside the building if allowed by local codes.

D. Sprinkler Heads:

1. In General: Pendant or upright heads, exposed pattern on exposed piping; fusing element temperature ratings per NFPA Pamphlet No. 13 requirements.
2. In Areas With Suspended Ceilings: Semi-recessed style heads, with integral escutcheon, Gem "Aquarius", or equal; c.p. finish; fusing element temperature ratings per NFPA 13 requirements.
3. Sidewall: Horizontal side wall; stain-chrome finish with chrome escutcheon; Viking Model C4, Central Model H or HF.
4. Wire Guards: Factory-fabricated; clamp-on type.
5. Heads in equipment rooms and storage rooms shall be furnished with chrome-plated wire guards. Heads in unfinished spaces such as mechanical rooms may be bronze finish.
6. Spare Heads: The Contractor shall furnish spare heads equal to one percent of the total number of heads installed under contract, but not less than 24. The heads shall be installed in a suitable cabinet and shall be representative of, and in proportion to, the number of each type and temperature rating head installed, at least one of each. In addition to the spare heads, the Contractor shall furnish not less than two special sprinkler head wrenches. Cabinet shall be constructed of minimum 20-gauge cold-rolled steel, with 16-gauge shelves and shall be equipped with lock.

E. Hangers and Pipe Rings, Sway Bracing and Supports: Per NFPA Standard No. 13 and as follows:

1. Manufacturer: Grinnell or Carpenter & Patterson.
2. Types: Rod type, with adjustable malleable iron or formed steel pipe rings; cadmium-plated, prime painted or galvanized hanger rods and pipe rings; threaded hot rolled steel or continuously threaded hanger rods. Hanger rod couplings are not acceptable.
3. Embedded Inserts: Malleable iron, embedded during construction for all hangers.

F. Miscellaneous Connections and Fittings: As required by NFPA Pamphlet No. 13 and NFPA No. 14. Provide all drains; inspector's test fittings; discharge outlets and flushing connections; sway bracing; flexible joints with grooved-end pipe and fittings.

G. Zone Control Valves: UL approved, outside screw and yoke or butterfly. Valves shall be sealed open with approved seal. Valves shall have tamper switch.

H. Drain Valves: Angle, Straightway, Viking, or equal.

- I. Water Flow Indicator for Local Alarm: UL approved suitable for variable pressure, complete with instantaneous recycling retard and electrical contacts for alarm system (number as required).
- J. Angle, Check and Globe Valves for Fire Sprinkler Service: Federal Specification WW-V-51, Class A, type as suitable for application. Viking, or equal.
- K. Backflow Preventer: Reduced pressure principle backflow preventer, Ames.

PART 3 - EXECUTION

3.01 GENERAL

- A. Installation of the sprinkler system shall not be started until complete plans and specifications (including water supply information and type of existing sprinkler system, if any) have been approved by the authority having jurisdiction.
 - 1. All piping shall be concealed unless shown or otherwise directed.
 - 2. Where piping is left exposed within a room, the same shall be run true to plumb, horizontal or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor or ceiling surfaces.
 - 3. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for a maximum headroom clearance. This clearance shall not be less than 7'-0" without written approval from the Architect.
 - 4. Minor changes in locations of equipment, piping, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner, providing such change is ordered before such items of work, or work directly connected to same, are installed and providing no additional material is required.
 - 5. Grade all piping as required by NFPA Pamphlet No. 13.
 - 6. Close ends of pipe immediately after installation; leave closure in place until removal is necessary for completion of installation.
 - 7. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.
 - 8. Pipe the discharge of each drain valve to floor sink or drain.
- B. Anchors:
 - 1. Piping shall be provided with anchors as required by NFPA Pamphlet No. 13 and CCR Title 24 as herein described.

C. Sleeves:

1. Holes through concrete walls or floors shall be core drilled. The space between pipe and hole through floor slabs on ground, through outside walls above or below grade, through roof and other locations as directed shall be made watertight. At walls below grade Link-Seal casing seals may be used in lieu of caulking. Pipes penetrating walls below grade shall be anchored at the wall.

D. Floor, Wall and Ceiling Plates:

1. Fit all pipes with or without insulation passing through walls, floors, or ceilings and all hanger rods penetrating finished ceilings with chrome plated or stainless steel plates.

E. Fireproofing:

1. The annular space between the pipe sleeves and the pipe through all floors and walls shall be packed with a noncombustible mastic or other suitable material.
2. Penetrations in fire rated assemblies shall also be protected in accordance with CBC Chapter 7.

F. Hangers and Supports:

1. General: Support all piping so that it is firmly held in place by approved iron hangers and supports and special hangers as required in accordance with NFPA Pamphlet No. 13. Hangers shall support the load specified in NFPA 13, and, in addition, shall support weight of pipe, fluid and pipe insulation, based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments, or hangers, of same size as pipe or hanger on which used, or nearest available. Materials, design, and type numbers per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58, provide lateral bracing where hangers exceed 12" long. Install concrete anchors as required. All hanger material shall be approved by the Architect before installation. Support no piping or ductwork by any plumbers' tape, wire, rope, wood or other makeshift devices.
2. Suspend rods from angle clips, in accordance with Section 23 05 00.

3.02 SEISMIC REQUIREMENTS:

- A. Seismic bracing system shall be a complete pre-engineered bracing system, Pipe Shields, Inc., Tension 360, or equal. Pre-engineered bracing system shall include plan layout, brace selection and specification, plan layout and calculations. Complete system shall be submitted to Engineer for approval.

3.04 VALVES:

- A. All valves shall be identified by permanent metal tags or other approved means.

3.05 SPRINKLER HEADS:

- A. Heads shall be spaced upright where on exposed piping, unless otherwise noted, and in pendant position on concealed piping, unless noted otherwise, with deflectors parallel to the ceiling or roof slope. Clearance between the deflectors and the ceilings, electric, or heating equipment, or other obstruction shall be in accordance with the requirements of NFPA Pamphlet No. 13. Provide sprinkler head guards where heads are subject to mechanical damage, at mechanical rooms, storage rooms and gymnasium.

3.06 DRAINS:

- A. Auxiliary drains shall be installed on all low points in each system.
 - 1. Five or fewer trapped heads will not require a drain valve but may be drained through a plugged fitting. Drain valves shall be in accordance with the requirements of NFPA Pamphlet No. 13.
- B. One inspector's test drain shall be installed on the sprinkler system. Extend drain to outside in location approved by the Architect. Water discharge shall be positioned such that landscaping will not be damaged.
- C. Drain valves shall be piped to safe place of discharge and the discharge shall be visible either by open-end drain pipe or sight drain fitting. Flushing connections shall be provided at ends of all cross mains.

3.07 APPROVALS:

- A. Systems shall be designed and installed so as to meet with the inspection and approval of NFPA and the authority having jurisdiction. Shop drawings shall be submitted to the authority having jurisdiction for approval prior to any installation of work. Seven copies of the approved shop drawings shall be submitted to the Architect for review.
- B. Submittal to the authority having jurisdiction shall be completed prior to review by the Architect.

3.08 TESTS:

- A. At various stages and upon completion, the system must be tested in the presence of the enforcing agency.
 - 1. All tests of systems shall be witnessed by representatives of DSA-ORS, Local Fire Protection District and the Engineer. Give at least seven days notice, prior to testing.

- B. Upon completion and prior to acceptance of the installation, the Contractor shall subject the entire new system to the tests required in NFPA and shall furnish the Owner with two certificates as provided by NFPA 13 for the underground and building portions of system. At various stages and upon completion, the system shall be tested in the presence of the enforcing agency.

3.09 QUALIFICATION OF BIDDERS:

- A. Bidders shall present evidence satisfactory to the Architect that they are regularly engaged in the manufacture and installation of automatic sprinkler equipment approved by the UL, or other appropriate testing laboratory, or are authorized licensees of manufacturers of such equipment.

3.10 COORDINATION:

- A. All piping, heads and sprinkler work shall be coordinated with the new Architectural, Structural, Mechanical and Electrical Work. Piping shall be concealed, except where so indicated or where absolutely necessary to be exposed. Exposed piping shall be placed as approved by the Architect prior to installation. Heads shall be fully coordinated with architectural reflected ceiling plan and placed in the center of ceiling tiles. Installation of heads or fabrication of piping system shall not be started until plans have been reviewed by the Architect.
- B. Due to the limited space available, on-the-job measurement of pipe will be required. Off-sets, pipe, fittings, drains, etc., required to meet job conditions shall be furnished and installed at no extra cost to the Owner.
- C. Additional heads required by NFPA Pamphlet No. 13 regulations shall be provided at no extra cost. Location of heads and mains shall not be changed unless approved by the Architect.
- D. Any differences or disputes concerning coordination, interference or extent of work shall be decided by the Architect and his decision shall be final.

3.11 CLEANING:

- A. Upon completion of tests, clean all equipment, piping, etc., installed under this Section of the Specification.

3.12 FLUSH:

- A. Entire system shall be flushed out and cleaned after completion of work. Flush shall be continued until water runs clear at all drain connections.

END OF SECTION

SECTION 22 05 00

PLUMBING AND UTILITIES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

- A. The requirements of the general conditions and Division 1 apply to all work hereunder; also, applicable provisions of Section 23 05 00 Mechanical Work - General Requirements.
- B. Furnish and install all plumbing work indicated on the Drawings and described herein. Also, any incidental work not shown or specified necessary to provide the complete system.

1.02 SERVICES:

- A. Make all arrangements for the utilities required. Pay all costs involved in obtaining the services, including gas service and meter, water meter and access box, street work, in lieu fees for sewer, etc.
- B. Verify the location of all services. No extra cost shall be allowed if services are not as shown.
- C. Determine storm and sanitary sewer elevation at point of connection before installing any sewer piping. Notify Architect immediately if indicated grades cannot be maintained.

1.03 RECORD DRAWINGS:

A print of the plumbing plan showing underground piping will be furnished by the Contractor on which he shall indicate the locations of the underground installations as the work progresses. This shall be returned to Architect at completion of job.

PART 2 - PRODUCTS

2.01 CLEANOUTS:

- A. Cleanouts shall be "T" or "Y" branches or trap hubs of same material as pipe in which they are placed. Cleanouts in cast iron lines shall have cast iron bodies with brass plugs. Cleanouts in floors and sidewalks shall be Josam 56010 or 56030 for ceramic tile floors with nickel bronze covers. Cleanouts in vertical lines shall be Josam 58710. Furnish cleanouts at ends of branch lines, at the base of vertical lines, at changes in direction and where shown or required to facilitate cleaning, a maximum spacing of 50' inside buildings, 100' outside, also in waste drop from each sink and urinal. Cleanout to grade shall be set in 14" x 14" x 5" deep concrete pad; trowel smooth and edge; set flush with finished grade. Cleanouts to be full size of line up to a maximum of 4". Cleanouts shall clear all obstructions by 18" minimum. Furnish to Owner one wrench for each size and type of cleanout used. Permanently identify exterior cleanouts: SS for sanitary sewer, SD for storm drain.

2.02 PIPE AND FITTINGS INSIDE BUILDING:

- A. See General Requirements, Section 23 05 00, for dielectric fittings and pipe protection. Terminate 5'-0" outside the building line or where marked.
- B. Soil, Storm, Waste and Vent Pipe underground and to 6" above ground: Service weight cast iron soil pipe and fittings, asphaltic coated, conforming to Cast Iron Soil Pipe Institute Standard #301 ASTM A-888 or ASTM A-74 and so stamped. Joints shall be No-Hub conforming to Cast Iron Soil Pipe Institute Standard #310; Ty-Seal or equal with gaskets conforming to ASTM C 564 and ASTM A74. Suspended pipe with No-Hub joints shall have a swaybrace at 20'-0" maximum spacing.
- C. Waste and Vent Pipe above ground from lavatories or sinks, rainwater leaders and overflows above the floor: Cast iron soil pipe and fittings with no hub joints conforming to the requirements of CISPI Standard 301, ASTM A-888 or ASTM A-74 for all pipe and fittings. Joints shall conform to CISPI 310 and shall be hubless couplings composed of stainless steel shield, clamp assembly and elastomeric sealing sleeve. DWV drainage tubing and fittings is acceptable when approved. Condensate drains shall be Type L hard copper, with long sweep elbows and cleanout tees at each change in direction. Connect condensate drains to air conditioning units with P-trap and run to an approved receptor and dry well. Provide vibration eliminators at A.C. units.
- D. Water Pipe (Hot and Cold Water): Type L copper tubing, hard temper, with wrought copper fittings. Capped or plugged outlets shall be Schedule 40 screwed brass. Provide full solder cup fittings.

2.03 FIXTURES AND TRIM:

- A. Designations are American Standard unless noted. Kohler, Eljer, are acceptable if equal in utility, quality and appearance.
- B. P-traps for lavatories and sinks shall be 17-gauge chrome plated brass, adjustable. Provide offset P-traps for handicapped sinks in order to maintain ADA clearances.
- C. Concealed stops shall be 1/2" Speedway SSR44, lock shield valves. 3/4" stops shall be Dick Bros. #3150-LK. Exposed stops and supplies shall be 1/2" Speedway #S3712A for LAVS, S3712DL for water closets with IPS inlet, lock shield, loose key.
- D. Hose Bibb: 3/4" Acorn #8121 interior, 8136 exterior wall mount, mounted 18" above finished grade or floor, C.P. cast bronze, lock shield, loose key. Exterior box mounted Acorn 8151 with locking door, Acorn 8126 for planters and roof areas, hot and cold water type Acorn 8156.
- E. Floor and Shower Drain: J.R. Smith #2005A for exposed concrete, and shower, #2005B for tile floor. Set top of lip flush with floor. Provide with nickel bronze adjustable strainer except shower shall be chrome plated, flashing clamp where applicable and cast iron "P" trap.
- F. Trap Primers: E & S Primer valve, connect as recommended by manufacturer. Mount in J.R. Smith 4740 wall box with locking cover.

G. See drawings for fixtures.

PART 3 - EXECUTION

3.01 SERVICES:

- A. Make all arrangements for the utilities required. Pay all costs involved in obtaining the services including gas service and meter, water meter, pressure reducing valve, access boxes, street work.
- B. Verify the location of all services. No extra cost shall be allowed if services are not as shown.
- C. Determine storm and sanitary sewer elevation at point of connection before installing any sewer piping. Notify Architect immediately if indicated grades cannot be maintained.

3.02 RECORD DRAWINGS:

- A. A print of the plumbing plan showing underground piping will be furnished to the Contractor on which he shall indicate the locations of the underground installations as the work progresses. This shall be returned to the Architect at completion of job.

3.03 DISINFECTION:

- A. Clean and disinfect all hot and cold water systems connected to domestic water systems in accordance with AWWA Standard C651 and as required by the local building and health department codes. This procedure shall be performed by a water treatment company that has a current Cal-EPA license to apply disinfectant chlorine in potable water.
- B. Preliminary Preparation: Provide a 1" service cock or valve connected to system at a point within 2'-0" of its junction with water supply line and inject disinfecting agent into system through this cock. When project is complete, with all fixtures connected and operable and ready for use and when, by test, system is proved to be free from leaks, it shall be thoroughly flushed by fully opening every outlet and operating every fixture until clear water flows from all of them.
- C. Disinfecting Agent: The chlorine shall be a registered product with Cal-EPA for use in California in potable water lines, such as Bacticide, Cal-EPA Registration No. 37982-20001.
- D. Disinfecting Procedure: Connect a hand operated pump, 100 psi rating, minimum to the 1" service cock or valve.
 - 1. With system completely full of water and supply valve open, adjust every faucet of system so that a trickle of water flows from each.
 - 2. Inject disinfectant until an orthotolidin test at each outlet shows a chlorine residual concentration of at least 50 parts per million (p.p.m.).

3. Close all outlets and valves, including valve connecting to water supply line and 1" service cock on solution injection connection. Maintain condition for 24 hours and chlorine residual of 50 p.p.m. should be retained in system for this 24 hour period. If, after 24 hours, orthotolidin tests indicate that chlorine residual concentration has decreased below 50 p.p.m. then disinfection procedure must be repeated until an approved result is obtained.
4. When the above procedure has been completed, flush out entire system with fresh water until an orthotolidin test at any outlet shows a residual of not more than 0.5 p.p.m.
5. Warning signs shall be provided at all outlets while chlorinating the system.

3.04 PIPING CONNECTION:

- A. Minimum grade on drain, vent, and waste piping shall be 1/4" per foot unless noted, or later approved. Vent piping shall be graded to a soil or waste line.
- B. Connections from stacks or horizontal wastes to wall or floor finish for wastes from lavatories, urinals, sinks, and drinking fountains and connection between floor drains and traps shall be IPS 85% red brass pipe.
- C. Special Equipment:
 1. Certain items of equipment will be furnished and set in place under a separate section of specifications; furnish all services and sink fittings and waste trap if required.
 2. Make cold and hot water, drain, vent, and other required connections to all the equipment. Each water connection shall have a valve and union in the line, unless noted otherwise.
 3. Sizes and locations of connection to special equipment are shown for equipment made by certain manufacturers. Secure rough-in data from the manufacturer for the equipment to be installed and rough-in accordingly. Final connections shall conform to the manufacturer's directions for the equipment furnished at no extra cost to the Owner.
- D. Trap Primers: Provide a trap primer for each indirect waste receptacle not receiving discharge from a plumbing fixture.

3.05 CLEANOUTS:

- A. Furnish cleanouts at ends of branch lines, at the base of vertical lines, at changes in direction and where shown or required to facilitate cleaning, a maximum spacing of 50 feet inside buildings, 100 feet outside, also in waste drop from each sink. Cleanout to grade shall be set in a 14" x 14" x 5" deep concrete pad, trowel smooth and edge, set flush with finished grade. Cleanouts to be full size of line up to a maximum of 6". Cleanouts shall clear all obstructions by 18" minimum. Furnish to Owner one wrench for each size and type of cleanout used. Permanently identify cleanouts: SS for sanitary sewer.

3.06 FIXTURES AND TRIM:

- A. Install all fixtures at locations shown on architectural drawings. Provide proper backing for hanging brackets and hold down screws 2 x 6 blocking secured with U.J.H. clips or carriers as specified. Grout voids between all fixtures and adjacent surfaces with clear Dow Silicon Sealant. Install hold down screws and wall hung lavatories.
- B. All exposed piping, bibbs, stops, faucets, traps, flush valves and other trim for all fixtures shall be chrome plated including piping inside sink cabinets. Provide Hudee rim for all counter type sinks and lavatories. Enameled ware shall be cast iron with acid resisting enamel.
- C. Provide 85% or IPS red brass pipe, securely anchored to building construction, for each connection to faucets, flush valves, stops, hose bibbs, etc. Each fixture except hose bibbs, shall have a stop valve installed on water supply lines to permit repairs without shutting off water mains.
- D. Installation for handicap accessible fixtures shall conform to Chapter 16 California Plumbing Code, Section 1115 B California Building Code, and ADA requirements.

END OF SECTION

SECTION 23 05 00

MECHANICAL WORK - GENERAL REQUIREMENTS

Conditions of Contract and Division 1 apply to this Section.

PART 1 - GENERAL

1.01 INCLUSIONS:

- A. This section applies for all Division 21, 22, and 23 mechanical sections. All conditions and materials are pertinent to the other sections as if repeated in those sections.
- B. Furnish and install any incidental work not shown or specified which is necessary to provide a complete and workable system.

1.02 DRAWINGS:

- A. Examine all Drawings prior to bidding of work and report any discrepancies in writing to the Architect.

For remodel work: Contractor shall visit the site of work and examine existing conditions in order to become familiar with the scope. If dimensions are shown on the plans, they shall be verified at the site. Discrepancies shall be brought to the attention of the Architect. Failure to examine the site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions which could affect the scope.

- B. Drawings showing location of equipment, piping, ductwork, etc., are diagrammatic and job conditions will not always permit their installation in the location shown. The Mechanical Drawings show the general arrangement of all piping, ductwork, equipment, etc., and shall be followed as closely as existing conditions, actual building construction and the work of other trades will permit. The Architectural and Structural Drawings shall be considered a part of the work insofar as these Drawings furnish the Contractor with information relating to design and construction of the building. Architectural Drawings shall take precedence over Mechanical Drawings. Because of the small scale of the Mechanical Drawing, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly providing such fittings, valves and accessories as may be required to meet conditions. When job conditions do not permit installation of equipment, piping, ductwork, etc., in the locations shown, it shall be brought to the Architect's attention immediately and the relocation determined in a joint conference. Contractor will be held responsible for the relocation of any items without first obtaining the Architect's approval. Contractor shall remove and relocate such items at his own expense if so directed by the Architect.

- C. Execute work mentioned in the Specifications and not shown on the Drawings, or vice versa, the same as if specifically mentioned in both.

1.03 CODES:

- A. Provide all work and materials in full accordance with the latest rules and regulations of the California Code of Regulations (CCR), Title 21, Title 22, and Title 24, as applicable, Safety Orders of the Division of Industrial Safety, (Cal OSHA); the California Electric Code; the California Plumbing Code; the California Building Code; California Mechanical Code; State Fire Marshal; and other applicable laws or regulations. Nothing in these plans or specifications is to be construed to permit work not conforming to these codes. Furnish without extra charge, any additional material and labor required to comply with these rules and regulations.
- B. Where material or equipment is specified to conform to standards such as American Society of Testing and Materials (ASTM), Underwriters' Laboratories, Inc., (UL), American National Standards Institute (ANSI) and the like, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.

1.04 FEES AND PERMITS:

- A. Procure and pay for all permits and licenses required.

1.05 SUBSTITUTIONS AND MATERIAL LIST:

- A. Product names are used as standards of quality, items furnished as standard on specified equipment shall be furnished on all substituted equipment at no extra cost to the contract regardless of disposition of submittal data; other materials or methods shall not be used unless approved in writing by the Architect. The burden of proof as to the equality of any proposed material shall be upon the Contractor; Architect's decision is final. Only one request for substitution shall be considered for each item. Equipment capacities specified are minimum acceptable. Submittals will not be accepted until compliance with the requirements of Contract Documents has been confirmed by the Contractor.
- B. Unless stipulated otherwise in General Conditions and Division 1, submit a list of 7 copies of materials for approval within 35 days after the award of the Contract. It shall be accompanied by shop drawings, pump performance curves, fan curves, and other pertinent data, showing the size and capacity of the proposed materials. All materials to be used, whether substitutions or not, shall be listed in the order in which they appear in the specifications.
- C. Any mechanical, electrical, structural or other changes required for the installation of any approved substituted equipment shall be made to the satisfaction of the Architect and without additional cost to the Owner. Approval by the Architect of the substituted equipment and/or dimensional drawings does not waive these requirements. Upon request, submit drawings of mechanical equipment spaces showing substituted equipment before installation.
- D. Review of material shall not be construed as authorizing any deviations from the specifications unless the attention of the Architect has been directed to the specific deviations.

- E. Furnish to the Project Representative, upon request, complete installation instructions on all materials and equipment before starting installation of same.
- F. Submittals shall bear the specification reference or drawing location where they are specified. Submittals shall not be accepted in incomplete form. Submittals shall be organized into booklets for each specification section and submitted in indexed loose leaf binders with notation when it is a deviation from the specifications.
- G. Have fire damper installation instructions available at the site during construction for use by the inspector.

1.06 SITE CONDITIONS:

- A. Information on the drawings relative to existing conditions is approximate only. Deviations found necessary during progress of construction to conform to actual conditions, as approved by the Architect, shall be made without additional cost to the Owner. The Contractor shall be held responsible for any damage caused to existing services. Promptly notify the Architect if services are found which are not shown on drawings.

1.07 GUARANTEE:

- A. Repair or replace any defective work, materials or part which may appear within 1 year of the date of acceptance. This shall include damage by leaks.
- B. On failure to comply with the above guarantee within a reasonable length of time after notification is given, the Architect shall have the repairs made at the Contractor's expense.

1.08 MAINTENANCE AND OPERATING INSTRUCTIONS:

- A. Instruct the Owner's authorized representatives in operation, adjustment and maintenance of all mechanical equipment and systems. Provide three copies of certificate signed by Owner's representatives attesting to their having been instructed.
- B. Furnish three complete sets of operating and maintenance instructions bound in a hardback binder and indexed. Start compiling the data upon approval of list of materials. Final observation will not be made until booklets are approved by Architect.
- C. These sets shall incorporate the following:
 - 1. Complete operating instructions for each item of heating, ventilating, air conditioning and plumbing equipment.
 - 2. Test data and air and water balancing reports as specified.
 - 3. Typewritten maintenance instructions for each item of equipment listing in detail the lubricant to be used, frequency of lubrication, inspections required, adjustment, etc.

4. Manufacturer's bulletins with parts numbers, instructions, etc., for each item of equipment, properly stripped and assembled.
5. Temperature control diagrams and literature.
6. A complete list or schedule of all major valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed.

1.09 SCHEDULE OF WORK:

- A. All temporary connections required to maintain services, including adequate heat and cooling, during the course of this Contract shall be made without additional cost to the Owner. The normal function of the building must not be interrupted; notify the Owner seven (7) days in advance before disturbing any service.

1.10 RECORD DRAWINGS:

- A. Upon completion of the work and as a precedent to final payment, deliver to the Architect originals of all Drawings showing the work exactly as installed. Also deliver to the Architect one complete set of reproducibles of all Drawings showing the work exactly as installed. All Record Drawings shall be signed by the Contractor verifying their accuracy.

1.11 DELIVERY AND STORAGE:

- A. All equipment, ducting and piping delivered to site shall be protected from the weather, humidity and temperature variations, dirt and dust and other contaminants.

PART 2 - PRODUCTS (OR MATERIALS)

2.01 GENERAL:

- A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in good condition.

2.02 VALVES AND FITTINGS:

- A. Valves: Shall be DeZurik, Crane, Nibco, Kennedy, or equal.
 1. Gate Valves thru 2-1/2" -- Crane #428, Kennedy #427, Nibco #T-595.
 2. Gate Valves 3" thru 4" -- Crane #460 or #461, Nibco #F-617.
 3. Check Valves 2-1/2" and smaller -- Muessco #203BP, Crane #36, Nibco #T-413.

4. Gas Valves -- DeZurik #425SIRS-49.
5. Valves in the ground shall be Crane #2487-1/2-0, Mueller #A-2380-21 or equal, and shall be installed in Christy Concrete Products #F1 valve box with C210 C.I. lid, Books #1-RT box with #1-RT C.I. lid or equal. Nut operated valves in Alhambra Foundry Co. #A-3004 or equal access boxes marked for service. Provide a tee handle wrench for each size. Set access boxes in 4" thick concrete pad, trowel smooth and edge, set flush with grade. Water service valve in ground shall be AWWA, 200 psi, nut operated.
6. Valves in copper lines shall be furnished with adapters, or may be solder joint type of equal quality to screw type valves.

B. Unions and Flanges:

1. Steel 2" and smaller -- 150# screwed black or galvanized malleable iron, match pipe, ground joint, brass-to-iron seat.
2. Steel 2-1/2" and larger -- 150# black flange union, flat faced, full gasket.
3. Copper or brass pipe or tubing 2" or smaller -- 150# cast bronze ground joint, bronze-to-bronze seat with copper-to-copper end connections.
4. Copper or brass pipe or tubing 2-1/2" and larger -- 150# brass flange union, flat faced, full gasket.
5. Gaskets - Hot and cold water -- Garlock Style 320D.
6. Flange Bolts -- Open-hearth bolt steel, square heads with cold pressed hexagonal nuts, cadmium plated in ground. Provide copper plated steel bolts and nuts or brass bolts and nuts for brass flanges.

2.03 SERVICE MARKERS:

- A. 4" round by 30" long concrete marker, Haley Mfg., Co., Pinkerton, or equal with engraved brass identification plate.

2.04 PIPE PROTECTION:

- A. Polyethylene Coating: Extruded polyethylene coating, X-Tru-Coat, or field wrap as in B, Raychem "Thermofit" polyethylene sleeve joints, or field wrap as in B.
- B. Tape Wrap: Pressure sensitive polyvinyl chloride tape, "Trantex #V-10 or V-20", "Scotchrap #50", Slipknot 100, or equal, with continuous identification. Tape shall be a minimum of 20 mils thick for fittings and irregular surfaces, 2 wraps, 50% overlap, 40 mils total thickness. Tape shall

be laminated with a suitable adhesive. Widths as recommended by the manufacturer for the pipe size. Wrap 50'-0" or longer sections of piping with an approved wrapping machine.

- C. Pabco Wrap: Pabco Specifications #D-40-240K double wrap, in accordance with manufacturer's recommendations or PVC as in B. Lap pipe wrap a minimum of 1/4" and stagger the second layer. All Pabco pipe wrapping shall be done by the manufacturer's agent and not by the Contractor, except the field joints.
- D. Field Joints and Fittings: Pabco double wrap and Polyvinyl Chloride type as above. Provide at least 2 thicknesses of tape over the joint and extend a minimum of 4" over adjacent pipe covering. Build up with primer to match adjacent covering thickness. Width of tape on fittings shall not exceed 2". Tape shall adhere tightly to all surfaces of the fittings, without air pockets.

PART 3 - EXECUTION

3.01 EXCAVATING:

- A. Perform all excavating required for work of this section.
- B. Unless shown otherwise, provide a minimum of 3'-0" above top of pipe to finished grade outside so as to be below frost line and a minimum of 1'-0" under building from bottom of slab. Trim trench bottom by hand or provide a 4" deep minimum bed of sand to provide a uniform grade and firm support throughout entire length of pipe. For cement asbestos pipe, insulated pipe, glass pipe, or plastic pipe, bed the pipe in sand.
- C. Maintain all warning signs, barricades, flares and red lanterns as required.
- D. For all trenches 5' or more in depth, shoring, bracing, slipping or other provisions shall be made for worker protection from the hazard of caving ground during the excavation of such trenches in accordance with Cal OSHA.

3.02 BACKFILLING:

- A. Backfill shall comply with applicable compaction provisions of Division 2 of these specifications.
- B. Backfill plastic pipe and insulated pipe with sand for a minimum distance of 12" above the top of the pipe. Compact sand backfill by impact tamper and concrete vibrator.
- C. Except under existing or proposed paved area, walks, roads, or similar surfaces, and in cases where rock is encountered, backfill more than 1'-0" above the top of the pipe shall be made using suitable excavated material or other approved material as necessary. Place the backfill in 8" layers, measured before compaction, and compact with impact hammer to at least 95% relative compaction per ASTM D1557.
- D. Entire backfill for excavations under existing or proposed pavements, walks, roads, or similar surfaces, under new slabs on grade and where rock is encountered, shall be made with clean sand

compacted with mechanical tamping equipment to at least 95% relative compaction per ASTM D1557. Remove excess earth from site or deposit on site if so directed by the Architect.

- E. Replace or repair to its original condition all sod, concrete, asphalt paving, or other materials, including landscape sprinklers, disturbed by the trenching operation. Repair within the guarantee period as required.

3.03 THRUST BLOCKS:

- A. Provide concrete anchors or thrust blocks on all cast iron and cement asbestos water and forced main sewer lines in the ground. Install thrust blocks at all changes in direction and at all connections to the mains 2" and larger. Form thrust blocks by pouring concrete between the pipes and trench wall. They shall be adequate in size and placed to take all thrusts created by the maximum internal water pressure.

3.04 INSTALLATION OF PIPING SYSTEMS:

A. General:

1. All piping shall be concealed unless shown or otherwise directed.
2. Where piping or conduit is left exposed within a room, the same shall be run true to plumb, horizontal or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor or ceiling surfaces.
3. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-8" without written approval from the Architect.
4. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.
5. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.
6. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.
7. Pipe the discharge of each relief valve, air vent, backflow preventer and similar device to floor sink or drain.
8. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.
9. Tracer Wires (for Non-Metallic Pipe):

- a. Install tracer wire where shown for non-metallic pipe in ground outside of buildings. Use AWG #12 tracer wire and lay continuously below vertical projection of pipe so that it is not broken or stressed by backfilling operations. Solder all joints.
- b. Locate terminals where shown. Terminals: Precast concrete box and cast iron locking traffic cover, Brooks 3TL, or equal; cover marked with name of service; 6" of loose gravel below box. Plastic terminal board with brass bolts; identify line direction with plastic tags. Test for continuity between terminals after backfilling in presence of Construction Supervisor.
- c. Option: Use electronically detectable plastic tape with metallic core,

3.05 SERVICE MARKERS:

- A. Mark the location of each plugged or capped pipe, set marker in 6" x 6" concrete pad flush with finish grade.

3.06 PIPE JOINTS AND CONNECTIONS:

- A. Cutting: Cut piping and tubing square, ream cut ends to full bore, remove rough edges, burrs, loose materials.
- B. Threaded Pipe: Make joints with Rectorseal #5 or Permatex #1 thread lubricant or joint tape. Use no caulking of any kind. Remake leaky joints with new materials.
- C. Copper and Brass Pipe and Tubing (except Control Piping): Make all joints with silver brazing alloy, Sil-Fos or equal, 1100 degrees F. melting point or greater, ASTM B-260, except that water piping 1-1/4" and smaller not buried in the ground or concrete and Type DWV plumbing piping may be made up with 95-5 tin-antimony, ASTM B-32, Grade 5A solder. Boss or saddle type fittings or mechanically extracted tube joints will not be allowed. Use leadless solder for potable water piping.
- D. Clay Sewer Pipe: Joints in bell and spigot clay sewer pipe shall comply with ASTM C-425, made with an approved type of interlocking, resilient mechanical compression joint, formed on the pipe at the factory or Calder or Band Seal couplings. Lubricate inside of bells and outside of spigots with a solution as recommended by the pipe manufacturer.
- E. Cast Iron Soil Pipe:
 1. Make-No Hub joints with torque wrench. Wrought iron, steel, or copper pipe shall have a ring or part of a coupling screwed on to form a spigot end where connected to a No-Hub joint. Suspended No-Hub pipe shall have sway brace at 20'-0" maximum spacing.
 2. Ty-Seal, Dual-Tite, or equal, pipe and fittings may be used at the Contractor's option.

3. Connect building drain piping to outside service pipe with reducers or increasers as required. Caulking of smaller pipe into the larger without a reducer or increaser will not be permitted. Provide for changes in material types.

3.07 UNIONS AND FLANGES:

- A. Install Epcoc, or equal, dielectric unions or flanges at points of connection between copper or brass piping material and steel or cast iron pipe or material except in drain, waste, vent, or rainwater piping. Bushings or couplings shall not be used. Dielectric unions shall not be installed below grade.
- B. Install unions, whether shown or not, at each connection to all equipment and tanks, at one connection to each valve or cock, and at all connections to all automatic valves, such as temperature control valves.
- C. Locate the unions for easy removal of the equipment, tank or valve.

3.08 PIPE PROTECTION:

- A. Wrap all underground bare galvanized and black steel pipe and copper pipe, buried in the ground and to 6" above grade, including piping in conduit, with a corrosive protective wrap as specified under "Pipe Protection" in Part 2 of Section 15010.
- B. Cleaning: Clean all piping thoroughly before wrapping.
- C. Inspection: Damaged or defective wraps shall be repaired as directed. No wrapped pipe shall be covered until approved by the Architect.
- D. Testing: Test completed piping with Tinker and Rasor Co. test machine (San Gabriel, Calif. 626/287-7942).
- E. Covering: No rocks or sharp edges shall be backfilled against the wrap. when backfilling with other than sand, protect wrap with an outer wrapping of Kraft paper. Leave in place during backfill.

3.09 CONCRETE WORK:

- A. Concrete work required for work of this section shall be included under another section of the specifications, unless otherwise noted. This shall include all poured in place concrete work for installing precast manholes, catch basins, etc., unless the work is specifically indicated on the drawings to be furnished under this section. Thrust blocks, underground anchors, and pads for cleanouts, valve access boxes and washer boxes are included under this section of the specification. Concrete shall be 2500 psi test minimum.

3.10 INSULATION WORK:

A. Insulation of Piping:

1. Domestic hot and tempered water shall be insulated with 1" thick 3-1/2# density fiberglass with ASJ-SSL jacket.

3.11 TESTS AND ADJUSTMENTS:

- A. Test the installation in accordance with the following requirements and all applicable codes. Notify the Architect at least 7 days in advance of any test. All piping shall be tested at completion of roughing-in, or at other times as directed by the Architect.
- B. Furnish all necessary materials, test pumps, gases, instruments and labor required for testing. Tests shall be witnessed by the Architect.
- C. Isolate from the system all equipment which may be damaged by test pressure.
- D. Test Schedule: No loss in pressure or visible leaks shall show after four hours at the pressures indicated.

<u>System Tested</u>	<u>Test Pressure PSI</u>	<u>Test With</u>
Sanitary Sewer, Drain, Vent	10 Ft. Hd.	Water
Storm Drain, Condensate Drains	10 Ft. Hd.	Water
Domestic Hot and Cold Water	125	Water

END OF SECTION

SECTION 23 05 10

HEATING, VENTILATING AND AIR CONDITIONING

Conditions of the Contract and Division 01 apply to this Section.

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. The requirements of the General Conditions and Division 01 apply to all work hereunder, also applicable provisions of Section 23 05 00 MECHANICAL WORK - General Requirements.
- B. Drawings and general provisions of the Contract, including general and supplementary conditions apply to the work of this Section.

1.02 DESCRIPTION OF WORK:

- A. Furnish and install all heating, ventilating and air conditioning work indicated on the drawings and described herein. Also any incidental work not shown or specified that is necessary to provide the complete system.

1.03 COORDINATED LAYOUTS:

- A. Contractor shall provide 1/4" equals one foot scaled coordination drawings showing plan and pertinent section views of all piping, ductwork and electrical systems. Drawings shall be on bond and the work represented shall be fully coordinated with the structure, other disciplines, and with all finishes. Since scale of contract drawings is small and all offsets and fittings are not shown, contractor shall make allowances in bid for additional coordination time, detailing, fittings, offsets, hangers and the like to achieve a fully coordinated installation. If changes in duct size are required, equivalent area shall be maintained and the aspect ratio shall not be in excess of 2 to 1 unless approved by the engineer. Drawings shall be submitted for review prior to fabrication and installation. Drawings may be submitted in packages representing at least 1/4 of the building ductwork.
- B. Check routing on all ductwork before fabricating. Report any discrepancies to Architect. No extra cost will be allowed for failure to conform to above.
- C. It shall be responsibility of Heating, Ventilating and Air Conditioning Contractor to coordinate the other mechanical and electrical trades so that complete job is neat and in conformity with plans and specifications.

1.04 PLUMBING:

- A. All plumbing work required in the course of this contract shall be performed in strict accordance with all codes and regulations. Plumbing work done under this contract shall not adversely affect the operation of the existing plumbing systems. All materials shall be new and shall match existing.

PART 2 PRODUCTS (OR MATERIALS)

2.01 PIPE AND FITTINGS:

- A. See General Requirements section for dielectric fittings and pipe protection.
- B. Water drain, or gas connections to equipment shall match connected piping.
- C. Condensate Drain Piping: Type DWV copper tubing and fittings or Schedule 40 galvanized steel pipe and cast iron drain or vent fittings.
- D. Blow Off and Relief Valve Discharge Piping: Schedule 40 galvanized steel pipe and galvanized malleable fittings.
- E. Refrigeration Piping: Refrigeration gas and liquid piping shall be Type "L" hard drawing copper tubing with wrought copper fittings. All joints shall be made with Sil-fos. Relief valve discharge piping shall be full size of relief discharge, Schedule 40 steel pipe and malleable fittings, all galvanized if exposed to the weather. Furnish and install Superior, Sporian, Alco, Henry, or equal, stop valves, solenoid valves, adjustable thermal expansion valves, sight glass, flexible connection, charging valve, and drier with valve bypass in the liquid lines and Superior DFN shell and cartridge suction line filter sized 2-1/2 times tonnage.

2.02 FANS:

- A. All fans AMCA labeled with self aligning, enclosed ball bearings, accessible for lubrication, unless specified otherwise.
- B. Roof Mounted:
 - 1. Provide bird guard and disconnect switch.
 - 2. Fan wheels shall be centrifugal, non-overloading, all aluminum.
 - 3. Curb cap and orifice inlet shall be one piece aluminum.
 - 4. Shaft and motor bearings shall be relubricable ball bearings for belt-drive.
 - 5. Wheel configuration shall be as scheduled on the drawings.

6. Hood fans shall be all aluminum with horizontal discharge, access door for cleaning, belts and drive system shall be completely out of air stream. Motor shall be mounted in completely enclosed compartment with positive ventilation.
 7. Provide ventilated curb for kitchen exhaust fans.
- D. Ceiling: Acoustic lined cabinet, built-in backdraft damper, vibration isolated fan and motor, variable speed switch.

2.03 FAN DRIVES:

- A. Drive Design: The design horsepower rating of each drive shall be at least 1.5 times, single belt drives 2 times, the name plate rating of the motor with proper allowances for sheave diameters, speed ratio, arcs of contact and belt length.
1. All drives shall be variable speed, Dayco, Browning or Woods. Allow for replacement of fan drive and belt as required to suite the balance requirements of the project.
 2. All drives for 5 horsepower motors and larger shall have a minimum of 2 belts.
 3. Belts shall be within 1 degree 30 minutes of true alignment in all cases.
 4. All variable speed drives shall be selected to allow an increase or decrease of minimum of 10% of design fan speed.
 5. Motors of 25 HP and less shall have adjustable pitch sheaves; sheaves on motors above 25 HP may be non-adjustable. Change, at no extra cost to Owner, the non-adjustable sheaves to obtain desired air quantities.
- B. Sheaves: Sheaves shall be cast or fabricated, bored to size or bushed with fully split tapered bushings to fit properly on the shafts. All sheaves shall be secured with keys and set screws.
- C. Belts: All belts shall be furnished in matched sets.

2.04 FILTERS:

- A. Air filters shall be of an approved type tested in accordance with test method SFM-12-71-1 as shown in Part 12, Title 24, California Code of Regulations. Preformed filters having combustible framing shall be tested as a complete assembly.
- B. Air filters in all occupancies shall be Class 2 or better as defined in the test method above.
- C. Air filters shall be accessible for cleaning.

- D. Air filters shall be SFM listed.
- E. Panel type filters shall be 2" thick Farr 30/30, Farr D/C, or equal with replaceable media.

2.05 DAMPERS:

- A. Backdraft Dampers: Ruskin CBD2, counterbalanced.
- B. Manual Air and Balance Dampers: Ruskin CD35, opposed blade.

2.06 DUCTWORK:

- A. Galvanized Sheet Metal, See Part 3.

PART 3 EXECUTION

3.01 EQUIPMENT START-UP:

- A. Initial start-up of supply, exhaust and return fan systems and pumps shall be under the direct supervision of the Testing and Balancing Contractor.

3.02 PIPING:

- A. Refrigerant Piping: Extreme care shall be taken to keep the entire system clean and dry during installation. All lines shall be straight and free from kinks, restrictions or traps; horizontal suction lines shall be sloped toward compressor, 1" to 10'. For pre-fab line sets, all tubing shall be evacuated and sealed at the factory. The seal must not be broken until ready for assembly. If there is any evidence of dust, moisture, or corrosion, the tubing must be cleaned out by drawing a swab soaked with methyl alcohol through the tubing as many times as necessary to thoroughly clean the tubing.
- B. All piping under suspended floors shall be kept 6" minimum above ground; excavate as necessary.

3.03 FILTERS:

- A. Mount filters in airtight frames furnished by the filter manufacturer, and install in accordance with manufacturer's recommendations.
- B. Provide temporary filters for all fans that are operated during construction; after all construction dirt has been removed from the building install new filters at no additional cost to the Owner.
- C. Identify each filter access door with 1/2" high minimum stenciled letters.

3.04 SHEET METAL WORK:

- A. Construct and install all sheet metal in accordance with latest SMACNA recommendations for 2" static pressure. Provide variations in duct size, and additional duct fittings as required to clear obstructions and maintain clearances, as approved by the Architect, at no extra cost to Owner.
- B. Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations. On ducts with flat seams, provide standard reinforcing on inside of duct. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.
 - 1. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers.
 - 2. All ductwork, adhesives, lining, sealants, flex duct and the like shall have a flame spread of 25 or less and developed smoke rating of 50 or less when tested in accordance with ASTM E84.
- C. Round ducts with equivalent effective cross sectional area as determined by ASHRAE Guide, latest edition, may be used in lieu of concealed rectangular ducts shown, space permitting. Round and oval sheet metal ducts shall be spiral lock seam or longitudinal construction seam construction. Fittings shall be continuous weld or spot weld and seal. United Sheet Metal, SEMCO, or equal.
- D. The throat radius of all bends shall be 1-1/2 times the width of the duct wherever possible and in no case shall the throat radius be less than one width of the branch duct. Provide square elbows with Titus or HEP double thickness turning vanes where space does not permit the above radius, or where square elbows are shown.
- E. The slopes of transitions shall be approximately one to five unless shown otherwise, and no abrupt changes or offsets of any kind in the duct system shall be permitted.
- F. Provide sheet metal angle frame at all duct penetrations to wall, floor, or ceiling. Seal ductwork watertight at equipment room floor.
- G. All round ductwork shall be United Sheet Metal spiral duct and fittings. Assemble with USM duct sealer and sheet metal screws.
- H. Exposed round ducts shall be United Sheet Metal spiral duct and fittings, 22 gauge minimum for duct, 20 gauge minimum for fittings. Assemble with duct sealer and sheet metal screws.
- I. Provide Ventlon flexible connections on inlet and outlet of AC Unit, air handler, and heating/evaporative cooler unit. Provide galvanized weather hood over flexible connections exposed to the weather.

- J. Duct size shown on lined duct is the outside dimension.
 - K. Paint inside of ducts, visible through grille, dull black.
 - L. Flexible ducts shall be Thermaflex M-KE secured with worm gear bands. Maximum length of flexible duct shall be 5'-0". Support flexible ducts at 30" maximum with 1-1/2" x 24 gauge straps. Factory-made air ducts shall be approved for the use intended or shall conform to the requirements of CMC Standard No. 6-1. Each portion of a factory-made air duct system shall be identified by the manufacturer with a label or other suitable identification indicating compliance with CMC Standard No. 6-1 and its class designation. These ducts shall be UL listed Class 1, 25/50 smoke and flame spread and shall be installed in accordance with the terms of their listing. Omit external insulation. Duct installed R value shall be R-8. R-5.2 may be used where ductwork is located within fully insulated envelope in accordance with Title 24 regulations.
 - M. Provide lateral bracing per Section 230500.
 - N. Ducts shall clear combustible construction by 1" minimum.
 - O. Seal airtight transverse seams of all supply and return ducts. Refer to Mechanical General Requirements specifications. Duct leakage shall not exceed 1%.
 - P. Provide Ventlok #699 test hole fittings where indicated or specified.
 - Q. All materials except sheet metal including duct liner shall be approved before installation.
- 3.05 DAMPERS:
- A. All dampers automatically controlled by damper motors are specified under "Temperature Control System" except those specified with items of equipment.
 - B. Provide opposed blade manual air dampers at each branch duct connection and at locations indicated on the drawings and where necessary to control air flow for balancing system. Provide Ventlok regulators. Provide an opposed blade balancing damper in each zone supply duct. Damper blades shall be 16 gauge minimum galvanized steel with 3/8" minimum shaft, and 10" maximum blade width. Provide an access panel or Ventlok flush-type damper regulator on ceiling or wall for each concealed damper.
 - C. Provide 18" x 12" minimum access doors in ductwork and furring for easy access to each fire damper; insulated access doors in insulated ducts. Label access doors with 1/2" high red letters.
 - 1. Provide Ventlok access doors with Series 100 hardware for convenient access to all automatic dampers and other components of the system, insulated type in insulated ducts. Provide Ventlok #202 for light duty up to 2" thick doors, #260 heavy duty up to 2" thick doors and #310 heavy duty for greater than 2" thick doors. Provide #260 hinges on all hinged and personnel access doors, include gasketing.

3.06 AIR INLETS AND OUTLETS:

- A. Provide all air inlets and outlets with gaskets and install so that there will be no streaking of the walls or ceilings due to leakage. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange. Support each ceiling diffuser with four wires from overhead construction per Title 24 and secure to ceiling framing system with two concealed screws at opposite sides.
- B. Furnish all air inlets and outlets with a baked prime coat unless otherwise noted. Provide off-white baked enamel finish on ceiling-mounted air inlets and outlets. Exposed mounting screws shall be painted to match the material being secured.
- C. Air inlets and outlets shall match all qualities of those specified including appearance, throw, noise level, adjustability, etc.

3.07 FANS:

- A. Each ceiling-mounted fan shall have multi-speed switch and integral backdraft damper.
- B. Provide access doors for fans or motors mounted in ductwork.
- C. Mount all fans so that they are completely isolated from building.
- D. Fan motors mounted in air-stream to be totally enclosed.
- E. Completely line supply, return or exhaust fan cabinets with 1" thick, 3/4 lbs. density acoustic insulation securely cemented in place.
- F. Roof fans shall be mounted level.

3.08 EQUIPMENT CHECK, TEST AND START:

- A. The check, test and start of each air conditioning unit, make-up air unit, air handler unit and gas unit heater shall be performed by a specialized company, Aircon Service, Commercial Air, or equal, acting as a subcontractor to the air conditioning contractor. The company selected shall have had experience on similar projects and shall have demonstrated by past performance that the personnel are qualified to do such work. The firm selected shall have approval of the Architect prior to start of work.
- B. The company shall provide all personnel, test instruments, and equipment to properly perform the check, test and start.

- C. The check, test and start of each item of equipment shall be in accordance with manufacturer's printed instructions. Three (3) copies of the completed check, test and start report of each item of equipment shall be bound with the operating and maintenance instructions.
- D. Upon completion of the work, provide a schedule of planned maintenance indicating frequency of service for all equipment components. Post schedule where directed under plastic.

3.09 TESTING AND BALANCING (SMALL AND MEDIUM SIZE; INDEPENDENT TEST):

- A. Obtain the service of an independent test and balance agency that specialized in, and whose business is limited to, testing and balancing of air conditioning systems.
- B. Coordinate work done by testing and balancing agency with work of other trades.
- C. Testing and balancing agency, as a part of its contract, shall act as authorized inspection agency and shall report any discrepancies or items not installed in accordance with Contract Drawings and/or Specifications pertaining to air and water distribution, and exhaust systems.
- D. Contractor shall provide for adjustments and/or additions or modifications to fan and motor sheaves, belts, damper linkages and the like to achieve proper air balance at no additional cost.
- E. Testing and balancing shall be performed in complete accordance with AABC National Standards for Field Measurement and Instrumentation, Volume Four. Testing and balancing shall be performed on air distribution system, chilled water system, condenser water system, heating water system, and domestic water system.
- F. Balance air quantities of supply and exhaust to achieve those given on Drawings. Measure the total air quantity at each fan. Measure the total air quantity at each supply fan with maximum outside air and with minimum outside air. Measure the ampere reading of each motor input after final adjustments have been made. Provide static pressure profile for each air moving equipment. Upon satisfactory completion of balance and operational test, submit three (3) sets of reports to the Architect on balance final readings, summary of fan CFM delivery rates, static pressure ratings, motor ampere input, and general summary of test results. Specified ratings and motor nameplate ratings shall be listed with measured readings.
- G. Instruments used for testing and balancing of systems shall have been calibrated within a period of six (6) months and shall be checked for accuracy prior to start of work.
- H. Three (3) copies of complete test report shall be submitted prior to final acceptance of project.
- I. Tabulate magnetic starters size, type, and manufacturer with heater strip size, type and rating along with motor nameplate data.
- J. Air balance shall be achieved using variable fan speeds.

K. Adjust single or double deflection registers and variable pattern diffusers to evenly distribute air within the conditioned space. The terminal air velocity at 5' above the floor shall not exceed 50 FPM in normal air conditioned spaces.

L. Measure the ampere reading of each motor input after final adjustments have been made.

3.10 EQUIPMENT MOUNTING:

A. Mounting and anchorage of equipment shall be in strict compliance with drawings details. Alternate anchorage methods will not be considered for roof mounted equipment.

END OF SECTION

SECTION 26 00 10
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Table of Contents, Division 26 - Electrical:

<u>SECTION NO.</u>	<u>SECTION TITLE</u>
260010	BASIC ELECTRICAL REQUIREMENTS
260090	ELECTRICAL DEMOLITION
260519	BUILDING WIRE AND CABLE
260526	GROUNDING AND BONDING
260529	ELECTRICAL HANGERS AND SUPPORTS
260531	CONDUIT
260533	BOXES
260543	UNDERGROUND DUCTS AND STRUCTURES
260546	SIGNAL SYSTEMS RACEWAY
260553	ELECTRICAL IDENTIFICATION
260926	NETWORK LIGHTING CONTROL
262416	PANELBOARDS
262716	CABINETS AND ENCLOSURES
262726	WIRING DEVICES
262816	OVERCURRENT PROTECTIVE DEVICES
262819	DISCONNECT SWITCHES
262900	MOTOR CONTROLS
264313	SURGE PROTECTIVE DEVICES
265100	INTERIOR LIGHTING
265600	EXTERIOR LIGHTING
266116	FIRE ALARM SYSTEM
266516	SECURITY ALARM MONITORING SYSTEM
267113	TELECOMMUNICATION CABLING SYSTEMS
275126	ASSISTIVE LISTENING SYSTEM (ALS)

B. Work included: This Section includes general administrative and procedural requirements for Division 26. The following administrative and procedural requirements are included in this Section to supplement the requirements specified in Division 01.

1. Quality assurance.
2. Definition of terms.
3. Submittals.
4. Coordination.
5. Record documents.
6. Operation and maintenance manuals.

7. Project management and coordination services.
 8. Rough-in.
 9. Electrical installation.
 10. Cutting, patching, painting and sealing.
 11. Field quality control.
 12. Cleaning.
 13. Project closeout.
- C. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete and operable installation.
1. General and supplementary conditions: Drawings and general provisions of Contract and Division 01 of the Specifications, apply to all Division 26 Sections.
 2. Earthwork: Include trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, in-grade pull boxes, vaults, lighting pole foundations, etc. Refer to Division 31, Earthwork.
 3. Concrete Work: Include forming, steel bar reinforcing, cast-in- place concrete, finishing and grouting as required for underground conduit encasement, light pole foundations, pull box slabs, vaults, housekeeping pads, etc. Also includes setting of floor boxes in existing concrete slabs, saw-cutting of existing slabs and grouting of conduits in saw-cut. Refer to Division 03, Concrete.
 4. Miscellaneous metal Work: Include fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, lighting fixtures, panelboards, distribution boards, switchboards, motor control centers, etc. Refer to Division 05, Miscellaneous Metals.
 5. Miscellaneous lumber and framing Work: Include wood grounds, nailers, blocking, fasteners and anchorage for support of electrical materials and equipment. Refer to Division 06, Rough Carpentry.
 6. Moisture protection and smoke barrier penetrations: Include membrane clamps, sheet metal flashing, counter flashing, caulking and sealant as required for waterproofing of conduit penetrations and sealing penetrations in or through fire walls, floors, ceiling slabs and foundation walls. All penetrations through vapor barriers at slabs on grade shall be taped and made vaportight. Refer to Division 07, Thermal and Moisture Protection.
 7. Access panels and doors: Required in walls, ceilings and floors to provide access to electrical devices and equipment. Refer to Division 08, Access Doors also, Division 05, Metals.
 8. Painting: Include surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, etc. where indicated as field painted in this Division. Refer to Division 09, Painting.

9. Lighting fixture supports: Provide slack fixture support wire for lighting fixtures installed in acoustical tile or lay-in suspended ceilings. Refer to Division 09, Acoustical Treatment.
- D. Work furnished and installed under another Division requiring connections under this Division includes but is not limited to:
1. Electric motors.
 2. Package mechanical equipment: fans, fan coil units, pumps, boilers, compressors, etc.
 3. Flow switches and valve monitors for sprinkler system.
 4. Elevator controllers.
 5. Pre-wired electrified partition furniture.
 6. Temperature control panel(s). (Line voltage only)
 7. Irrigation controller(s). (Line voltage only)
 8. Kitchen equipment and appliances.
 9. Laboratory equipment.
 10. Electric signage.
 11. Electric door locks.
 12. Electric heat trace tape.
 13. Door hold-open/release devices.
 14. Variable frequency drive units.
 15. Chiller starters.
 16. Motorized roll down/sliding doors and grills.
 17. Projection screens.
- E. Items furnished under another Division, but installed and connected under this Division includes but is not limited to:
1. Wall mounted control stations for motorized roll down and sliding doors.
 2. Electric fire sprinkler water flow bells.
 3. Speed control switches for ceiling exhaust fans.

1.2 QUALITY ASSURANCE

- A. Reference to Codes, Standards, Specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.
- B. When codes, standards, regulations, etc. allow Work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred authority for reducing the quality, requirements or extent of the Contract Documents. The Contract Documents address the minimum requirements for construction.

C. Work shall be performed in accordance with all applicable requirements of the latest edition of all governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:

1. California Electric Code (CEC).
2. California Building Code (CBC).
3. California Fire Code (CFC).
4. California Mechanical Code (CMC).

D. Standards: Equipment and materials specified under this Division shall conform to the following standards where applicable:

ACI	American Concrete Institute
ANSI	American National Standards Institute
ASTM	American Society for Testing Materials
CBM	Certified Ballast Manufacturers
ETL	Electrical Testing Laboratories
FS	Federal Specification
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IPCEA	Insulated Power Cable Engineer Association
NEMA	National Electrical Manufacturer's Association
UL	Underwriters' Laboratories

E. Independent Testing Agency qualifications:

1. Testing Agency shall be an independent testing organization that will function as an unbiased authority, professionally independent of Manufacturer, Supplier and Contractor, furnishing and installing equipment or system evaluated by Testing Agency.
2. Testing Agency shall be regularly engaged in the testing of electrical equipment, devices, installations and systems.
3. Testing Agency shall meet Federal Occupational Safety and Health Administration (OSHA) requirements for accreditation of independent testing laboratories, Title 9, Part 1907.
4. On-site technical personnel shall be currently certified by the International Electrical Testing Association in electrical power distribution system testing.
5. Testing Agency shall use technicians who are regularly employed by the firm for testing services.
6. Contractor shall submit proof of above Testing Agency qualifications with bid documentation upon request.

F. All base material shall be ASTM and/or ANSI standards.

G. All electrical apparatus furnished under this Section shall conform to NEMA standards and the CEC and bear the UL label where such label is applicable.

H. Certify that each welder performing Work has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

1.3 DEFINITION OF TERMS

- A. The following list of terms as used in the Division 26 documents shall be defined as follows:
1. "Provide": Shall mean furnish, install and connect unless otherwise indicated.
 2. "Furnish": Shall mean purchase and deliver to Project site.
 3. "Install": Shall mean to physically install the items in-place.
 4. "Connect": Shall mean make final electrical connections for a complete operating piece of equipment.
 5. "As directed": Shall be as directed by the Owner or their authorized Representative.
 6. "Utility Companies": Shall mean the company providing electrical, telephone or cable television services to the Project.

1.4 SUBMITTALS

- A. Format: Furnish in format as noted in Division 01.
- B. Submittals shall consist of detailed Shop Drawings, Specifications, block wiring diagrams, "catalog cuts" and data sheets containing physical and dimensional information, performance data, electrical characteristics, materials used in fabrication and material finish. Clearly indicate by arrows or brackets precisely what is being submitted on and those optional accessories which are included and those which are excluded. Each submittal shall be labeled with the Specification Section Number and shall be accompanied by a cover letter or shall bear a stamp stating that the submittal has been thoroughly reviewed by the Contractor and is in full compliance with the requirements of the Contract Documents. Cover letters shall list in full the items and data submitted. Failure to comply with this requirement shall constitute grounds for rejection of data.
- C. The Contractor shall submit detailed Drawings of all electrical equipment rooms and closets if the proposed installation layout differs from the construction documents. Physical size of electrical equipment indicated on the Drawings shall match those of the electrical equipment that is being submitted for review, i.e.: switchboards, panelboards, transformers, control panels, etc. Minimum scale: 1/4" = 1'- 0". Revised electrical equipment layouts must be approved prior to release of order for equipment and prior to installation.
- D. The Manufacturer shall recommend the method of anchoring the equipment to the mounting surface and shall provide the Contractor with the assembly dimensions, weights and approximate centers of gravity.
- E. All re-submittals shall include a cover letter that lists the action taken and revisions made to each Drawing and equipment data sheet in response to Submittal Review Comments. Resubmittal packages will not be reviewed unless accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the resubmittal package.
- F. Shop Drawings for the following systems must be prepared via a computer aided drafting (CAD) system for submission by the Contractor. The Engineer in either Autocad Release 14 or DXF file format can provide files of the electrical Contract Documents to the Contractor.
1. Low-voltage lighting control, Section 260926
- G. Independent Testing Agency report:
1. Testing Agency shall provide 3 copies of the complete testing report.

2. Test report shall include the following:
 - a. Summary of Project.
 - b. Description of equipment.
 - c. Equipment used to conduct the test.
 - 1) Type.
 - 2) Manufacturer.
 - 3) Model number.
 - 4) Serial number.
 - 5) Date of last calibration.
 - 6) Documentation of calibration leading to NIST standards.
 - d. Description of test.
 - e. Test results, as compared to Manufacturers or industry accepted standards and tolerances.
 - f. Conclusion and recommendation.
 - g. Signature of responsible test organization authority.
 3. Furnish completed test report to Engineer no later than 30 days after completion of testing, unless otherwise directed.
- H. Substitutions:
1. All requests for substitutions shall conform to the general requirements and procedure outlined in Division 01.
 2. Where items are noted as "or equal," a product of equal design, construction and performance will be considered. Contractor must submit to the Engineer all pertinent test data, catalog cuts and product information required substantiating that the product is in fact equal to that specified. Only one substitution will be considered for each product specified.
 3. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the Contract Documents are used to establish standards of quality, utility and appearance. Materials, processes or equipment, which in the opinion of the Engineer is equal in quality, utility and appearance, will be approved as substitutions to that specified.
 4. Whenever any material, process or equipment is specified in accordance with a Federal specification, an ASTM standard, an ANSI specification, UL rating or other association standard, the Contractor shall present an affidavit from the Manufacturer certifying that the product complies with the particular standard specification. When requested by the Engineer, support test data to substantiate compliance shall be submitted by the Contractor at no additional cost.
 5. Substitutions shall be equal, in the opinion of the Architect/Engineer, to the specified product. The burden of proof of such shall rest with the Contractor. When the

Architect/Engineer in writing accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted article or material to be equal to the one specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the Work or from any provisions of the Specifications.

6. The Contractor shall be responsible for all expenses in connection with the substitution materials, processes and equipment, including the effect of the substitution on the Contractor, Subcontractor's or other Contractor's Work. No substitution of material, processes or equipment shall be permitted without written authorization of the Architect/Engineer. Any assumptions on the acceptability of a proposed substitution prior to acceptance by the Engineer are at the sole risk of the Contractor.

1.5 COORDINATION

A. Discrepancies:

1. In the event of discrepancies within the Contract Documents, the Engineer shall be so notified, within sufficient time, as delineated in Division 01, prior to the Bid Opening to allow the issuance of an Addendum.
2. If, in the event that time does not permit notification or clarification of discrepancies prior to the Bid Opening, the following shall apply: The Drawings govern in matters of quantity and the Specifications govern in matters of quality. In the event of conflict within the Drawings involving quantities or within the Specifications involving quantities or within the Specifications involving quality, the greater quantity and higher quality shall apply. Such discrepancies shall be noted and clarified in the Contractor's Bid. No additional allowances will be made because of errors, ambiguities or omissions that reasonably should have been discovered during the preparation of the Bid.

B. Project conditions:

1. Examination of Project site: The Contractor shall visit the Project site and thoroughly review the locale, working conditions, conflicting utilities and the conditions in which the Electrical Work will take place. Verify all existing conditions in the field. No allowances will be made subsequently for any costs that may be incurred because of any error or omission due to failure to examine the Project site and to notify the Engineer of any discrepancies between Contract Documents and actual Project site conditions.
2. Underground Utility Surveys: Prior to commencing any underground work, the Contractor shall perform independent surveys of the existing underground utilities and infrastructure in all areas of anticipated underground electrical work.
3. Protection: Keep conduits, junction boxes, outlet boxes and other openings closed to prevent entry of foreign matter. Cover fixtures, equipment, devices and apparatus and protect them against dirt, paint, water, chemical or mechanical damage, before and during construction period. Prior to final acceptance, restore to original condition any fixture, apparatus or equipment damaged including restoration of damaged factory applied painted finishes. Protect bright finished surfaces and similar items until in service. No rust or damage will be permitted.
4. Supervision: Contractor shall personally or through an authorized and competent representative constantly supervise the Work from beginning to completion and, within

reason, keep the same foreman and workmen on the Project throughout the Project duration.

C. Preparation:

1. Drawings:

- a. Layout: General layout indicated on the Drawings shall be followed except where other Work may conflict with the Drawings.
- b. Accuracy: Drawings for the Work under this Section are essentially diagrammatic within the constraints of the symbology applied.

1.6 RECORD DOCUMENTS

A. Provide Project Record Drawings as described herein:

1. Drawings shall fully represent installed conditions including actual locations of outlets, true panelboard connections following phase balancing routines, correct conduit and wire sizing as well as routing, revised fixture schedule listing Manufacturers and products actually installed and revised panel schedules. Contractor shall record all changes in the Work during the course of construction on blue or black line prints. These prints shall be made subject of monthly review by the Owner's Representative to ascertain that they are current. If not current monthly payments may be withheld.
2. Record Drawings shall be the transfer of information on these prints to the construction documents via computer aided drafting (CAD) process. A set of CAD files of the electrical documents will be provided to the Contractor in either Autocad Release 14 or DXF file format.
3. Record drawing submissions shall be provided to the Engineer to review upon the completion of the following phases of Work:
 - a. All underground installation.
 - b. Building electrical rough-in.
 - c. Final electrical installation.
4. Include in the record drawing submission shop drawings with all updated installation information.
5. A single set of half size prints of the Record Drawings shall be submitted for review. Upon receipt of the Engineer's review comments, corrections shall be made and the Contractor shall provide the following:
 - a. Two sets of full size prints.
 - b. Four sets of half size prints.
 - c. One set of full size reproducibles.
 - d. DXF files of Drawings.

B. Panel schedules:

1. Typewritten panel schedules shall be provided for panelboards indicating the loads served and the correct branch circuit number. Schedules shall be prepared on forms

provided by the Manufacturer and inserted in the pocket of the inner door of each panelboard.

1.7 OPERATION AND MAINTENANCE MANUALS

- A. Prior to Project closeout furnish to the Owner, six (6) hard back 3-ring binders containing all bulletins, operation and maintenance instructions, part lists, service telephone numbers and other pertinent information as noted in each Section all equipment furnished under Division 26. Binders shall be indexed into Division Sections and labeled for easy reference. Bulletins containing more information than the equipment concerned shall be properly stripped and assembled.

1.8 PROJECT MANAGEMENT AND COORDINATION SERVICES

- A. Overview: Contractor shall provide a Project Manager/Engineer for the duration of the Project to coordinate the Division 26 Work with all other trades. Coordination services, procedures and documentation responsibility shall include, but shall not be limited to the items listed in this Section.
- B. Review of Shop Drawings prepared by other Subcontractors:
1. Obtain copies of all Shop Drawings for equipment provided by others that require electrical service connections or interface with Division 26 Work.
 2. Perform a thorough review of the Shop Drawings to confirm compliance with the service requirements contained in the Division 26 Contract Documents. Document any discrepancy or deviation as follows:
 - a. Prepare memo summarizing the discrepancy.
 - b. Provide a copy of the specific shop drawing, indicating via cloud, the discrepancy.
 3. Prepare and maintain a shop drawing review log indicating the following information:
 - a. Shop drawing number and brief description of the system/material.
 - b. Date of your review.
 - c. Indication if follow-up coordination is required.
- C. Request for information (RFI):
1. Thoroughly review the Contract Documents prior to the preparation and submission of an RFI. If an RFI is submitted, attach 8 1/2" x 11" copies of all relevant documents to clarify the issue.
 2. Prepare and maintain an RFI log indicating the following information:
 - a. RFI number and brief summary of the issue.
 - b. Date of issuance and receipt of response.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 ROUGH-IN

- A. Contractor shall verify lines, levels and dimensions indicated on the Drawings and shall be responsible for the accuracy of the setting out of Work and for its strict conformance with existing conditions at the Project site.
- B. Verify final locations for rough-ins with field measurements and with the requirements for the actual equipment to be connected.
- C. Refer to equipment specification in Divisions 22 through 33 for rough-in requirements.

3.2 ELECTRICAL INSTALLATION

- A. Preparation, sequencing, handling and installation shall be in accordance with Manufacturer's written instructions and technical data particular to the product specified and/or accepted equal except as otherwise specified. Comply with the following requirements:
 - 1. Shop Drawings prepared by Manufacturer.
 - 2. Verify all dimensions by field measurements.
 - 3. Arrange for chases, slots and openings in other building components during progress of construction, to allow for electrical installations.
 - 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 - 5. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 - 6. Where mounting height is not detailed or dimensioned, contact the Architect for direction prior to proceeding with rough-in.
 - 7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies and controlling agencies. Provide required connection for each service.
 - 8. Install systems, materials and equipment to conform with approved submittal data, including coordination Drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are indicated only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
 - 9. Install systems, materials and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 - 10. Install electrical equipment to facilitate servicing, maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
 - 11. Coordinate electrical systems, equipment and materials installations with other building components.
 - 12. Provide access panel or doors where devices or equipment are concealed behind finished surfaces. Furnish and install access doors per the requirements of Division 08.

13. Install systems, materials and equipment giving right-of-way priority to other systems that are required to maintain a specified slope.

14. Conform to the National Electrical Contractors' Association "Standard of Installation" for general installation practice.

3.3 CUTTING, PATCHING, PAINTING AND SEALING

A. Structural members shall in no case be drilled, bored or notched in such a manner that will impair their structural value. Cutting of holes, if required, shall be done with core drill and only with the approval of the Architect and Structural Engineer.

B. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

C. Application of joint sealers:

1. General: Comply with joint sealer Manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.

2. Installation of fire-stopping sealant: Install sealant, including forming, packing and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire-stops and fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

3.4 FIELD QUALITY CONTROL

A. General testing requirements:

1. The purpose of testing is to ensure that all tested electrical equipment, both Contractor and Owner supplied, is operational and within industry and Manufacturer's tolerances and is installed in accordance with design Specifications.

2. Tests and inspections shall determine suitability for energization.

3. Perform tests in presence of the Owner's Representative and furnish test equipment, facilities and technical personnel required to perform tests.

4. Tests shall be conducted during the construction period and at completion to determine conformity with applicable codes and with these Specifications.

B. Tests: In addition to specific system test described elsewhere, tests shall include:

1. Equipment operations: Test motors for correct operation and rotation.

2. Lighting control circuits: Test lighting circuits for correct operation through their control devices.

3. Alarm and interlock systems: Produce malfunction symptoms in operating systems to test alarm and interlock systems. In addition, all specific tests described in the fire alarm system shall be performed.

4. Circuit numbering verification: Select on a random basis various circuit breakers in the panelboards and cycle them on and off to verify compliance of the typed panel directories with actual field wiring.

5. Voltage check:
 - a. At completion of job, check voltage at several points of utilization on the system that has been installed under this Contract. During test, energize all installed loads.
 - b. Adjust taps on transformers to give proper voltage, which is 118 to 122 volts for 120 volt nominal systems and proportionately equivalent for higher voltage systems. If proper voltage cannot be obtained, inform the Owner and the serving Utility Company.
- C. Contractor shall provide test power required when testing equipment before service energization and coordinate availability of test power with General Contractor after service energization. The Contractor shall provide any specialized test power as needed or specified herein.
- D. Testing safety and precautions:
 1. Safety practices shall include the following requirements:
 - a. Applicable State and Local safety operating procedures.
 - b. OSHA.
 - c. NSC.
 - d. NFPA 70E.
 2. All tests shall be performed with apparatus de-energized and grounded except where otherwise specifically required ungrounded by test procedure.
- E. Calibration of test equipment:
 1. Testing Agency shall have calibration program that assures test instruments are maintained within rated accuracy.
 2. Instruments shall be calibrated in accordance with the following frequency schedule:
 - a. Field instruments: Analog, 6 month maximum; Digital, 12 months maximum.
 - b. Laboratory instruments: 12 months.
 - c. Leased specialty equipment: 12 months where accuracy is guaranteed by lessor.
 3. Dated calibration labels shall be visible on test equipment.
 4. Records, which show date and results of instruments calibrated or tested, must be kept up-to-date.
 5. Up-to-date instrument calibration instructions and procedures shall be maintained for test instrument.
 6. Calibration standards shall be of higher accuracy than instrument tested.
 7. Equipment used for field testing shall be more accurate than instrument being tested.
- F. Coordinate with General Contractor regarding testing schedule and availability of equipment ready for testing.
- G. Notify Owner and Engineer one week in advance of any testing.

- H. Any products which fail during the tests or are ruled unsatisfactory by the Owner's Representative shall be replaced, repaired or corrected as prescribed by the Owner's Representative at the expense of the Contractor. Tests shall be performed after repairs, replacements or corrections until satisfactory performance is demonstrated.
- I. Testing Agency shall maintain written record of tests and shall assemble and certify final test report. All test results/reports shall be submitted to the Electrical Engineer for review.
- J. Include all test results in the maintenance manuals.

3.5 CLEANING

- A. Prior to energizing of electrical equipment, the Contractor shall thoroughly clean the interior of enclosures from construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.
- B. Upon completion of Project, prior to final acceptance, the Contractor shall thoroughly clean both the interior and exterior of all electrical equipment per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt and debris.
- C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

3.6 PROJECT CLOSEOUT

- A. Training: At the time of completion, a period of not less than 4 hours shall be allotted by the Contractor for instruction of building operating and maintenance personnel in the use of all systems. This 2 hours training is in addition to any instruction time called out in the Specifications for specific systems. All personnel shall be instructed at one time, the Contractor making all necessary arrangements with Manufacturer's Representative. The equipment Manufacturer shall be requested to provide product literature and application guides for the users' reference. Costs, if any, for the above services shall be paid by the Contractor.
- B. Special tools: Provide one of each tool required for proper operation and maintenance of the equipment provided under this Section. All tools shall be delivered to the Owner at the Project completion.
- C. Keying: Provide two keys for each lock furnished under this Section and turn over to Owner.

END OF SECTION

- D. All equipment, fixtures, devices, etc., which are removed shall be delivered to the Owner for disposition. All items which are removed and not wanted by the Owner and which are not reused shall become the property of the Contractor and shall be legally removed from the Project site.
- E. Cutting and patching necessary for the removal of Electrical, communication and Fire Life Safety Work shall be included.
- F. Remove and replace lighting fixtures, rework, relocate or replace conduit and wiring and do other Work required by the installation of new ductwork, piping, etc., above the ceiling. Coordinate with other trades and verify the extent of the Work.

3.3 LIGHT FIXTURES

- A. Disconnect and remove abandoned light fixtures. Remove conduits, wiring, boxes, brackets, stems, hangers and other accessories.
- B. All lamps and ballasts shall be recycled/disposed of, in accordance with California DTSC and EPA Guidelines.

3.4 COMMUNICATIONS

- A. Disconnect and remove abandoned equipment racks, patch panels, termination hardware, intercom headend, clock headend, associated devices and panels. Remove conduits, wiring, boxes, brackets, stems, hangers and other accessories.

3.5 FIRE ALARM

- A. Disconnect and remove abandoned fire alarm devices and panels. Remove conduits, wiring, boxes, brackets, stems, hangers and other accessories.

3.6 SECURITY ALARM

- A. Disconnect and remove abandoned security alarm devices and panels. Remove conduits, wiring, boxes, brackets, stems, hangers and other accessories.

3.7 OUTLETS

- A. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

3.8 CONDUIT

- A. Remove abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors and patch surfaces.

3.9 WIRING

- A. Removed abandoned wiring to source of supply

3.10 EXISTING SYSTEMS

- A. Electrical distribution system: Disable system only to make switchovers and connections. Obtain permission from Owner's designated representative at least 72 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to Work area.

- B. Fire alarm system: Maintain the existing system in service. Disable system only to make temporary connections to maintain service in areas adjacent to Work area(s). Notify Owner and Fire Supervisory Service at least 72 hours before partially or completely disabling the system.
- C. Security alarm system: Maintain the existing system in service. Disable system only to make temporary connections to maintain service in areas adjacent to Work area(s). Notify Owner and Fire Supervisory Service at least 72 hours before partially or completely disabling the system.
- D. Telephone system: Maintain the existing system in service throughout construction. Disable system only to make temporary connections where necessary to maintain service in areas adjacent to Work area(s). Notify Owner and Telephone Utility at least 72 work week hours before partially or completely disabling the system.
- E. Intercom and clock system: Maintain the existing system in service if required. Disable system only to make temporary connections to maintain service in areas adjacent to Work area(s). Notify Owner and at least 72 hours before partially or completely disabling the system.

3.11 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment that shall remain.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- C. Luminaries: Remove lenses and lamps and clean all exposed surfaces and lenses.

END OF SECTION

SECTION 26 0519
BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Building wire.
 - 2. Cable.
 - 3. Wiring connections and terminations.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Federal Specifications (FS):
 - FS J-C-30A; Cable and Wire, Electrical (Power, Fixed Installation).
 - FS W-S-610C; Splice Conductor.
 - FS HH-I-595C; Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic.
 - 2. Underwriters Laboratories, Inc. (UL):
 - UL 44; Thermoset-Insulated Wires and Cables.
 - UL 62; Flexible Cord and Fixture Wire.
 - UL 83; Thermoplastic-Insulated Wires and Cables.
 - UL 183; Manufactured Wiring Systems.
 - UL 310; Electrical Quick-Connect Terminals.
 - UL 486A & B; Wire Connectors.
 - UL 486C; Splicing Wire Connectors.
 - UL 486D; Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
 - UL 493; Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables.
 - UL 510; Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
 - UL 854; Service-Entrance Cables.

- UL 1569; Metal-Clad Cables.
- UL 1581; Reference Standard for Electrical Wires, Cables and Flexible Cords.

3. National Electrical Manufacturer Association (NEMA):

- NEMA WC-5; Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

- NEMA WC-7; Cross-Linked Thermosetting Polyethylene Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

4. Institute of Electrical and Electronic Engineers (IEEE):

- IEEE 82; Test Procedure for Impulse Voltage Tests on Insulated Conductors.

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instructions.
4. Final test results.

1.4 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.
- C. Independent Testing Agency qualifications: Refer to Section 260010: Basic Electrical Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Building wire:
 - a. America Insulated Wire Corp.
 - b. Rome Cable.
 - c. Southwire Company

2. Metal-Clad:
 - a. AFC Cable Systems
 - b. Southwire Company
 - c. Encore Wire
 3. Flexible Cords and Cables:
 - a. Carol Cable Company.
 - b. PWC Corp.
 - c. ITT Royal Electric.
 4. Wiring connectors and terminations:
 - a. 3M Company.
 - b. Ideal.
 - c. Blackburn-Holub.
 - d. Burndy.
 - e. Thomas & Betts Corp.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 BUILDING WIRE

A. Conductor material:

1. Provide annealed copper for all wire, conductor and cable, unless otherwise indicated.
2. Wire AWG #10 and larger shall be stranded, unless otherwise indicated.
3. Wire AWG #12 and smaller may be solid, unless otherwise indicated.

B. Insulation material:

1. All insulated wire, conductor and cable shall be 600 volt rated unless otherwise noted on the Drawings.
2. Thermoplastic-insulated building wire: NEMA WC 5.
3. Rubber-insulated building wire: NEMA WC 3.
4. Feeders and branch circuits larger than 6 AWG: Type THW, XHHW or dual rated THHN/THWN.
5. Feeders and branch circuits 6 AWG and smaller: Type TW, THW, XHHW or dual rated THHN/THWN.
6. Service Entrance: Type RHW or THWN.
7. Control Circuits: Type THW or dual rated THHN/THWN.
8. Identify system conductors as to voltage and phase connections by means of color-impregnated insulation.

2.3 METAL-CLAD CABLE (MC)

- A. MC Cable shall be an armored assembly of two or more dual rated THHN/THWN conductors. A full sized green insulated ground wire.
- B. MC Cable sheath shall be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design.
- C. Conductors shall be color-coded for the correct phase and voltage as specified herein.
- D. Fittings: Connectors shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Fittings shall be UL listed for use with MC Cable type specified.

2.4 ARMORED CABLE (AC)

- A. AC cable is not allowed on this project.

2.5 FLEXIBLE CORDS AND CABLES (TYPE'S')

- A. Provide flexible cords and cables of size, type and arrangement as indicated on the Drawings.
- B. Type 'S' flexible cords and cables shall be manufactured in accordance with CEC Article 400 and composed of two or more conductors and a full size green insulated ground wire with an outer jacket of rubber or neoprene as noted.
- C. Flexible cords and cables shall be fitted with wire mesh strain relief grips either as an integral component of the connector or as an independently supported unit.
- D. Suspended flexible cords and cables shall incorporate safety spring(s) unless otherwise noted.

2.6 WIRING CONNECTIONS AND TERMINATIONS

- A. Bolted pressure connectors: Provide wide range-taking connectors with cast bronze compression bolts, designed for parallel taps, tees, crosses or end-to-end connections.
- B. Electrical spring wire connectors:
 - 1. Provide multi-part construction incorporating a non-restricted, zinc coated square cross-section steel spring enclosed in a steel sheet with an outer jacket of plastic and insulating skirt.
 - 2. Self-striping pigtail and tap U-contact connectors shall not be used.
- C. Push-in wire connectors:
 - 1. Multi-port push-in wire connectors are not allowed on this project.
- D. Compression type terminating lugs:
 - 1. Provide tin-plated copper high-compression type lugs for installation with hand or hydraulically operated circumference-crimping tools and dies as stipulated by the lug Manufacturer or as indicated on Drawings. Notch or single point type crimping is NOT acceptable.
 - 2. Two hole, long barrel lugs shall be provided for size (4/0) and larger wire where terminated to bus bars. Use minimum of three crimps per lug, on sizes where possible.
- E. Splicing and insulating tape: Provide black, ultraviolet proof, self-extinguishing, 7 mil thick vinyl general purpose electrical tape with a dielectric strength of 10,000 volts suitable for

- temperatures from minus 18 degrees C to 105 degrees C. Federal Spec. HH-I-595, Scotch 33+ or equal minimum.
- F. Insulating putty:
1. Provide pads or rolls of non-corrosive, self-fusing, one-eighth inch thick rubber putty with PVC backing sheet. Scotch vinyl mastic pads and roll or equal.
 2. Use putty suitable for temperatures from minus 17.8 degrees C to 37.8 degrees C with a dielectric strength of 570-volts/mil minimum.
- G. Insulating resin:
1. Provide two-part liquid epoxy resin with resin and catalyst in pre-measured, sealed mixing pouch. Scotchcast 4 or equal for wet or underground vaults, boxes, etc. splices or terminations.
 2. Use resin with a set up time of approximately 30 minutes at 21.1 degrees C and with thermal and dielectric properties equal to the insulating properties of the cables immersed in the resin.
- H. Terminal strips:
1. Provide box type terminal strips in the required quantity plus 25% spare. Install in continuous rows in terminal cabinets.
 2. Use the box type terminal strips with barrier open backs and with ampere ratings as required.
 3. Identify all terminals with numbering sequence being used for a particular system.
- I. Crimp type connectors:
1. Provide insulated fork or ring crimp terminals with tinned electrolytic copper-brazed barrel with funnel wire entry and insulation support
 2. Fasten crimp type connectors or terminals using a crimping tool recommended by the connector Manufacturer.
 3. Provide insulated overlap splices with tinned seamless electrolytic copper barrel with funnel wire entry and insulation support.
 4. Provide insulated butt splices with tinned seamless electrolytic copper barrel with center stop; funnel wire entry and insulation support.
- J. Cable ties: Provide harnessing and point-to-point wire bundling with nylon cable ties. All cable ties shall be installed using tool supplied by Manufacturer of ties.
- K. Wire lubricating compound:
1. UL listed for the wire insulation and conduit type and shall not harden or become adhesive.
 2. Shall not be used on wire for isolated type electrical power systems.
- L. Bolt termination hardware:
1. Bolts shall be plated, medium carbon steel heat-treated, quenched and tempered equal to ASTM A-325 or SAE grade 5; or silicon bronze alloy ASTM B-9954 Type B.

2. Nuts shall be heavy semi-finished hexagon, conforming to ANSI B18.2.2, threads to be unified coarse series (UNC), class 2B steel or silicon bronze alloy.
3. Flat washers shall be steel or silicon bronze, Type A plain standard wide series, conforming to ANSI B27.2. SAE or narrow series shall not be used.
4. Belleville conical spring washers shall be hardened steel, cadmium plated or silicon bronze.
5. Each bolt connecting lug(s) to a terminal or bus shall not carry current exceeding the following values:
 - a. 1/4" bolt - 125 amps
 - b. 5/16" bolt - 175 amps
 - c. 3/8" bolt - 225 amps
 - d. 1/2" bolt - 300 amps
 - e. 5/8" bolt - 375 amps
 - f. 3/4" bolt - 450 amps

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of wire and cable installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 APPLICATION

- A. All wire, conductor and cable with their respective connectors, fittings and supports shall be UL listed for the installed application and ambient condition.
- B. Feeders and branch circuits in wet locations shall be rated 75 degree C.
- C. Feeders and branch circuits in dry locations shall be rated 90 degree C.
- D. Minimum conductor size:
 1. Provide minimum AWG #12 for all power and lighting branch circuits.
 2. Provide minimum AWG #14 for all line voltage signal and control wiring unless otherwise indicated.
- E. Color coding:
 1. For 120/208 volt, 3 phase, 4 wire systems:
 - a. Phase A - Black
 - b. Phase B - Red
 - c. Phase C - Blue
 - d. Neutral - White
 - e. Ground - Green

2. For 277/480 volt, 3 phase, 4 wire systems:
 - a. Phase A - Brown
 - b. Phase B - Orange
 - c. Phase C - Yellow
 - d. Neutral - Gray
 - e. Ground - Green
3. Switch leg individually installed shall be the same color as the branch circuit to which they are connected, unless otherwise noted.
4. Travelers for 3-way and 4-way switches shall be a distinct color and pulled with the circuit switch leg or neutral.

3.3 WIRING METHODS

- A. Install wires and cables in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
- B. Install all single conductors in raceway system, unless otherwise noted.
- C. Parallel circuit conductors and terminations shall be equal in length and identical in all ways.
- D. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.
- E. Provide #10 AWG pig tails on all 20A and 30A wiring devices served by #8 AWG conductors and larger.
- F. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes or handholes. Group and bundle with tie wrap each neutral with its associated phase conductor where more than one neutral is present in a conduit.
- G. Install cable supports for all vertical feeders in accordance with the CEC Article 300. Provide split wedge type fittings, which firmly clamp each individual cable and tighten due to cable weight.
- H. Neatly form, train and tie the cables in individual circuits. For panelboards, cabinets, wireways, switches and equipment assemblies.
- I. Seal cable or wire, entering a building from underground between the wire or cable and conduit, where it exits the conduit, with a non-hardening approved compound, i.e. duct seal or equal.
- J. Provide UL-listed factory-fabricated, solderless metal connectors of size, ampacity rating, material, type and class for applications and for services indicated. Use connectors with temperature ratings equal to or greater than the wires that are being terminated.
- K. Stranded wire shall be terminated using fitting, lugs or devices listed for the application. However, in no case shall stranded wire be terminated solely by wrapping it around a screw or bolt.

- L. Flexible cords and cables supplied, as part of a pre-manufacturer fixture or unit assembly shall be installed according to Manufacturers published installation instructions.

3.4 WIRING INSTALLATION IN RACEWAYS

- A. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical Work likely to injure conductors has been completed. Pull all conductors into a raceway at the same time. Exercise care in pulling conductors so that insulation is not damaged. Use UL listed, non-petroleum base and insulating type pulling compound as needed.
- B. Completely mandrel all underground or concrete encased conduits prior to installing conductors.
- C. Completely and thoroughly swab raceway system before installing conductors.
- D. Do not use block and tackle, power driven winch or other mechanical means for pulling conductors of size smaller than AWG #1.
- E. Wire pulling:
 - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
 - 2. Use rope made of nonmetallic material for pulling feeders.
 - 3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors.
 - 4. Pull in together multiple conductors or cables in a single conduit.
- F. Install and test all cables in accordance with Manufacturer's instructions and warranty.

3.5 MC CABLE INSTALLATION

- A. Use of MC Cable is restricted as follows:
 - 1. Do not use MC Cable for feeders.
 - 2. Do not use MC Cable for homeruns back to panel.
 - 3. Do not install MC Cable above inaccessible ceiling space.
 - 4. Do not install exposed MC Cable.
- B. Install MC Cable in accordance with Manufacturer's instructions and in strict accordance with CEC Article 330. Follow Manufacturer's explicit instructions when connecting the cable to fittings and boxes. Connectors shall be firmly secured to the cable, but not over-tightened. Connector shall be firmly attached to the metal boxes.
- C. Support cables every 6 feet and within 12 inches of boxes, per CEC Article 330, using separate spring metal clip or metal cable ties (not steel tie wire) for each cable. Cables shall not be bundled together.
- D. Suspended ceiling drop wire may be used to directly support a maximum of two separate MC Cables.
- E. Provide separate drop wire above accessible ceiling, to support more than (2) two MC Cables.

- F. Do not rest cables on ceiling tiles or allow contact with mechanical piping systems.
- G. Bend the cable per CEC Article 330.
- H. Provide separate sleeves and/or fire barriers where cable penetrated firewalls, unless cable is UL listed for the application.

3.6 **WIRE SPLICES, JOINTS AND TERMINATION**

- A. Join and terminate wire, conductors and cables in accordance with UL 486A, C, CEC and Manufacturer's instructions.
- B. Thoroughly clean wires before installing lugs and connectors.
- C. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- D. Splices and terminations shall be made mechanically and electrically secure.
- E. Where it's determined that unsatisfactory splice or terminations have been installed, remove the devices and install approved devices at no addition cost.
- F. Terminate wires in Terminal Cabinets, relay and contactor panels, etc. using terminal strip connectors.
- G. Insulate spare conductors with electrical tape and leave sufficient length to terminate anywhere in the panel or cabinet.
- H. Install cable ties and maintain harnessing.
- I. Encapsulate splices in exterior outlets, pullboxes and junction boxes using specified insulating resin kits. Make all splices watertight for exterior equipment and equipment in pump rooms.
- J. Connections/splices in underground pull boxes shall be watertight.
- K. Make up all splices and taps in accessible junction or outlet boxes with connectors as specified herein. Pigtails and taps shall be the same color as the feed conductor. Form conductor prior to cutting and provide at least six (6) inches of tail and neatly packed in box after splice is made up.
- L. Branch circuits (#10 AWG and smaller):
 - 1. Connectors: Solderless, screw-on, reusable spring pressure cable type, 600 volt, 105-degree C. with integral insulation, approved for copper conductors.
 - 2. The integral insulator shall have a skirt to completely cover the stripped wires.
 - 3. The number, size and combination of conductors as listed on the Manufacturers packaging shall be strictly complied with.
- M. Feeder circuits: (#6 to 750 MCM)
 - 1. Join or tap conductors from #6 AWG to 750 MCM using bolted pressure connectors or insulate mechanical compression (hi-press) taps with pre-molded, snap-on insulating boots or specified conformable insulating pad and over wrapped with two half-lapped layers of vinyl insulating tape starting and ending at the middle of the joint.

2. Terminate conductors from size #6 AWG to 750 MCM copper using bolted pressure or mechanical compression lugs in accordance with Manufacturer recommendation or as specified elsewhere.
 3. Field installed compression connectors for cable sizes 250 MCM and larger shall have not less than two clamping elements or compression indents per wire.
 4. Insulate splices and joints with materials approved for the particular use, location, voltage and temperature. Insulate with not less than that of the conductor level that is being joined.
- N. Termination hardware assemblies:
1. AL/CU lugs connected to aluminum plated or copper buss, shall be secured using a steel bolt, flat washer (two per bolt), Belleville washer and nut.
 2. Copper lugs connected to copper bus, shall be secured using silicon bronze alloy bolt, flat washer (two per bolt), Belleville washer and nut.
 3. The crown of Belleville washers shall be under the nut.
 4. Bolt assemblies shall be torque to Manufacturer recommendation. Where manufacture recommendation are not obtainable, the following values shall be used:
 - a. 1/4" - 20 bolt at 80-inch pounds torque.
 - b. 5/16" - 18 bolt at 180-inch pounds torque.
 - c. 3/8" - 16 bolt at 20-foot pounds torque.
 - d. 1/2" - 13 bolt at 40-foot pounds torque.
 - e. 5/8" - 11 bolt at 55-foot pounds torque.
 - f. 3/4" - 10 bolt at 158-foot pounds torque.

3.7 IDENTIFICATION

- A. Refer to Section 260553: Electrical Identification for additional requirements.
- B. Securely tag all branch circuits. Mark conductors with specified vinyl wrap-around markers. Where more than two conductors run through a single outlet, mark each conductor with the corresponding circuit number.
- C. Color code conductors size #8 and larger using specified phase color markers and identification tags.
- D. Provide all terminal strips with each individual terminal identified using specified vinyl markers.
- E. In manholes, pullboxes and handholes, provide tags of the embossed brass type and also show the cable type and voltage rating. Attach the tags to the cables with slip-free plastic cable lacing units.

3.8 FIELD QUALITY CONTROL

- A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing required herein. Independent

Testing Agency shall meet the requirements as outlined in Section 260010: Basic Electrical Requirements.

- B. Prefunctional testing:
1. Visual and mechanical inspection:
 - a. Compare cable data with Contract Documents.
 - b. Inspect exposed sections of wires and cables for physical damage and proper connections.
 - c. Verify tightness of accessible bolted connections with calibrated torque wrench in accordance with Manufacturer's published data.
 - d. Inspect compression applied connectors for correct cable match and indentation.
 - e. Verify visible cable bend meet or exceed ICEA and Manufacturer's minimum allowable bending radius.
 - f. If cables are terminated through window type current transformers, make an inspection to verify neutral and ground conductors are correctly placed for operation of protective devices.
 - g. Ensure wire and cable identification has been installed as specified herein.
 2. Electrical testing:
 - a. Contractor shall perform feeder and branch circuit insulation test after installation and prior to connection to utilization devices such as fixtures, motors or appliances. Testing shall be as follows:
 - 1) 100% of all feeders 100 amp rated and above.
 - 2) 50% of all feeders smaller than 100 amps
 - 3) 10% of all branch circuits at each individual panelboard
 - b. Perform insulation-resistance test using megohm meter with applied potential of 1000V DC for a continuous duration of 60 seconds. Test conductors phase-to-phase and phase-to-ground. Conductors shall test free from short-circuit and ground faults.
 - c. Perform continuity test of all feeder and branch circuits to ensure correct cable connections. Test all neutrals for improper grounds.
 - d. Contractor shall furnish instruments, materials and labor for these tests.
 3. Test values: Investigate resistance values less than 50 megohms.
 4. Furnish test results in typewritten report form for review and inclusion in the operation and maintenance manuals.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Power system grounding.
 - 2. Site lighting grounding.
 - 3. Electrical equipment and raceway grounding and bonding.
 - 4. Safety ground grid and/or mat.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. Division 05: Building Steel.
 - 2. Division 22: Cold Water Piping.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Underwriters Laboratories, Inc. (UL):
 - UL 467; Grounding and Bonding Equipment.
 - 2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - IEEE No. 142; Recommended Practice for Grounding of industrial and Commercial Power Systems.
 - IEEE No. 81 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

1.3 SYSTEM DESCRIPTION

- A. Ground the electrical service system neutral at service entrance equipment as described herein and indicated on Drawings.
- B. Ground each separately derived system neutral as described herein and indicated on Drawings.
- C. Except as otherwise indicated, the complete electrical installation including the neutral conductor, metallic conduits and raceways, boxes, cabinets and equipment shall be completely and effectively grounded in accordance with all code requirements, whether or not such connections are specifically indicated or specified.
- D. Resistance:

1. Resistance from the main switchboard ground bus through the ground electrode to earth shall not exceed 5 OHMS unless otherwise noted.
2. Resistance from the farthest panelboard, switchboard, etc. ground bus through the ground electrode to earth shall not exceed 20 OHMS

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 3. Submit Manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 1. Ground Rods:
 - a. Erico / Eritect
 - b. Weaver.
 2. Ground Wells:
 - a. Christy/ Oldcastle Precast
 - b. Jensen Precast
 - c. Forni Corp.
 3. Ground Bushings, Connectors, Jumpers and Bus:
 - a. O-Z/Gedney.
 - b. Erico
 - c. Thomas & Betts Corp.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 GROUND CONDUCTORS

- A. Refer to Specification Section 260519: Building Wire and Cable for conductor specifications.
 - B. General purpose insulated:
 - 1. UL approved and code sized copper conductor, with dual rated THHN/THWN insulation, color identified green.
 - 2. Where continuous color-coded conductors are not commercially available, provide a minimum 4" long color band with green, non-aging, plastic tape in accordance with CEC.
 - C. Bare conductors in direct contact with earth or encased in concrete: #2/0 AWG copper minimum, U.O.N.
 - D. Bonding pigtails: Insulated copper conductor; identified green, sized per code and provide with termination screw or lug. Provide solid conductors for #10 AWG or smaller and stranded conductors for #8 AWG or larger.
- 2.3 DRIVEN (GROUND) RODS
- A. Copper clad steel, minimum 3/4-inch diameter by 8 feet long, unless otherwise noted.
- 2.4 GROUND WELL BOXES FOR GROUND RODS
- A. Precast concrete box nominal 9" throat diameter x 14" deep with light duty concrete cover for non-traffic areas or steel plate for traffic areas. Cover shall be embossed or engraved with "GROUND ROD".
- 2.5 INSULATED GROUNDING BUSHINGS
- A. Plated malleable iron or steel body with 150 degree Centigrade molded plastic insulating throat and lay-in grounding lug.
- 2.6 CONNECTIONS TO PIPE
- A. For cable to pipe: UL and CEC approved bolted connection.
- 2.7 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS OR SPLICES
- A. Where required by the Drawings, grounding conductors shall be spliced together, connected to ground rods or connected to structural steel using exothermic welds or high pressure compression type connectors.
 - 1. Exothermic welds shall be used for cable-to-cable and cable-to-ground rod and for cable to structural steel surfaces. Each particular type of weld shall use a kit unique to that type of weld.
 - 2. High-pressure compression type connectors shall be used for cable-to-cable and cable-to-ground rod connections.
- 2.8 EXTRA FLEXIBLE, FLAT BONDING JUMPERS
- A. Where required by Code, indicated on the Drawing, and specified herein.
- 2.9 BUILDING GROUND BUS REQUIREMENTS
- A. Main building power system ground bus:

1. Provide one 24" wide x 4" high x 1/4" thick copper bus bar as a minimum. Mount on wall in main electrical room utilizing insulating stand-offs at 18" above finished floor.
 2. Furnish complete with cast copper alloy body lugs for connecting grounding system conductors. Attach lugs to bus with appropriate size cadmium bronze bolt, flat washer and Belleville washer. Torque all lug connections.
 3. All holes shall be drilled and tapped for single-hole lugs. Provide 6 spare lugs and lug spaces.
- B. Building power system reference ground bus:
1. The reference ground bus is furnished as part of the main electrical switchboard for the building, along with neutral disconnect and bus, and is in addition to the main building power system ground bus outlined above. The building grounding electrode shall make a direct connection to the building referenced ground bus in the main switchboard.
 2. Provide copper ground conductor connection between the building reference ground bus in switchboard and the main building ground bus wall mounted in main electrical room.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of grounding system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

- A. Grounding electrodes:
1. Metal underground water pipe: Cold water metal piping system: Where the underground cold water service line is metal, indirect contact with the earth for 10 feet or more, the Contractor shall install a grounding electrode conductor from the main incoming cold water line ahead of the meter and extend to the main building reference ground bus in the main electrical room. The electrode shall be sized per CEC Article 250. Electrode connection should be accessible.
 2. Concrete encased grounding electrode (UFER ground): Provide bare copper conductor encased along the bottom of concrete foundation or footings which are in direct contact with the earth and where there is no impervious water-proofing membrane between the footing and the soil. The electrode shall extend through a horizontal length of 30 feet minimum and shall be encased in not less than 2 or more than 5 inches of concrete separating it from surrounding soils. The electrode shall emerge from the concrete slab through a protective non-metallic sleeve and shall be extended to the main building reference ground bus.
 3. Provide additional "supplemental grounding" electrodes, per the CEC.
- B. Grounding electrode conductor: Provide grounding electrode conductor as indicated on the Drawings or sized per CEC Article 250, whichever is greater.
- C. Power system grounding:

1. Provide, unless otherwise indicated, a main building power system ground bus mounted on the wall in the main electrical room. Connect the following items using CEC sized copper grounding conductors to lugs on the main building ground bus:
 - a. Grounding conductor from building reference ground bus in main service switchboard.
 - b. Bonding conductor to metallic cold water piping system.
 - c. Bonding conductor to building structural steel.
 - d. Separately derived system grounding conductors in same room.
 2. At the building power system reference ground bus in the main service switchboard, connect the grounding electrode conductor from concrete encased UFER ground or other grounding electrode systems as indicated on the Drawing or herein.
- D. Separately derived electrical system grounding:
1. Ground each separately derived system per requirements in CEC Article 250 as a minimum, unless greater requirements are required elsewhere in the Contract Documents.
- E. Equipment bonding/grounding:
1. Provide a CEC sized insulated copper ground conductor in all 120VAC through 600 VAC feeder and branch circuit distribution conduits and cables.
 2. Provide a separate grounding bus at panelboards, switchboards, and motor control centers. Connect all metallic enclosed equipment so that with maximum fault current flowing, shall be maintained at not more than 35 volts above ground.
 3. Conduit terminating in concentric, eccentric or oversized knockouts at panelboards, cabinets, gutters, etc. shall have grounding bushings and bonding jumpers installed interconnecting all such conduits.
 4. Provide bonding jumpers across expansion and deflection couplings in conduit runs, pipe connections to water meters, dielectric couplings in metallic cold water piping system.
 5. Provide internal ground wire in flexible conduit connected at each end via grounding bushing.
 6. Provide external ground wire wrapped around flexible conduit and terminate to connectors designed for the purpose.
- F. Site lighting grounding: Bond all metallic light poles and bollards.
- 3.3 FIELD QUALITY CONTROL
- A. Independent Testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing required herein.
- B. Pre-functional testing:
1. Provide Testing Agency with Contract Documents for their review prior to the commencement of ground testing.
 2. Visual and mechanical inspection:

- a. The Testing Agency shall inspect the grounding electrode and connections prior to concrete encasement, burial or concealment.
 - b. Check tightness and welds of all ground conductor terminations.
 - c. Verify installation complies with the intent of the Contract Documents
3. Obtain and record ground resistance measurements both from electrical equipment ground bus to the ground electrode and from the ground electrode to earth. Furnish and install additional bonding and add grounding electrodes as required complying with resistance limits specified under this Section of the Specification.
 4. A typewritten record of measured resistance values shall be submitted for review and included with the operation and maintenance manual furnished to the Owner at the time of Project closeout and before certificate of final payment is issued.

END OF SECTION

SECTION 26 05 29

ELECTRICAL HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Conduit supports.
 - 2. Equipment supports.
 - 3. Fastening hardware.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. Division 03: Cast-in-place concrete. Concrete equipment pads.
 - 2. Division 05: Miscellaneous metals. Hangers for electrical equipment.
 - 3. Division 09: Ceiling suspension systems. Slack fixture support wires.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Underwriters Laboratories, Inc. (UL):
 - UL 2239; Hardware for the Supports of Conduit, Tubing and Cable.

1.3 SYSTEM DESCRIPTION

- A. Provide devices specified in this Section and related Sections for support of electrical equipment furnished and installed under Division 26.
- B. Provide support systems that are adequate for the weight of equipment, conduit and wiring to be supported.

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein.
 - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 3. Submit Manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.
- C. All exterior exposed hangers, supports, and hardware shall be galvanized or cadmium plated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Concrete fasteners:
 - a. Refer to Sheet S0.02 in the DSA approved Construction Documents for list of acceptable concrete and masonry anchors.
 - 2. Concrete inserts and construction channel:
 - a. Unistrut Corp.
 - b. GS Metals "Globe Strut."
 - c. Thomas & Betts "Kindorf" Corp.
 - 3. Conduit straps:
 - a. O-Z/Gedney.
 - b. Erico "Caddy" Fastening Products.
 - c. Thomas & Betts "Kindorf" Corp.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 CONCRETE FASTENERS

- A. Provide expansion-shield type concrete anchors.

2.3 CONCRETE INSERTS

- A. Provide pressed galvanized steel, concrete spot insert, with oval slot capable of accepting square or rectangular support nuts of ¼ inch to ½ inch diameter thread for rod support.

2.4 THREADED ROD

- A. Provide steel threaded rod, sized for the load unless otherwise noted on the Drawings or in the Specifications.

2.5 CONSTRUCTION CHANNEL

- A. Provide 1-5/8 inch by 1-5/8 inch (nominal), 12 gauge galvanized steel channel with 17/32-inch diameter bolt holes and 1-1/2 inch on center in the base of the channel.

2.6 CONDUIT STRAPS

- A. One hole strap, steel or malleable iron, with malleable iron clamp-back spacer for surface mounted wall and ceiling applications.

1. Use malleable strap with spacers for exterior and wet locations.
 2. Use steel strap without spacers for interior locations.
- B. Steel channel conduit strap for support from construction channel.
- C. Steel conduit hanger for pendant support with threaded rod
- D. Steel wire conduit support strap for support from independent #12 gauge hanger wires.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of supporting device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

- A. Coordinate size, shape and location of concrete pads with Division 03, Cast-in-place concrete.
- B. Layout support devices to maintain headroom, neat mechanical appearance and to support the equipment loads.
- C. Where indicated on the Contract Documents, install freestanding electrical equipment on concrete pads.

3.3 INSTALLATION

- A. Furnish and install supporting devices as noted throughout Division 26.
- B. Electrical device and conduit supports shall be independent of all other system supports that are not structural elements of the building, unless otherwise noted.
- C. Fasten hanger rods, conduit clamps, outlet and junction boxes to building structure using precast inserts, expansion anchors, preset inserts, beam clamps, lag bolts or wood screws.
- D. Use expansion anchors or preset inserts in solid masonry walls.
- E. Use self-drilling anchors, expansion anchor or preset inserts on concrete surfaces.
- F. Use sheet metal screws in sheet metal studs and wood screws in wood construction.
- G. Do not fasten supports to piping, ductwork, mechanical equipment, conduit or acoustical ceiling suspension wires.
- H. Do not drill structural steel members unless first approved in writing by the Architect or Structural Engineer.
- I. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- J. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide additional support backing in stud walls prior to sheet rocking as required to adequately support cabinets and panels.
- K. Bridge studs top and bottom with channels to support flush mounted cabinets and panelboards in stud walls.

L. All exterior exposed hangers, supports, and hardware shall be galvanized or cadmium plated.

3.4 ERECTION OF METAL SUPPORTS

A. Cut, fit and place miscellaneous metal fabrications accurately in location, alignment and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code."

3.5 WOOD SUPPORTS

A. Wood supports are not allowed on this project.

3.6 ANCHORAGE

A. All floor mounted, free standing electrical equipment such as transformers, switchboards, distribution boards, and motor control centers, and etc. shall be securely fastened to the floor structure.

B. Anchorage of electrical equipment shall comply with the seismic requirements as outlined in Section 260010: Basic Electrical Requirements.

END OF SECTION

SECTION 26 05 31

CONDUIT

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Rigid steel conduit and fittings.
 - 2. PVC insulated rigid steel conduit and fittings.
 - 3. Electrical metallic tubing and fittings.
 - 4. Flexible metallic conduit and fittings.
 - 5. Liquidtight flexible metallic conduit and fittings.
 - 6. Miscellaneous conduit fittings and products.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. Division 01: Cutting and patching.
 - 2. Division 07: Sheet metal flashing and trim.
 - 3. Division 09: Painting. Exposed conduit and other devices.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Federal Specifications (FS):
 - FS WW-C-563; Electrical Metallic Tubing.
 - FS WW-C-566; Specification for Flexible Metal Conduit.
 - FS WW-C-581; Specification for Galvanized Rigid Conduit.
 - FS W-C-1094A; Conduit and Conduit Fittings Plastic, Rigid.
 - 2. American National Standards Institute, Inc. (ANSI):
 - ANSI C80.1; Rigid Steel Conduit, Zinc-Coated.
 - ANSI C80.3; Electrical Metallic Tubing, Zinc Coated.
 - 3. Underwriters Laboratories, Inc. (UL):
 - UL 1; Flexible Metal Conduit.
 - UL 6; Rigid Metal Conduit.
 - UL 360; Liquid-Tight Flexible Steel Conduit.

- UL 514B; Conduit, Tubing and Cable Fittings.
- UL 635; Insulating Bushings.
- UL 797; Electrical Metallic Tubing - Steel.
- UL 1242; Intermediate Metal Conduit - Steel.

- 4. National Electrical Manufacturer Association (NEMA):
 - NEMA RN1; PVC Externally coated Galvanized Rigid Steel Conduit.

1.3 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 3. Submit Manufacturer's installation instruction. Provide written instructions for raceway products requiring glues, special tools or specific installation techniques.

1.4 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted and approved.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Metal conduit:
 - a. Allied Tube and Conduit Co.
 - b. Triangle PWC, Inc.
 - c. Western Tube and Conduit Corp.
 - d. Spring City Electrical Manufacturing Co.
 - e. Occidental Coating Co. (OCAL).
 - f. Alflec Corp.
 - g. American Flexible Metal Conduit Co.
 - h. Anaconda.
 - 2. Fittings:
 - a. Appleton Electric Co.

- b. OZ/Gedney.
 - c. Thomas & Betts Corp.
 - d. Spring City Electrical Manufacturing Co.
 - e. Occidental Coating Co. (OCAL).
- 3. Penetration seals:
 - a. GPT/EnPro (Link Seal)
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.
- 2.2 GALVANIZED RIGID STEEL CONDUIT (GRS)
 - A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and UL 6.
 - B. Standard threaded couplings, locknuts, bushings and elbows: Only materials of steel or malleable iron are acceptable. Locknuts shall be bonding type with sharp edges for digging into the metal wall of an enclosure.
 - C. Three piece couplings: Electroplated, cast malleable iron.
 - D. Insulating bushings: Threaded polypropylene or thermosetting phenolic rated 150 degree C minimum.
 - E. Insulated grounding bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw.
 - F. Insulated metallic bushings: Threaded cast malleable iron body with plastic insulated throat rated 150 degrees C.
 - G. All fittings and connectors shall be threaded.
- 2.3 PVC INSULATED GALVANIZED RIGID STEEL CONDUIT (PVC GRS)
 - A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with nominal 20 or 40 mil thermoplastic vinyl coating, heat fused and bonded to the exterior of the conduit.
 - B. Fittings: Conduit couplings and connectors shall be as specified for galvanized rigid steel conduit and shall be factory PVC coated with an insulating jacket equivalent to that of the coated material.
- 2.4 ELECTRICAL METALLIC TUBING (EMT)
 - A. Conduit: Shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam and hot dip galvanized after fabrication. Conduit shall conform to ANSI C80.3 Specifications and shall meet UL requirements.
 - B. Set screw type couplings: Electroplated, steel or cast malleable iron, UL listed concrete tight. Use set screw type couplings with four setscrews each of conduit sizes over 2 inches. Setscrews shall be of case hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.

- C. Set screw type connectors: Electroplated steel or cast malleable iron UL listed concrete tight with male hub and insulated plastic throat, 150 degree C temperature rated. Setscrew shall be same as for couplings.
- D. Raintight couplings: Electroplate steel or cast malleable iron; UL listed raintight and concrete tight, using gland and ring compression type construction.
- E. Raintight connectors: Electroplated steel or cast malleable iron, UL listed raintight and concrete tight, with insulated throat, using gland and ring compression type construction.

2.5 FLEXIBLE METALLIC CONDUIT (FMC)

- A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design and conforming to UL 1. Aluminum flexible metallic conduit is not allowed on this project.
- B. Fittings: Connectors shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Exception: Pressure cast screw-in connectors shall be acceptable for fixture connection in suspended ceilings and cut-in outlet boxes within existing furred walls.

2.6 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC)

- A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strips, interlocking spirally wound, covered with extruded liquidtight jacket of polyvinyl chloride (PVC) and conforming to UL 360. Provide conduit with a continuous copper-bonding conductor wound spirally between the convolutions.
- B. Fittings: Connector body and gland nut shall be of cadmium plated steel or cast malleable iron, with tapered, male, threaded hub; insulated throat and neoprene "O" ring gasket recessed into the face of the stop nut. The clamping gland shall be of molded nylon with an integral brass push-in ferrule.

2.7 MISCELLANEOUS CONDUIT FITTINGS AND PRODUCTS

- A. Watertight conduit entrance seals: Steel or cast malleable iron bodies and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Fittings shall be supplied with neoprene sealing rings between the body and PVC sleeve.
- B. Watertight cable sealing bushings: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel sealing screws and zinc plated cast malleable iron locking collar.
- C. Expansion fittings: Multi-piece unit comprised of a hot dip galvanized malleable iron or steel body and outside pressure bussing designed to allow a maximum of 4" conduit movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. Unit shall be UL listed for wet or dry locations.
- D. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve with internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling shall accommodate .75-inch deflection, expansion or contraction in any direction and allow 30-degree angular deflections. Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber jacket and stainless steel jacket clamps. Unit shall comply with UL467 and UL514.

- E. Fire rated penetration seals:
 - 1. UL building materials directory classified.
 - 2. Conduit penetrations in fire rated separation shall be sealed with a UL classified fill, void or cavity material.
 - 3. The fire rated sealant material shall be the product best suited for each type of penetration and may be a caulk, putty, composite sheet or wrap/strip.
- F. Standard products not herein specified:
 - 1. Provide listing of standard electrical conduit hardware and fittings not herein specified for approval prior to use or installation, i.e. locknuts, bushings, etc.
 - 2. Listing shall include Manufacturers name, part numbers and a written description of the item indicating type of material and construction.
 - 3. Miscellaneous components shall be equal in quality, material and construction to similar items herein specified.
- G. Under-slab Conduits and Fitting: Provide in accordance with Section 260543 Underground Ducts and Structures.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of conduit system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 APPLICATION

- A. Galvanized rigid steel conduit (GRS) shall be used in the following applications:
 - 1. For feeders and branch circuits located indoors, concealed or exposed above suspended ceilings, in damp/wet locations, in crawl spaces, in attics, chases, furred spaces, equipment rooms, loading docks or in hazardous locations in accordance with CEC.
 - 2. For feeders and branch circuits concealed in concrete floors and walls when not in contact with earth.
- B. PVC insulated galvanized rigid steel conduit shall be used in the following applications:
 - 1. Use 40-mil coating for feeders and branch circuits in damp or wet locations.
 - 2. Use 20 or 40 mil for feeders and branch circuits concealed in concrete walls or slabs in contact with earth.
 - 3. Use 40-mil for all below grade penetrations through floor slabs on grade or exterior walls.
- C. Intermediate metal conduit (IMC): Shall be used for the same application as galvanized rigid steel conduit as specified herein, except for hazardous locations prohibited by CEC.
- D. Electrical metallic tubing (EMT): Shall be used exposed or concealed for interior electrical feeders 4" and smaller, interior power and lighting branch circuits and low tension

distribution system where run above suspended ceilings, in concrete slabs and walls not in contact with earth; in stud walls, furred spaces and crawl spaces.

- E. Flexible metallic conduit (FMC): Shall be used only in dry locations for connections from an adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices and to lighting fixtures installed in suspended ceilings, minimum sizes shall be 3/8" for lighting fixtures and control wiring and 1/2" for motor and transformer connections. U.O.N.
- F. Liquidtight flexible metallic conduit (LFMC): Shall be used in wet or damp locations for connections from adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices. These areas are typically food preparation and dishwashing areas, sump wells, loading docks, pump rooms, exterior areas, etc. Minimum sizes shall be 1/2".
- G. Under-slab Conduits and Fitting: Provide in accordance with Section 260543 Underground Ducts and Structures.

3.3 PREPARATION

- A. Locations of conduit runs shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.
- B. Where practical, install conduits in groups in parallel vertical or horizontal runs and at elevations that avoid unnecessary offsets.
- C. All conduits shall be run parallel or at right angles to the centerlines of columns and beams, whether routed exposed, concealed above suspended ceiling or in concrete slabs.
- D. Conduits shall not be placed closer than 12 inches to a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.
- E. Exposed conduit installation shall not encroach into the ceiling height headroom of walkways or doorways. Where possible, install horizontal raceway runs above water and below steam piping.
- F. In long runs of conduit, provide sufficient pull boxes inside buildings to facilitate pulling wires and cables, with spacing not to exceed 150 feet. Support pull boxes from structure independent of conduit supports. These pull boxes are not indicated on the Drawings.
- G. Provide all reasonably inferred standard conduits fitting and products required to complete conduit installation to meet the intended application whether noted, indicated or specified in the Contract Documents or not.
- H. Connect recessed lighting fixtures to conduit runs with maximum six feet of flexible metal conduit or MC cable extending from a junction box to the fixture or manufactured wiring system.

3.4 INSTALLATION

- A. Install conduit in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

- N. Make bends with standard conduit bending hand tool or machines. The use of any item not specifically designed for the bending of electrical conduit is strictly prohibited.
- O. A run of conduit between terminations at wire pulling points shall not contain more than the equivalent of four quarter bends (360 degrees, total).
- P. Conduits shall not be installed on top of the roof or within the roofing material section.

3.5 PENETRATIONS

- A. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, wall, etc. Penetrations are acceptable only when the following occurs:
 - 1. Where indicated on the Structural Drawings.
 - 2. As approved by the Structural Engineer prior to construction and after submittal of Drawing showing location, size and position of each penetration.
- B. Cutting or holes:
 - 1. Cut holes through concrete, masonry block or brick floors and floors of structure with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Structural Engineer as required by limited working space. Obtain the approval of the Structural Engineer prior to drilling through structural sections.
 - 2. Provide sleeves or "can outs" for cast-in-place concrete floors and walls. Following conduit installation, seal all penetrations using non-iron bearing, chloride free, non-shrinking, dry-pack grouting compounds; or fire rated penetration-sealing materials.
 - 3. Cut holes for conduit penetrations through non-concrete and non-masonry walls, partitions or floors with a hole saw. The hole shall be only as large as required to accommodate the size of the conduit.
 - 4. Provide single piece escutcheon plates around all exposed conduit penetrations in public places.
- C. Sealing:
 - 1. Penetrations shall be constructed in accordance with Section 078400 Fire Stopping and 078413 Penetration Fire Stopping.
 - 2. Non-rated penetrations: Pack opening around conduits with non-flammable insulating material and seal with gypsum wallboard taping compound.
 - 3. Fire stop: Where conduits, wireways and other electrical raceways pass through fire rated partitions, walls, smoke partitions or floor; install a UL classified fire stop material to provide an effective barrier against the spread of fire, smoke and gases. Completely fill and seal clearances between raceways and openings with the fire stop material.
- D. Waterproofing: At floor, exterior wall and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Division 07: Sealants and Caulking.
 - 1. Install specified watertight conduit entrance seals (Link Seal by GPT/EnPro or approved equal) at all below grade wall and floor penetrations.
 - 2. Conduits penetrating exterior building walls and building floor slab shall be PVC coated rigid galvanized steel.
 - 3. For roof penetrations furnish and install roof flashing, counter flashing and pitch-pockets as specified under Roofing and Sheet Metal Sections of the Specifications.
 - 4. Provide membrane clamps and cable sealing fittings for any conduit that horizontally penetrates the waterproof membrane.

5. Conduits that horizontally penetrate a waterproof membrane shall fall away from and below the penetration on the exterior side a minimum of two times the conduit diameters.

3.6 CONCEALED IN CONCRETE

- A. Installation of conduit in concrete slabs is not allowed on this project..
- B. Installation of conduit in structural concrete must be approved by the Structural Engineer.
- C. Where nonmetallic conduit or tubing is used, raceways must be converted to PVC coated rigid steel conduit before rising above floor except that:
 1. Conduit for utility company services shall be in accordance with the utility company's requirements.
 2. Conduit terminating in free standing equipment may be nonmetallic provided that the pull distances / calculated pull tension is such that the conduit will not be damaged when conductors are pulled into the conduit.
- D. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

3.7 MAKE COUPLINGS AND CONNECTIONS WATERTIGHT. TERMINATIONS AND JOINTS

- A. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings except as otherwise indicated.
- B. Raceways shall be joined using specified couplings or transition couplings where dissimilar raceway systems are joined.
- C. Conduits shall be securely fastened to cabinets, boxes and gutters using two locknuts and an insulating bushing or specified insulated connectors. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors. Install grounding bushings or bonding jumpers on all conduits terminating at concentric or eccentric knockouts.
- D. Conduit terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using specified connectors and hubs.
- E. Install specified cable sealing bushings on all conduits originating outside the building walls and terminating in switchgear, cabinets or gutters inside the building. Install cable sealing bushings or raceway seal for conduit terminations in all grade level or below grade exterior pull, junction or outlet boxes.
- F. Raceway seal: Inject into wire filled raceways, pre-formulated rigid 2 lbs. density polyurethane foam which expands a minimum 35 times its original bulk. Foam shall have the physical properties of water vapor transmission of 1.2 to 3.0 perms; water absorption less than 2% by volume, fungus and bacterial resistant. Foam shall permanent seal against water, moisture, insects and rodents. Install raceway sealing foam at the following points:
 1. Where conduits pass from warm locations to cold locations to prevent passage of water vapor (such as refrigerated spaces, constant temperature rooms, air-conditioned spaces, etc.).
 2. Where conduits enter buildings from below grade.

- G. Install expansion couplings where any conduit crosses a building separation or expansion joint as follows:
 - 1. Conduits three inches and larger, shall be rigidly secured to the building structure on opposite sides of a building expansion joint and provided with expansion or deflection couplings. Install the couplings in accordance with the Manufacturer's recommendations.
 - 2. Conduits smaller than three inches shall be rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 15 inches of slack flexible conduit. Flexible conduit shall have a copper green ground-bonding jumper installed. For concrete embedded conduit, use expansion and deflection couplings as specified above for three inches and larger conduits.
- H. Use short length (maximum of 6ft) of the appropriate FMC or LFMC conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters or noise transmission. Provide liquidtight flexible metal conduit for installation in exterior locations, moisture or humidity-laden atmosphere, corrosive atmosphere, water hose or spray wash-down operations and locations subject to seepage or dripping of oil, grease or water. Provide a green ground wire with FMC or LFMC conduit.

3.8 SUPPORTS

- A. Provide supports for raceways as specified in Section 260529: Electrical Hangers and Supports.
- B. All raceways systems shall be secured to building structures using specified fasteners, clamps and hangers spaced according to the NEC.
- C. Support single runs of conduit using one-hole pipe straps. Where run horizontally on walls in damp or wet locations, install "clamp backs" to space conduit off the surface.
- D. Multiple conduit runs shall be supported using "trapeze" hangers fabricated from specified construction channel, mounted to 3/8-inch diameter, and threaded steel rods secured to building structures. Fasten conduit to construction channel with standard one-hole pipe clamps or the equivalent. Provide lateral seismic bracing for hangers.
- E. Individual 1/2" and 3/4" conduits installed above suspended ceilings may be attached to the ceiling's hanger wire using spring steel support clips provided that not more than two conduits are attached to any single support wire.
- F. Support exposed vertical conduit runs at each floor level, independent of cabinets or switches to which they run, by means of acceptable supports.
- G. Fasteners and supports in solid masonry and concrete:
 - 1. Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
 - 2. After concrete installation:
 - a. Steel expansion anchors not less than 1/4 inch bolt size and not less than 1-1/8 inch embedment.
 - b. Power set fasteners not less than 1/4 inch diameter with depth of penetration not less than three inches.
 - c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- H. Hollow masonry: Toggle bolts are permitted. Bolts supported only by masonry block are not acceptable.

- I. Metal structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

END OF SECTION

SECTION 26 05 33

BOXES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Wall and ceiling outlet boxes.
 - 2. Pull and junction boxes.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. Division 08: Access doors. Wall and ceiling access doors.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
 - 1. American National Standards Institute/National Electrical Manufacturer Association:
 - ANSI/NEMA OS-1; Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
 - ANSI/NEMA OS-2; Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
 - NEMA 250; Enclosures for Electrical Equipment (1000 volts maximum).
 - 2. Underwriters Laboratories (UL):
 - UL 50; Enclosures for Electrical Equipment.
 - UL 514A; Metallic Outlet Boxes.
 - UL 1773; Termination Boxes.

1.3 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 3. Submit Manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Outlet and junction boxes:
 - a. Spring City Electrical Manufacturing Co.
 - b. Thomas & Betts Corp.
 - c. Raco, Inc.
 - 2. Cast boxes:
 - a. Appleton Electric Co.
 - b. Crouse-Hinds.
 - 3. Pullboxes:
 - a. Circle AW Products.
 - b. Hoffman Engineering Co.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 OUTLET BOXES

- A. Standard outlet box:
 - 1. Provide galvanized, one-piece die formed or drawn steel, knockout type box of size and configuration best suited to the application indicated on the Drawings.
 - 2. 4-inch square by 2-1/8 inch deep shall be minimum box size.
 - 3. ANSI/NEMA OS 1.
- B. Concrete box:
 - 1. Provide galvanized steel, 4-inch octagon rings with mounting lugs, backplate and adapter ring as required.
 - 2. Select height as necessary to position knockouts above concrete reinforcing steel.
 - 3. ANSI/NEMA OS 1.
- C. Tile box:
 - 1. Provide outlet boxes for installation in tile or concrete block walls.
 - 2. Standard outlet boxes with raised, square corners and device covers are acceptable.
 - 3. ANSI/NEMA OS 1.

- D. Cast metal outlet body:
 - 1. Provide four inch round, galvanized cast iron alloy with threaded hubs and mounting lugs as required.
 - 2. Provide boxes with cast cover plates of the same material as the box and neoprene cover gaskets.
- E. Conduit outlet body: Provide Cadmium plated cast iron alloy, oblong conduit outlet bodies with threaded conduit hubs and neoprene gasket, cast iron covers.

2.3 PULL AND JUNCTION BOXES

- A. Sheet metal pull and junction box:
 - 1. Provide standard outlet or concrete ring boxes wherever possible; otherwise use minimum 16 gauge galvanized sheet metal, NEMA 1 boxes, sized to Code requirements with covers secured by cadmium plated machine screws located 6 inches on centers.
 - 2. ANSI/NEMA OS 1.
- B. Cast metal pull and junction box: Provide standard cast malleable iron outlet or device boxes wherever possible; otherwise use cadmium plated, cast malleable iron boxes with bolt-on, interchangeable conduit hub plates with neoprene gaskets.
- C. Flush mounted pullboxes and junction boxes: Provide overlapping covers with flush head cover retaining screws, prime coated.

2.4 FLOOR BOXES

- A. Refer to Section 262726: Wiring Devices for floor mounted service boxes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of box installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

- A. Install all outlet boxes flush with building walls, ceilings and floors except where boxes are installed in mechanical and electrical rooms, in cabinetry, above accessible ceilings or where exposed Work is called for on the Drawings.
- B. Locate pullboxes and junction boxes in concealed locations above removable ceilings or exposed in electrical rooms, utility rooms or storage areas.
- C. Install outlet boxes at the locations and elevations indicated on the Drawings or specified herein. Make adjustments to locations as required by structural conditions and to suit coordination requirements of other trades.
- D. Locate switch outlet boxes on the latch side of doorways unless otherwise indicated.
- E. Locate outlet boxes above hung ceilings having concealed suspension systems, adjacent to openings for removable recessed lighting fixtures.

- F. Do not install outlet boxes back-to-back, separate boxes by at least 6". In fire rated walls separate boxes by at least 24" and wall stud.
- G. Adjust position of outlet boxes in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for boxes.

3.3 INSTALLATION

- A. Install boxes in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
- B. Locate electrical boxes as indicated on Drawings and as required for splices, taps, wire pulling, equipment connections and Code compliance.
- C. Install junction or pullboxes where required to limit bends in conduit runs to not more than 360 degrees or where pulling tension achieved would exceed the maximum allowable for the cable to be installed. Note that these boxes are not indicated on the Drawings.
- D. Install raised covers (plaster rings) on all outlet boxes in stud walls or in furred, suspended or exposed concrete ceilings. Covers shall be of a depth to suit the wall or ceiling finish.
- E. Leave no unused openings in any box. Install close-up plugs as required to seal openings.
- F. Provide cast metal boxes with gasketed cast metal cover plates where boxes are exposed in damp or wet locations.
- G. Provide precast concrete boxes in exterior planting areas, walkways, roads etc.
- H. Provide an access panel in permanent ceiling or wall where boxes are installed and will be inaccessible.
- I. For boxes mounted in exterior walls, make sure that there is insulation behind outlet boxes to prevent condensation in boxes.
- J. For outlets mounted above counters, benches or backsplashes, coordinate location and mounting heights with built-in units. Adjust mounting height to agree with required location for equipment served.
- K. Use conduit outlet bodies to facilitate pulling of conductors or to make changes in conduit direction only. Do not make splices in conduit outlet bodies.
- L. Add additional sheet rock as necessary to maintain original fire rating of walls where boxes are installed.
- M. Install galvanized steel coverplates on boxes in unfinished areas, above accessible ceilings and on surface mounted outlets.

3.4 SUPPORTS

- A. Provide boxes installed in metal stud walls with brackets designed for attaching directly to the studs or mount boxes on specified box supports.
- B. Mount boxes, installed in suspended ceilings of gypsum board or lath and plaster construction, to 16 gauge metal channel bars attached to main ceiling runners.
- C. Support boxes independently of conduit system.

- D. Support boxes, installed in suspended ceilings supporting acoustical tiles or panels, directly from the structure above wherever pendant mounted lighting fixtures are to be installed from the box.
- E. Support boxes, mounted above suspended acoustical tile ceilings, directly from the structure above.
- F. Box supports between studs shall be adjustable box mounting brace type, manufactured by Hubbell/Raco or approved equal.

END OF SECTION

SECTION 26 05 43

UNDERGROUND DUCTS AND STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Underground conduits and ducts.
 - 2. Under-slab conduits.
 - 3. Handhole and pullboxes.
 - 4. Excavation, trenching and backfill.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. Division 31 - Earthwork: General requirements for Excavation and Backfill and related items for ducts, manholes, pullboxes and handholes.
 - 2. Division 03 - Cast-in-place concrete: Protective envelope for ducts.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Federal Specifications (FS):
 - FS RR-F-621E; Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole.
 - FS SS-S-210A; Sealing Compound, Preformed Plastic for Expansion Joints and Pipe Joints.
 - FS WW-C-581; Specification for Galvanized Rigid Conduit.
 - FS W-C-1094A; Conduit and Conduit Fittings Plastic, Rigid.
 - 2. American Concrete Institute (ACI):
 - ACI 318; Building Code Requirements for Structural Concrete
 - 3. American National Standards Institute, Inc. (ANSI):
 - ANSI C80.1; Rigid Steel Conduit, Zinc-Coated.
 - 4. American Society for Testing And Materials (ASTM):
 - ASTM C31; Standard Practice for Making and Curing Concrete Test Specimens in the Field

ASTM C39;	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C172;	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C192;	Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231;	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C478;	Specification for Precast Reinforced Concrete Manhole Sections
ASTM C805;	Test Method for Rebound Number of Hardened Concrete
ASTM C857;	Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM C858;	Specification for Underground Precast Concrete Utility Structures
ASTM C877;	Specification for External Sealing Bands for Concrete Pipe, Manholes and Precast Box Sections
ASTM C891;	Practice for Installation of Underground Precast Concrete Utility Structures
ASTM C990;	Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM C1037;	Practice for Inspection of Underground Precast Concrete Utility Structures
ASTM C1064;	Standard Test Method for Temperature of Freshly Mixed Concrete
ASTM C1231;	Standard Practice for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Concrete Cylinder
ASTM C1611;	Standard Test Method for Slump Flow of Self-Consolidating Concrete

5. Underwriters Laboratories, Inc. (UL):

UL 6;	Rigid Metal Conduit.
UL 651;	Schedule 40 and 80 Rigid PVC Conduit.

6. National Electrical Manufacturer Association (NEMA):

NEMA RN1;	PVC Externally-coated Galvanized Rigid Steel Conduit.
NEMA TC 2;	Electrical Plastic Tubing and Conduit.
NEMA TC 3;	PVC Fittings for use with Rigid PVC Conduit.

1.3 DEFINITIONS

- A. Duct: Electrical conduit and other raceway, either metallic or nonmetallic, used underground embedded in earth or concrete.

- B. Duct bank: Two or more conduits or other raceway installed underground in same trench or concrete envelope.
- C. Handhole: An underground junction box in a duct or duct bank.
- D. Manhole: An underground utility structure, large enough for a person to enter, connecting with ducts to afford facilities for installing and maintaining cables.
- E. Vault: An underground utility structure, large enough for a person to enter, connecting with ducts to afford facilities for installing, operating and maintaining equipment and wiring.

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 3. Submit Manufacturer's installation instructions.
 - 4. Complete bill of material listing all components.

1.5 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted and approved.
- C. Precast concrete vaults shall be designed and fabricated by an experienced and acceptable precast concrete manufacturer. The manufacturer shall have been regularly and continuously engaged in the manufacture of precast concrete units similar to that indicated in the project specifications or drawings for at least 10 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Underground precast concrete utility structures:
 - a. Oldcastle Enclosure Solutions.
 - b. Jensen Precast.
 - 2. Conduits, ducts and fittings:
 - a. Prime Conduit.
 - b. JM Eagle.
 - c. Cantex.

d. Occidental Coating Company (OCAL).

B. Substitution: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 CONDUIT AND DUCT

A. Refer to 260531: Conduit.

B. Rigid non-metallic conduit (PVC):

1. Conduit:

Rigid polyvinylchloride, schedule 40 conforming to NEMA TC2 and UL 651. UL listed for exposed and direct-burial applications and for 90 degrees C conductor insulation. Conduit shall include an integral bell fitting at one end.

2. Fittings: Couplings, adaptors, transition fittings, bell ends, etc., shall be molded PVC, slip on and solvent weld type. Schedule 40 conforming to NEMA TC 3.

C. Duct supports: Rigid PVC spacers selected to provide minimum duct spacing and concrete cover depths, while supporting ducts during concrete pour.

D. Duct sealing compound: Non-hardening, safe for human skin contact, not deleterious to cable insulation, workable at temperatures as low as 35 degree F, withstands temperature of 300 degrees F without slump and adheres to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, cable sheaths and jackets, etc.

2.3 PULLBOXES AND HANDHOLES

A. Construction: High densities precast reinforced concrete box, extension, base and cover. Furnish box with end and side knockouts and non-settling shoulders. Cover shall have hold-down bolts and two lifting eyes.

B. Size: As indicated on the Drawings.

C. Cover markings: Covers shall read "ELECTRICAL" or "SIGNAL" as appropriate.

D. Rated covers: Use cast iron lid with H20 traffic rating for all locations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of duct and manhole installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 EARTHWORK

A. Excavation and backfill: Conform to Division 31, Earthwork.

B. Underground Utility Surveys: Prior to commencing any underground work, the Contractor shall perform independent surveys of the existing underground utilities and infrastructure in all areas of anticipated underground electrical work.

C. Excavation for underground electrical structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation or services, other construction and for inspection.

1. Excavate, by hand, areas within drip-line of large trees. Protect the root system for damage and dry-out. Maintain moist conditions for root system and over exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint.
 2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
- D. Trenching: Excavate trenches for electrical installation as follows:
1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches clearances on both sides of raceways and equipment.
 2. Excavate trenches to depth indicated or required.
 3. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceways and equipment. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and electrical installations.
- E. Backfilling and filling: Place soil materials in layers to required sub-grade elevations for each area classification, using materials and methods specified in Division 31: Earthwork.
1. Under building slabs, use drainage fill materials.

3.3 CONDUIT AND DUCT INSTALLATION

- A. Install duct lines in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
- B. Application:
1. Direct burial ducts: Schedule 40 minimum 24-inches below finished grade.
 2. Concrete encased ducts: Schedule 40, minimum 30 inches below finished grade.
 3. Below building slab-on-grade: Schedule 40, minimum 4-inches below bottom of slab except that bends and penetrates through floor slab shall be PVC coated galvanized rigid steel.
 4. Utility pole riser: Per utility company standards.
 5. Penetrations of building and equipment slabs: PVC insulated rigid steel.
- C. Slope duct to drain towards manholes and handholes and away from building and equipment entrances. Pitch not less than 4-inches per 100-feet. Curved sections in duct lines shall consist of long sweep bends with a minimum radius of 25-feet in the horizontal and vertical directions. The use of manufactured bends is limited to building entrances and equipment stub-ups.
- D. Underground conduit stub-ups to inside of building and exterior equipment shall be PVC insulated rigid steel except that conduits for utility services shall be per the utility company's standards.
- E. Make joints in ducts and fittings watertight according to Manufacturer's instructions.
- F. Terminate duct lines at manholes and handholes with end bells spaced 10-inches on center for 5-inch ducts and varied proportionately for other duct sizes. Change from regular spacing

to end-bell spacing 10-feet from the end bell without reducing duct line slope and without forming trap in the line. Grout end bells into manhole walls from both sides to provide watertight entrance.

- G. Separation between direct buried duct lines shall be 3-inches minimum for like systems and 12 inches minimum between power and signal ducts.
- H. For direct burial installations install continuous warning strip of heavy gage plastic imprinted "electrical ducts below", approximately 12-inch wide at 12-inches above ducts.
- I. Mandrel all ducts upon completion of installation and prior to pulling cables.

3.4 HANDHOLE AND PULL BOX INSTALLATION

- A. Install handholes and pull boxes in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
- B. Handholes and pull boxes shall be installed flush with finished grade or surface. Install on a level 6-inch bed of well-tamped gravel or crushed stone.
- C. Orientation of handholes and pull boxes shall be coordinated in advance with Landscape Architect and arranged to minimize connecting duct bends and deflections.
- D. Handholes and pull boxes shall not be located in drainage areas, roof drip lines, or low landscape areas.

3.5 FIELD QUALITY CONTROL

- A. Testing: Demonstrate capability and compliance with requirements upon completion of installation of underground duct and structures.
 - 1. Duct integrity: Rod ducts with a mandrel 1/4-inch smaller in diameter than internal diameter of ducts. Where rodding indicates obstructions in ducts, remove the obstructions and retest.

3.6 CLEANING

- A. Pull brush through full length of ducts. Use round bristle brush with a diameter 1/2-inch greater than internal diameter of duct.
- B. Clean internal surfaces of handholes. Remove foreign material.

END OF SECTION

SECTION 26 0546

SIGNAL SYSTEMS RACEWAY

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Telephone and cable television (CATV) service entrance provisions.
 - 2. Signal terminal backboards.
 - 3. Signal systems pullboxes.
 - 4. Telecom/data cabling, television distribution, fire alarm, security, fire alarm/life safety nurse call, clock, intercom, public address systems conduit, cable tray, "J" hooks and outlets.

- B. Related work: Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.
 - 1. Division 06: Rough Carpentry.

1.2 SYSTEM DESCRIPTION

- 1. Provide a complete raceway system as indicated on Drawings and herein for the signal systems referenced above. Raceway systems shall include conduit, cable tray, "J" hooks, pullboxes, junction boxes, supports, fittings, coverplates, terminal backboards, pull ropes and other material as required for a complete installation.

1.3 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein.
 - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 3. Shop Drawings shall include:
 - a. Symbols legend.

- b. Equipment list showing quantity, make, model number of all hardware components.
4. Plot plan and floor plans of building with partitions, walls and room identification, showing general routing of signal systems pathway, location of all rated penetrations, junction boxes, terminal cabinets, conduit sleeves, etc.
5. Hardware installation details.
6. Rated penetration details and UL listing numbers.
7. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
8. Submit Manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 TERMINAL BACKBOARD

- A. Refer to Division 06: Rough Carpentry.
- B. 4' wide x 8' high x 3/4" thick fire retardant plywood backboard.

2.2 BOXES

- A. Refer to Section 260533: Boxes.
- B. Outlet boxes:
 1. Standard electrical knockout boxes 4 11/16" square by 2-1/8" deep.
 2. Single gang plaster ring, unless otherwise noted or required for device mounting, in depth to match wall finish.
 3. Pullboxes: Standard knockout type boxes sized as indicated on Electrical Drawings or Shop Drawings by equipment Manufacturer.

2.3 OUTLET COVERPLATES

- A. Refer to Section 262726: Wiring Devices.
- B. Where devices or coverplates are not being furnished under another Section, provide blank coverplates.

2.4 CONDUIT

- A. Refer to Section 260531: Conduit.
- B. Provide a conduit system sized and in layout indicated on Electrical Drawings or Shop Drawings by equipment Manufacturer.
- C. Include all fittings and supports as required for a complete system.

2.5 CABLE TRAYS

- A. Refer to Section 260536: Cable Trays.
- B. Provide a cable tray system for the distribution of signal systems cabling sized and in layout indicated on Electrical Drawings. Cable tray shall support only the signal system cables specifically noted for application in their individual Specification Section.
- C. Include all accessories, fittings and supports as required for a complete system.

2.6 "J" HOOK HANGER

- A. Manufacturers:
 - 1. Equal products by the following Manufacturers will be considered providing that all features of the specified product are provided:
 - a. Unistrut Corporation.
 - b. B-Line Systems, Inc.
 - c. Name
 - 2. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.
- B. "J" hook hanger:
 - 1. Assembly: Shall be complete to include "J" hook with plastic coating, "T" bolt and nut.
 - 2. Construction: "J" hook, bolt and nut shall be electroplated steel. "J" hook shall be coated in plastic.
 - 3. Size: 1/4 inch thick x 1 1/2 inch wide x 8 inches in diameter, minimum dimensions.

2.7 PULL ROPE

- A. Provide a polyethylene pulling rope in all empty conduits.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of signal systems raceway installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

- A. Provide a complete raceway system installation for the signal systems as indicated on Drawings and specified herein, to include all necessary fittings and supports.
- B. Refer to applicable Sections referenced above for specific installation requirements of equipment specified herein.
- C. Minimum conduit size for signal system shall be 1.25 inch, but not less than size indicated on Drawings.
 - 1. Refer to system Shop Drawings prepared by Manufacturer for conduit routing and sizes.

- D. Conduits terminating at signal terminal backboard shall extend a minimum of 4" above finished floor. For conduits terminating overhead provide a construction channel, in length as required, across the top of backboard to fasten-down conduits. All conduits terminating at backboard shall be provided with insulated bushings.
- E. Install fire retardant plywood backboard per the requirements of Division 06 - Rough Carpentry. Provide in length as indicated on Drawings.
- F. Install a pull rope in all empty conduits.
 - 1. Wall mounted outlets and/or device served by cable routed exposed above the suspended ceiling shall consist of an outlet box with plaster ring, 1 1/4" EMT conduit from box to stub-out above ceiling and a insulated throat connector at each end.
 - 2. Cable tray shall be installed per Specification Section 260536: Cable Trays and as indicated on Drawings.

3.3 "J" HOOK HANGERS

- A. Layout:
 - 1. Location of "J" hook hangers shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas. Installation shall not unnecessarily cross other conduits or pipes, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment. Provide offsets as required to avoid obstructions with other trades.
 - 2. "J" hook hanger runs shall not be placed closer than 12 inches to a flue, parallel hot water, steam line or other heat producing source or 3 inches from such lines when crossing perpendicular to the runs.
 - 3. "J" hook hanger runs shall not be placed closer than 3 inches to any feeder or branch circuit power raceway.
- B. Installation:
 - 1. Support "J" hook hangers with 1/2 inch threaded rod from structure above via expansion anchors suitable for construction.
 - 2. Space hangers 4 feet on center within the layout indicated on the Drawings.
- C. Penetrations:
 - 1. "J" hook hanger cables penetrating fire rated walls shall be installed in a solid-bottom type cable tray with flanged solid cover. Cable shall extend beyond wall 18 inches on both sides. Cable tray shall be 3" high x 12" wide. Cover shall be sealed and non-removable.
 - 2. Wall shall be patched around cable tray per the requirements of Division 07.
 - 3. Provide fire rated firestop pillows within solid cable tray to maintain fire separation rating of wall. Install pillows per the requirements of the Manufacturer in quantities as required based on opening size. Pillows shall be Nelson type PLW firestop or approved equal.

3.4 EXPOSED SIGNAL CABLE ROUTING ABOVE CEILING

- A. General:

1. Cable shall be suitable for exposed installations above suspended ceilings. Provide plenum rated cable where ceiling space is utilized for return air plenum.
 2. Install cable in conduit above non-accessible ceilings, in walls and exposed locations.
- B. Cable Support:
1. Support cables leaving cable tray or "J" hook hanger system at a maximum spacing of 6 feet on center.
 2. Support cables using spring metal cable clips or metal cable ties for each cable. Suspended ceiling support wires may be used to directly support a maximum of two cables.
 3. Provide separate drop wires above accessible ceiling to support more than two cables.
 4. Do not attach cables to conduits, ducts or pipes.
 5. Do not rest cables on ceiling tiles or allow contact with mechanical piping system.
 6. Provide separate sleeves and/or fire barriers where individual cables penetrate firewalls.

END OF SECTION

SECTION 26 05 53

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Electrical equipment nameplates.
 - 2. Panelboard directories.
 - 3. Wire and cable identification.
 - 4. Buried electrical line warnings.
 - 5. Junction box identification.
 - 6. Inscribed device coverplates.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. Division 09: Painting.

1.2 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein.
 - 2. Schedules for nameplates to be furnished.

1.3 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Conduit and wire markers:
 - a. Thomas & Betts Corp.
 - b. Brady.
 - c. Griffolyn.

- 2. Inscription Tape:
 - a. Kroy.
 - b. Merlin.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.
- 2.2 NAMEPLATES
 - A. Type NP: Engraved, plastic laminated labels, Signs and Instruction Plates. Engrave stock melamine plastic laminate 1/16-inch minimum thickness for signs up to 20 square inches or 8 inches in length; 1/8 inch thick for larger sizes. Engraved nameplates shall have white letters and be punched for mechanical fasteners.
 - B. Color and letter height as specified in Part 3: Execution.
- 2.3 LEGEND PLATES
 - A. Type LP: Die-stamped metal legend plate with mounting hole and positioning key for panel mounted operator devices, i.e. motor control pilot devices, hand-off-auto switches, reset buttons, etc.
 - B. Stamped characters to be paint filled.
- 2.4 BRASS TAGS
 - A. Type BT: Metal tags with die-stamped legend, punched for fastener.
 - B. Dimensions: 2" diameter 19 gauge.
- 2.5 PANELBOARD DIRECTORIES (400 AMP OR LESS)
 - A. Directories: A 6" x 8" minimum size circuit directory frame and card with clear plastic covering shall be provided inside the inner panel door.
 - B. Circuit numbering: Starting at the top, odd numbered circuits in sequence down the left hand side and even numbered circuits down the right hand side. Multi-section panelboards shall have continuous consecutive circuit numbers, i.e. Section 1 (circuit numbers 1-42), Section 2 (circuit numbers 43-84), Section 3 (circuit numbers 85-126).
- 2.6 WIRE AND TERMINAL MARKERS
 - A. Provide self-adhering, pre-printed, machine printable or write-on, self-laminating vinyl wrap around strips. Blank markers shall be inscribed using the printer or pen recommended by Manufacturer for this purpose.
- 2.7 CONDUCTOR PHASE MARKERS
 - A. Colored vinyl plastic electrical tape, 3/4" wide, for identification of phase conductors. Scotch 35 Brand Tape or equal.
- 2.8 UNDERGROUND CONDUIT MARKER
 - A. 6-inch wide, yellow polyethylene tape, with continuous black imprinting reading "Caution - Buried Electric Line Below".
- 2.9 INSCRIBED DEVICE COVERPLATES
 - A. Coverplate material shall be as specified in Section 262726: Wiring Devices.

- B. Methods of inscription: (Unless otherwise noted)
 - 1. Type-on-tape:
 - a. Imprinted or thermal transfer characters onto tape lettering system.
 - b. Tape trimmer.
 - c. Matte finish spray-on clear coating.
 - 2. Engraving:
 - a. 1/8" high letters.
 - b. Paint filled letters finished in black.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of identification device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 NAMEPLATES

- A. Installation:
 - 1. Degrease and clean surfaces to receive nameplates.
 - 2. Install nameplates parallel to equipment lines.
 - 3. Secure nameplates to equipment fronts using machine screws.
- B. Provide type 'NP' color coded nameplates that present, as applicable, the following information:
 - 1. Equipment designations as indicated on the drawings.
 - 2. Amperage, KVA or horsepower rating, where applicable.
 - 3. Voltage or signal system name.
 - 4. Source of power or control.
 - 5. Examples:
 - a. Boards: EHD2A; 1200A; 277/480V, 3PH, 4W; Served from: ATS1A
 - b. Transformers: ETX2A; 150KVA; 480V pri. - 120/208V, 3PH, 4W sec.; Served from: EHD2A; Load Served: EL2A
 - c. Disconnects or Individual Motor Starters: EF-1; 20HP; 480V,3PH,3W; Served from MCC1A
 - d. Signal: STB3C; Public Address System; Served from STB2C
- C. Nameplates for normal power system distribution equipment and devices are to be black. Nameplates for standby and emergency power distribution equipment are to be red.
- D. Minimum letter height shall be as follows:

1. For panelboards, switchboards, battery panels motor control center, etc.: ½ inch letters to identify equipment designation. Use ¼ inch letters to identify voltage, phase, wires, etc.
2. For individual circuit breakers, switches and motor starters in panelboards, switchboards and motor control centers use 3/8-inch letters to identify equipment designation. Use 1/8-inch letters to identify all other.
3. For individual mounted circuit breakers, disconnect switches, enclosed switches and motor starters use 3/8-inch letters to identify equipment designation. Use 1/8" letters to identify all other.
4. For transformers use 1/2 inch letters to identify equipment designation. Use ¼ inch letters to identify primary and secondary voltages, etc.
5. For equipment cabinets, terminal cabinets, control panels and other cabinet enclosed apparatus use 3/8-inch letters to identify equipment designation.

3.3 LEGEND PLATES

- A. Provide panel-mounted operators devices such as pilot lights, reset buttons, "HAND-OFF-AUTO" switches, etc.

3.4 BRASS TAGS

- A. Provide type BT tags for individual ground conductors to exposed ground bus indicating connection i.e. "UFER", "Cold water bond", etc.
- B. Provide tags for all feeder cables in underground vaults and pull boxes.
- C. Provide tags for empty conduits in underground vault, pull boxes and stubs.

3.5 PANELBOARD DIRECTORIES (400 AMP OR LESS)

- A. Provide typewritten directories arranged in numerical order denoting loads served by room number or area for each circuit.
- B. Verify room numbers or area designation with Project Manager.
- C. Mount panelboard directories in a minimum 6" x 8" metal frame under clear plastic cover inside every panelboard.

3.6 WIRE AND CABLE IDENTIFICATION

- A. Provide wire markers on each conductor in panelboards, pull boxes, outlet and junction boxes and at load connection. Identify with branch circuit or feeder number for power and lighting circuits and with control wire number as indicated on equipment Manufacturer's Shop Drawings for control wiring.
- B. Provide colored phase markers for conductors as noted in Section 260519: Building Wire and Cable. Apply colored, pressure sensitive plastic tape in half-lapped turns for a distance of 3 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Do not cover cable identification markings by taping.

3.7 UNDERGROUND CONDUIT MARKERS

- A. During trench backfilling, for exterior underground power, signal and communications lines, install continuous underground plastic line marker, located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker.

3.8 JUNCTION BOX IDENTIFICATION

- A. The cover of junction, pull and connection boxes for both power and signal systems, located above suspended ceilings and below ceilings in non-public areas, shall be clearly marked with a permanent ink felt pen. Identify the circuit(s) (panel designation and circuit numbers) contained in each box, unless otherwise noted or specified.

3.9 INSCRIBED DEVICE COVERPLATE

A. General:

1. Lettering type: Helvetica, 12 point or 1/8" high.
2. Color of characters shall be black.
3. Locate the top of the inscription 1/2" below the top edge of the coverplate.
4. Inscription shall be centered and square with coverplate.

B. Application:

1. Provide inscribed coverplates for devices as outlined below:
 - a. Receptacles.
 - b. Outlets in surface raceways.
 - c. Multi-ganged (four or more) switch arrangement.
 - d. Special purpose switches, i.e. projection screens, shades, exhaust fans, etc.
 - e. Telecommunication outlets.
2. Type-on-tape inscriptions shall be provided for the following devices:
 - a. Receptacles.
 - b. Outlets in surface raceways.
 - c. Telecommunication outlets.
3. Engraved inscriptions shall be provided for the following devices:
 - a. Multi-ganged switches.
 - b. Special purpose switches.
4. Type-on-tape installation:
 - a. Tape shall be trimmed to the height of the letters.
 - b. Trim tape length to 1/4 inch back from each edge of coverplate.
 - c. Contractor hands shall be clean or covered with surgical type glove prior to application of tape. Tape installations with visible fingerprints or smudges will not be acceptable.

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GRA Architecture
Project #18-06

END OF SECTION

SECTION 26 0926
NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
1. Room controllers or network power/relay packs.
 2. Wallbox dimmers and switches.
 3. Occupancy sensors.
 4. Daylight sensors.
 5. Receptacle control device.
 6. I/O modules.
 7. Relay panel.
 8. BACnet interface module.
 9. Emergency lighting control.
 10. Network components and cabling.
 11. System software.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
1. Division 25 - Energy management control system (EMCS): Lighting control interface.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
1. National Electrical Manufacturer Association (NEMA):
 - NEMA 250; Enclosures for Electrical Equipment.
 - NEMA ICS 1; Industrial Control and Systems.
 - NEMA ICS 4; Terminal Blocks and Industrial use.
 - NEMA ICS 6; Enclosures for Industrial Controls and Systems.
 2. Underwriters Laboratories, Inc. (UL):
 - UL 50; Cabinets and Boxes.
 - UL 773A; Nonindustrial Photoelectric Switches for Lighting Control.

UL 916; Energy Management.

1.3 SYSTEM DESCRIPTION

- A. Provide a complete lighting control system consisting of stand-alone components, capable of being networked together enabling digital communication. Devices shall be individually addressable.
- B. The lighting control system shall provide time-based, sensor-based (occupancy, daylighting), and manual (on/off, dimming) lighting control.
- C. The system architecture shall be capable of enabling stand-alone groups (rooms) of devices to function in some default capacity even if network connectivity to the greater system is lost.
- D. The system architecture shall facilitate remote operation via a computer connection.
- E. The system shall not require any centrally hardwired switching equipment.
- F. The system shall be capable of wireless, wired, or hybrid wireless/wired architectures.
- G. Space Control Requirements: Unless otherwise noted on the plans, provide a minimum application of lighting controls as follows:
 - 1. Provide occupancy/vacancy sensors with Manual or Partial ON functionality in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic ON occupancy sensors are more appropriate. Provide Manual ON occupancy sensors for any enclosed office, conference room, meeting room, or classroom. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.
 - 2. Receptacle Control: Provide automatic shut off of non-essential plug loads in all spaces required by the 2016 Building Energy Efficiency Standards. Provide Automatic-ON of plug loads whenever spaces are occupied. For spaces with multiple occupants a single shut off consistent with the overhead lighting may be used for the area.
 - 3. Daylit Areas – Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by the 2016 Building Energy Efficiency Standards :
 - a. All luminaires within each code-defined primary and secondary daylight zone or skylit zone shall be controlled separately from luminaires.
 - b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
 - c. Multiple-leveled switched daylight harvesting controls may be utilized for areas marked on drawings.
 - d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.

4. Classrooms shall instead have at least four (4) pre-set lighting scenes unless otherwise specified, including a scene conducive to AV presentations. Classroom occupancy sensors shall turn off the room's HVAC when the space is vacant.
5. Spaces with moveable walls shall include controls that can be reconfigured when the room is partitioned.

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 2. Describe system operation, equipment and dimensions and indicate features of each component.
 3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 4. Shop Drawings to include:
 - a. Plot plans and building floor plans, showing location of and conduit routing to all devices.
 - b. Point-to-Point wiring diagram in block or riser format showing all low-voltage lighting control components, conduit and wire types and sizes with cable legend.
 5. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
 6. Submit Manufacturer's installation instructions.
 7. Complete bill of materials listing all components.
 8. Warranty.

1.5 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements to include the following:
 1. Operation and maintenance manuals shall include the following:
 2. A detailed explanation of the operation of the system.
 3. Instructions for routine maintenance.
 4. Pictorial parts list and part numbers.
 5. Shop drawings to include the following:
 - a. Floor plans showing lighting fixture layout, and layout of all network lighting control devices.
 - b. Show network communication cablings and pre-fabricated lengths.
 - c. Indicate device addresses.

- d. Riser diagram indicating system backbone and headend connections.
 - 6. Telephone numbers for the authorized parts and service distributors.
 - 7. Final testing report.
- 1.6 QUALITY ASSURANCE
- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
 - B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.
- 1.7 PRODUCT DELIVERY, STORAGE AND HANDLING
- A. Delivery: Addressable lighting control components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.
 - B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
 - C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.
- 1.8 WARRANTY
- A. Units and components offered under this Section shall be covered by a 5 year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.
- 1.9 SYSTEM START-UP
- A. Upon completion of installation, a factory trained dealer service representative shall perform initial start-up of the dimming system. Sufficient time shall be allowed to properly check the system out and perform required minor adjustments before the Engineer's witnessed test shall begin.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Network lighting control system:
 - a. SensorSwitch “nLight”.
 - b. Wattstopper “Digital Light Management” (DLM).
 - c. Douglas “Dialog Room Controller”.
 - d. Eaton/Cooper “Room Controller”.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 GENERAL

A. All components of the network lighting control system shall connect via Class 2 low voltage cable; Cat-5 cabling with RJ-45 connectors, or 2-wire non-polarized data line.

2.3 ROOM CONTROLLERS OR NETWORK POWER/RELAY PACKS

1. Provide universal voltage (120V or 277V), plenum rated, network room controllers or power packs for control of each lighting zone indicated on the plans. Quantity of devices required within each room may vary by manufacturer.
2. The room controller/power pack shall provide Class 2 power to other devices connected to the system.
3. Each device shall incorporate one or more Class 1 relays, rated as follows:
 - a. 20A Suitable for General Purpose Loads @ 120/277/247VAC
 - b. 20A Suitable for Standard Ballasts and Tungsten Loads @ 120/277VAC
 - c. 16A Suitable for Electronic Ballasts @ 120/277VAC
 - d. 0.5HP @120/277Vac
4. Provide devices with 0-10V control output for dimming applications.
5. The device shall mount to an electrical junction box via threaded chase nipple.
6. Locate room controllers/power packs above accessible ceiling space, preferably in front of doorway. Identify the location of the device with type-on-tape visible from below the ceiling.

2.4 WALLBOX DIMMERS AND SWITCHES

- A. Devices shall recess into single-gang switch box and fit a standard GFI opening.
- B. All devices shall provide toggle switch (on/off) control. Dimming control and low temperature/high humidity operation are available options.
- C. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
- D. Devices with mechanical push-buttons shall be made available with custom button labeling

2.5 OCCUPANCY SENSOR

- A. General:
 1. Occupancy sensors shall comply with the latest edition of the California Building Energy Efficiency Standards, California Building Code, Part 6 and be certified by The California Energy Commission. All sensors shall be listed in the most current directory of Certified Occupancy Sensing Devices or be on file with the CEC.
 2. Occupancy sensors shall be dual-technology type infrared/ultrasonic.
 3. All sensors shall have an adjustable time delay for turning off lights and a sensitivity adjustment.

4. All sensors shall be ceiling mounted and shall operate at low-voltage, maximum 24VDC input, 40mA current draw. Sensors shall be powered via the system.
 5. Units shall be furnished to cover the areas being controlled. No allowance shall be given for providing sensors improperly sized for the square footage of the controlled area.
- B. Color: Device color shall be white, unless otherwise noted.
- C. Ceiling mounted single-directional sensors:
1. Sensor shall have a minimum coverage of up to 900 square feet.
 2. Operation shall be automatic "ON" and automatic "OFF".
 3. Time delay adjustment from 30 seconds to 30 minutes. Set adjustment at 10 minutes. Set sensitivity adjustment at maximum.
 4. For use in small office areas.
- D. Ceiling mounted omnidirectional sensors:
1. Sensor shall have a minimum coverage of up to 1000 square feet.
 2. Operation shall be automatic "ON" and automatic "OFF".
 3. Time delay adjustment from 30 seconds to 15 minutes. Set adjustment at 10 minutes. Set sensitivity adjustment at maximum.
 4. For use in larger open office areas.

2.6 DAYLIGHT SENSOR

- A. Interior day-light harvesting dimming control sensors:
1. Automatically dims 0–10VDC fluorescent dimming ballasts.
 2. Closed loop control for natural daylight harvesting.
 3. The sensor shall continuously monitor the ambient light level.
 4. One sensor shall permit different outputs to switch and/or control light levels as ambient light changes. Light levels shall be controlled by ‘sensor only’ or in combination with a time schedule or with a dimming switch.
 5. Sensor shall be capable of setting a maximum light level which cannot be exceeded during Natural Daylight operations.
 6. Dimming sinks up to 20mA.
 7. Self-calibrating set-points.
 8. Digital set-point control.
 9. Push-button programmable.
 10. Green LED status indicator.
 11. 100 hour lamp burn-in timer mode.

2.7 RECEPTACLE CONTROL DEVICE

1. Provide a networked single-relay controller or power pack for control of 120V receptacles where required by the 2016 Building Energy Efficiency Standards. Receptacle control may be accomplished by a relay in the Room Controller if option is available from the manufacturer.

2.8 INPUT/OUTPUT “I/O” MODULES

A. General:

1. The universal I/O module provides an interface between lighting components such as ballasts, contact closures, occupancy sensors and photocell sensors to the system communication network.
2. The I/O module automatically detects and addresses the type of device to which it is wired and establishes two-way communication between the ECU and itself. Individually addressable, the I/O module enables each lighting component to be independently controlled and configured.
3. When connected to fixture ballast, the I/O module can switch a fixture “on” or “off” via a relay contained in the module as well as deliver a low-voltage dimming signal to any conventional 0-10V dimming ballast.
4. When connected to an occupancy sensor or photocell sensor, the I/O module provides power to operate the device and relays sensor information from the device to the ECU. The I/O module can also be connected to power relays or switch packs to enable switching of larger electrical loads.
5. In the event of a power failure, I/O modules connected to light fixtures shall default to the “on” state at full light output.

B. Specifics:

1. Voltage compatibility: Universal voltage control to 347VAC maximum.
2. Recommended relay rating: 300 watts, 120-347VAC for local switching.
3. Primary relay rating: 6.5A, 120-277V or 4.5A, 347-480V with up to 2 ballasts.
4. Compatibility with electronic dimming ballasts using 0 to 10VDC dimming signals.
5. Power:
 - a. Supplies 12 to 24VDC, 40mA maximum for occupancy sensors.
 - b. Supplies 10VDC, 25mA for photocell sensors.
6. Control signal: Supplies 0-10VDC, 25mA maximum dimming signal to attached ballast or receives control signal from attached sensor.
7. Two RJ45 connectors for communication network connection.
8. Memory: Retains all system settings in non-volatile memory.

C. Mounting:

1. The I/O module is easily mounted to a lighting fixture or electrical junction box knock-out via threaded hub base with lock-nut.
2. Mounts to standard ½” knock-out.

D. Environmental Specifications

1. Operating Temperature Range: 0°C to 40°C
2. Relative Humidity: 20% to 90% non-condensing

2.9 RELAY PANEL

- A. Addressable relay panel that fully integrates with the addressable control system, consisting of individual relays, control module, power supplies, network connection interface, DIN rail supports and cabinet.
- B. Cabinet: NEMA 1 enclosure sized to accept up to 24 relays. Enclosure shall be 19" high x 18" wide x 4" deep minimum.
- C. Cover: Standard surface mount, hinged, lockable cover with windows for viewing relay status indicators. A wiring schedule directory card shall be affixed to the rear of the cover.
- D. Interior: DIN rail supports for relays and circuit board back control module pre-wired to relays. Each relay can be addressed as individual zone or as part of a larger zone and is controlled through the software.
- E. Control relays: Heavy-duty momentary pulsed mechanically latching contactors. Operating voltage is 24VAC; contacts are rated at 20 amps at 120 or 277VAC. They shall attach to the interior DIN rail support and pre-wire to circuit board.
- F. Control module: The control module is mounted in the center of the panel with 12 relays on either side and is wired to each individual relay. Each relay is addressable via the control module can be controlled independently via the system software.
- G. Power supply: 120/277VAC input transformer with 24VAC, 60Hz, 1.6A (40VA) Class II power supplies output.
- H. Network connection: Class 2 wiring input.

2.10 BACNET INTERFACE

- A. The lighting control system shall be capable of networking to a central BACnet based management system. This capability may be integral to the Room Controller device, or via a separate BACnet interface module. BACnet interface shall include the following functions:
 1. Enables the integration of the control system with any BACnet compatible building automation system. The control system operates autonomously while lighting status, lighting levels and energy usage are all shared and possible controlled via BACnet. Connection between the two systems is established via BACnet/IP.
 2. Enables BACnet switching and dimming control.
 3. Provides load shedding control over the lighting system, meeting the 2016 Building Energy Efficiency Standards requirements for Automatic Demand Response.
 4. Shares occupancy sensor information obtained by the control system with a BACnet client for HVAC system integration.
 5. Utilizes a centralized BACnet time schedule.
- B. The BACnet interface creates access points with names and descriptions that can be customized to accommodate any client's naming scheme. It also exports standard BACnet

object properties in a clear, structured manner and can define an unlimited number of groups of lighting fixtures.

- C. The control system BACnet interface shall adhere to ANSI/ASHRAE Standard 135-2004 "BACnet" (ISSN 1041-2336).

2.11 EMERGENCY LIGHTING CONTROL

- A. Provide a UL 924 listed device capable of emergency lighting circuit control. The device shall force emergency lights ON upon loss of normal power. Features include:
 - 1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
 - 2. Push to test button
 - 3. Auxiliary contact for remote test or fire alarm system interface

2.12 NETWORK COMPONENTS & CABLING

- A. Provide control module (Gateway) as required to facilitate communication of network devices, linking into an Ethernet, and linking into the lighting control system management software. This network capability may also be integral to the Room Controller device.
- B. Network cabling shall be Class 2 wiring as recommended by the specified manufacturer. Cable shall be plenum rated.

2.13 SYSTEM SOFTWARE

- A. Every device parameter (e.g. sensor time delay and photocell set-point) shall be available and configurable remotely from the software
- B. The following status monitoring information shall be made available from the software for all devices for which it is applicable: current occupancy status, remaining occupancy time delay(s), current photocell reading, current photocell inhibiting state, photocell transitions time remaining, current dim level, device temperature, and device relay state(s).
- C. The following device identification information shall be made available from the software: model number, model description, serial number, manufacturing date code, custom label(s), and parent network device.
- D. The software must offer a Graphical User Interface (GUI).
- E. A printable network inventory report shall be available via the software.
- F. A printable report detailing all system profiles shall be available via the software.
- G. Software shall require all users to login with a User Name and Password.
- H. Software shall provide at least three permission levels for users.
- I. All sensitive stored information and privileged communication by the software shall be encrypted.
- J. All device firmware and system software updates must be available for automatic download and installation via the internet.
- K. Software shall be capable of managing systems interconnected via a WAN (wide area network)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of low-voltage lighting control installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

- A. Install the network lighting control system in accordance with the Manufacturer's written instructions, as indicated on the shop drawings and as specified herein.
- B. All components of the network lighting control system are not necessarily shown on the plans. Provide all components required for a complete and functional system; locate devices not shown on the plans where they can be easily accessed for maintenance, and include location on the record drawings (shop drawings).
- C. Coordinate location of all wall and ceiling mounted devices with the architectural RCPs and elevations.
- D. Locate relay panel(s) where indicated on the plans.
- E. All exterior lighting fixtures shall be controlled via the relay panel with homeruns wired through panel.
- F. Route cabling in conduit except above accessible ceiling space.

3.3 OCCUPANCY SENSOR SWITCHES

- A. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.
- B. Coverage of occupancy sensors may vary by manufacturer. It shall be the responsibility of the Contractor to place sensors in the proper place and with proper alignment to cover to all the area intended in the Contract Documents.

3.4 PROGRAMMING

- A. Programming of the addressable lighting control system shall be by a factory-authorized agent of the Manufacturer of the system. All programming, testing, trouble shooting, etc. shall be included in this contract.
- B. The lighting control system shall be fully integrated with the building management system.
- C. Coordinate all Ethernet physical connectivity and IP addressing with the owner in advance of programming and installation.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's field service: Contractor shall arrange and pay for the services of a factory-authorized service representative to supervise the initial start-up, pretesting and adjustment of the low-voltage lighting control system.
- B. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.

- C. Prefunctional resting:
 - 1. Visual and mechanical inspection:
 - a. Inspect for physical damage, defects alignment and fit.
 - b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
 - c. Compare nameplate information and connections to Contract Documents.
 - d. Check tightness of all control and power connections.
 - e. Check that all covers, barriers and doors are secure.
 - 2. Contractor shall provide all necessary programming assistance to set up and program the low-voltage lighting control equipment.
 - 3. Electrical tests:
 - a. The system shall be completely tested in accordance with operational parameters, tolerances and Manufacturer's instructions. Any problem shall be documented and corrected.
 - b. Test all control circuits and verify proper operation of all lighting circuits throughout the control system.
 - c. Ensure the lighting zone controls match that of the Contract Documents.
 - d. Verify the proper integration with the mechanical control system for override control and monitoring of low-voltage lighting control system.
 - e. Provide a complete report listing every device, the date it was tested, the results and the date retested (if failure occurred during the previous test). The test report shall indicate that every device tested successfully.
- D. Provide all system wide functional performance testing per the project commissioning requirements.
- E. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.
- F. Contractor shall submit the testing final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.

3.6 TRAINING

- A. Factory authorized service representative shall conduct a 4 hour training session for Owner's Representatives upon completion and acceptance of system. Instruction shall include operation, programming and maintenance of equipment.
- B. Contractor shall schedule training with a minimum of 7 days advanced notice.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Branch circuit panelboards.
 - 2. Distribution panelboards (400 amps to 800 amps).
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
 - 1. Federal Specifications (FS):
 - FS W-C-375; Circuit Breakers, Molded Case, Branch Circuit and Service.
 - FS W-P-115; Power Distribution Panel.
 - 2. National Electrical Manufacturers Association (NEMA):
 - NEMA AB 1; Molded Case Circuit Breakers.
 - NEMA PB 1; Panelboards.
 - NEMA PB 1.1; Instructions for safety instruction, operation and maintenance of panelboard rated 600 volts or less.
 - NEMA PB 1.2; Application Guide for Ground-Fault Protective Devices for Equipment.
 - 3. Underwriters Laboratories, Inc. (UL):
 - UL 67; Panelboards.
 - UL 486E; Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
 - UL 489; Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
 - UL 870; Wireways, Auxiliary Gutters and Associated Fittings.

1.3 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards
 - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 3. Shop Drawings: Include elevations, cabinet dimensions, gutter sizes, layout of contactors, relays, time clocks, lug sizes, bussing diagrams; make, location and capacity of installed equipment; mounting style; finish and panelboard nameplate inscription.
 - 4. Submit Manufacturer's installation instructions.
 - 5. Complete bill of material listing all components.
 - 6. Warranty.
- B. Dimensions and configurations of panelboards shall conform to the spaces allocated on the Drawings for their installation. The Contractor shall include with the submittal a layout of the electrical room if it differs from construction documents for review and approval by the Engineer prior to release of order.

1.4 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
 - 1. A detailed explanation of the operation of the system.
 - 2. Instructions for routine maintenance.
 - 3. Pictorial parts list and parts number.
 - 4. Telephone numbers for authorized parts and service distributors.
 - 5. Final testing reports.

1.5 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Panelboard components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

- C. Handling: Handle in accordance with NEMA PB1.1 and Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.7 WARRANTY

- A. Units and components offered under this Section shall be covered by a 1 year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

1.8 EXTRA MATERIAL

- A. Turn over two (2) sets of panelboard keys to the Owner at completion of Project. All panelboards shall be keyed alike.
- B. Provide one spray can of matching finish paint for touching up damaged surfaces after installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Eaton Electrical
 - 2. Siemens
 - 3. Square D
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 PANELBOARDS - GENERAL

- A. Enclosure:
 - 1. Cabinets shall be NEMA Type 1 enclosure, door and trim of code gauge galvanized steel. Provide NEMA Type 3R enclosures for exterior mounted panelboards.
 - 2. Enclosures shall not be furnished with predetermined (factory) knock-outs.
 - 3. Panelboard covers shall be door-in-door construction such that inner door exposes the overcurrent protective devices and the outer door exposes the complete panelboard interior (i.e. branch circuit conductors, lugs, neutral and ground bus, overcurrent protective devices, etc.). Outer door shall have full-length piano hinge and inner door shall have two-point hinges.
 - 4. Provide combination spring catch and lock on inside edge of the inner door trims with flush fitting joint between door and trim. Locks on all panelboards shall be keyed alike. Doors 36 inches and over in height shall be provided with three-point catch and lock. Provide quarter-turn captive bolts on the outer door.
- B. Bus assembly and terminations:
 - 1. Bus shall be bolted copper with taps arranged for distributed phase connections to branch circuit devices

2. Cross connectors shall be copper, drilled and tapped for bolt-on device connections, arranged for double row placement of device and designed to permit removal or addition of overcurrent protection devices without disturbing adjacent devices or removing main bus connections.
 3. Neutral bus shall be 100 percent rated of phase bus bars and shall have lugs for each outgoing branch circuit or feeder requiring a neutral connection unless otherwise noted.
 4. Ground bus shall be full size with lugs for each outgoing branch circuit and feeder.
 5. Refer to panelboard schedules for bus rating. Bus rating shall match or be greater than main device or main lug rating.
 6. As a minimum, bus bars shall be rated 10,000 AIC for 120/208 volt panelboards and 25,000 AIC for 277/480 volt panelboards. Unless otherwise noted.
 7. Provide full sized bussing in all sections of multi-section panelboards.
 8. Termination Lugs: Rated for use with aluminum/copper conductors.
 9. All "SPACES" shall be ready for installation of future overcurrent protective device.
- C. Miscellaneous requirements:
1. Circuit numbering: Starting at the top, indicate odd numbered circuits in sequence down the left hand side and even numbered circuits down the right hand side. Multi-section panelboards shall have continuous consecutive circuit numbers, i.e. Section 1 (circuit numbers 1-42), Section 2 (circuit numbers 43-84), Section 3 (circuit numbers 85-126). Provide metal embossed circuit identification of panelboards.
 2. Directories: A 6" x 8" minimum size circuit directory frame and card with clear plastic covering shall be provided inside the inner panelboard door to reflect conditions at completion of Work. Directory shall be typewritten denoting loads served by room number or area for each circuit.
 3. Nameplates: Provide engraved nameplate for each panelboard. See Section 260533: Electrical Identification for requirements.
- D. Refer to Panelboard Schedules for the following:
1. Mounting style; service voltage; terminal lug size, location and quantity; bus ampacity; interrupting capacity of bus and breakers; quantity, poles and rating of overcurrent protective devices.
- E. Overcurrent protective devices:
1. Refer to Section 262816: Overcurrent Protection Devices.
 2. Overcurrent protective devices shall be molded case circuit breakers.
 3. Main devices shall be hard bus connected to the panelboard bus bars.
 4. In all cases, panelboards fed directly from a transformer shall have a main overcurrent protective device. If not indicated on the Drawings or Panelboard Schedules, provide this device sized to provide the full capacity of the transformer rating.
 5. Main devices shall be vertically mounted and shall have their operating handle in the up position when energized. Main devices that are mounted in the same manner as the

branch devices are NOT acceptable; i.e. main devices shall be individually mounted at the top or bottom of the phase bus bars.

6. Panelboards overcurrent protective devices layout shall conform to the layout indicated on the panelboard schedules.
7. Provide handle ties for single pole circuit breakers that share a neutral conductor.
- F. Finish: Five step zinc phosphate pre-treatment, one coat of rust inhibiting dichromate primer and one coat of baked-on enamel finish, ANSI 61 (light gray).

2.3 DISTRIBUTION PANELBOARDS

- A. Enclosures shall be sized as required and shall meet the space restriction allocated on Drawings. Panelboard shall comply with NEMA PS 1 and FS W-P-115.
- B. Provide necessary hardware to permit locking every overcurrent protective device handle in the "OFF" position.
- C. Where "SPACE" is indicated on panelboard schedules or Drawings, install cross connectors and mounting hardware to match the frame size ampere rated noted.

2.4 BRANCH CIRCUIT PANELBOARDS

- A. Enclosure shall be 20" wide x 5-3/4" deep, surface or flush mounted and shall comply with NEMA PB 1 and FS W-P-115.
- B. Flush panelboards mounted adjacent to each other shall be same physical size.
- C. Where "SPACE" is indicated on panelboard schedules or Drawings, install minimum 100-ampere branch circuit cross connectors and mounting hardware. For future device spaces larger than 100 amps, cross connectors shall match the frame size ampere rated noted.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of panelboard installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

- A. Install panelboards in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
- B. Set panels plumb and symmetrical with building lines in conformance with PB1.1. Furnish and install all construction channel bolts, angles, etc., required to mount the equipment furnished under this Section.
- C. Mounting height shall be 6 feet to the top of the panelboard, unless otherwise noted.
- D. Panelboards shall be anchored and braced to withstand seismic forces as calculated per Section 260010: Basic Electrical Requirements.
- E. Provide mounting hardware brackets, busbar drillings and filler pieces for all unused spaces.
- F. "Train" interior wiring; bundle and clamp, using specified plastic wire wraps specified under Section 260519: Building Wire and Cable.

- G. Replace panel pieces, doors or trim exhibiting dents, bends, warps or poor fit that may impede ready access, security or integrity.
- H. Conduits terminating in concentric, eccentric or oversized knockouts at panelboards shall have ground bushings and bonding jumpers installed interconnecting all such conduits and the panelboard.
- I. Check and tighten all bolts and connections with a torque wrench using Manufacturer's recommended values.
- J. Visually inspect panelboard for rust and corrosion. If signs of rust and corrosion are present, restore or replace panelboard to new condition.
- K. In damp and wet locations, mount panelboards with a minimum one inch of air space between cabinet and the wall or other support material.
- L. Provide close up plugs in all unused openings in the cabinet.
- M. Field install handle ties on single pole circuit breakers that share a neutral conductor.
- N. Circuit breakers feeding "Fire Alarm Control Panel(s)" shall be red in color.

3.3 FIELD QUALITY CONTROLS

- A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:
 - 1. Assure panelboard installation conforms to specified requirements and operates within specified tolerances.
 - 2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
 - 3. Prepare final test report including results, observations, failures, adjustments and remedies.
 - 4. Apply label on panelboards upon satisfactory completion of tests and results.
 - 5. Verify ratings and settings and make final adjustments.
- B. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.
- C. The Contractor shall supply a suitable and stable source of electrical power to each test site. The Testing Agency shall specify the specific power requirements.
- D. Testing of overcurrent protective devices shall be done only after all devices are installed and system is energized.
- E. Prefunctional testing:
 - 1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.
 - 2. Visual and mechanical inspection:
 - a. Inspect for physical damage, defects alignment and fit.

- b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
 - c. Compare nameplate information and connections to Contract Documents.
 - d. Check tightness of all power connections.
 - e. Check that all covers, barriers and doors are secure.
3. Electrical tests:
- a. Insulation resistance: 1000 volt DC tests for one minute on all 600 volt and lower rated equipment, components, buses, feeder and branch circuits and control circuits. Test phase-to-phase and phase-to-ground circuits showing less than 10 megohms resistance to ground shall be repaired or replaced.
 - b. Circuit continuity: All feeders shall be tested for continuity. All neutrals shall be tested for improper grounds.
 - c. Ground resistance: Test resistance to ground of system and equipment ground connection.
 - d. Test overcurrent protection devices per Section 262816: Overcurrent Protective Devices.
- F. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation. The Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the Engineer's hourly rate.
- G. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.
- H. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.
- 3.4 CLEANING
- A. Prior to energizing of panelboards the Contractor shall thoroughly clean the interior of enclosure of all construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.
 - B. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean both the interior and exterior of panelboards per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt and debris.
 - C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

END OF SECTION

SECTION 26 2716

CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Hinged cover enclosures.
 - 2. Cabinets.
 - 3. Terminal blocks and accessories.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. National Electrical Manufacturer's Association (NEMA):
 - NEMA 250; Enclosures for Electrical Equipment.
 - NEMA ICS 1; Industrial Control and Systems.
 - NEMA ICS 4; Terminal Blocks and Industrial use.
 - NEMA ICS 6; Enclosures for Industrial Controls and Systems.
 - 2. Underwriters Laboratories (UL):
 - UL 50; Enclosures for Electrical Equipment.
 - UL 65; Standards for Wired Cabinets.
 - UL 1059; Terminal Blocks.
 - UL 1773; Termination Boxes.

1.3 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Describe Project construction, material, finish and any specific features of each component.
 - 3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 4. Submit Manufacturer's installation instructions.
 - 5. Shop Drawings: Indicating wiring diagrams and equipment arrangement within cabinets.

6. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.

1.4 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 1. Hoffman Engineering Co.
 2. Circle AW Products.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 CABINETS AND ENCLOSURES

- A. Construction: Shall be code gauge galvanized steel with standard concentric knockouts for conduit terminations. Size shall be as indicated on Drawings. Cabinet shall be NEMA 250 Type 1.
- B. Finish: Manufacturer's standard gray baked enamel finish.
- C. Covers: Continuous hinged steel door, lockable and keyed to match panelboard locks.
- D. Mounting:
 1. Flush cabinets shall be furnished with concealed trim clamps and shall be not less than 4 inches deep.
 2. Surface cabinets shall be furnished with screw cover trim, flush hinged door and shall not be less than 6 inches deep.

2.3 BACKBOARDS

- A. Furnish cabinet with 3/4-inch fire retardant plywood mounting backboard on interior unless otherwise indicated on Drawings.

2.4 TERMINAL BLOCKS AND ACCESSORIES

- A. Terminal blocks: NEMA ICS 4; UL listed.

- B. Power terminals: Unit construction type, closed-back with tubular pressure screw connections, rated 600 volts.
- C. Signal and control terminals: See terminal strips in Section 260519: Building Wire and Cable.
- D. Identification: Identify terminal strips with permanent numbers.
- E. Wiring diagram: Provide wiring diagram in protective pocket on inside front cover of cabinet. Diagram shall indicate control wiring, connections and layout of components within enclosure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of cabinets and enclosures installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

- A. Set cabinets and enclosures plumb and symmetrical with building lines. Furnish and install all construction channel bolts, angles, etc. required to mount all equipment furnished under this Section of the Specifications.
- B. Cabinets and enclosures shall be anchored and braced to withstand seismic forces calculated in accordance with that referenced in Section 260010: Basic Electrical Requirement.
- C. "Train" interior wiring, bundle and clamp using specified plastic wire wraps.
- D. Replace doors or trim exhibiting dents, bends, warps or poor fit that may impede ready access, security or integrity.
- E. Terminate conduit in cabinet with lock nut and grounding bushing.
- F. Terminate wiring on terminal blocks and identify each with heat shrink tags.

3.3 CLEANING

- A. Touch-up paint any marks, blemishes or other finish damage suffered during installation.
- B. Vacuum clean cabinet on completion of installation.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Switches.
 - 2. Occupancy sensors.
 - 3. Receptacles.
 - 4. Floor mounted service boxes.
 - 5. Coverplates.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. Division 03: Cast-in-place concrete.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
 - 1. Federal Specification (FS):
 - FS W-P-455A; Plate, Wall Electrical.
 - FS W-C-596; Electrical Power Connector, Plug, Receptacle and Cable Outlet.
 - FS W-S-896; Switch, Toggle.
 - 2. National Electrical Manufacturer's Association (NEMA):
 - NEMA WD-1; General-Purpose Wiring Devices.
 - NEMA WD-5; Specific-Purpose Wiring Devices.
 - 3. Underwriter's Laboratories (UL):
 - UL 20 General-Use Snap Switches.
 - UL 231; Power Outlets.
 - UL 310; Electrical Quick-Connect Terminals.
 - UL 498; Attachment Plugs and Receptacles.
 - UL 514A; Metallic Outlet Boxes.
 - UL 514D; Cover Plates for Flush-Mounted Wiring Devices.

- UL 943; Ground-Fault Circuit-Interruptioners.
- UL 1681; Wiring Device Configurations.

1.3 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 3. Provide color finishes for Architect to select from.
 - 4. Submit Manufacturer's installation instructions.
- B. Where inscribed device coverplates are noted on the Drawings or in the Specifications, conform to the requirements of Section 260553: Electrical Identification.

1.4 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.5 WARRANTY

- A. Occupancy sensors offered under this Section shall be covered by a 1 one year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Switches, receptacles and coverplates:
 - a. Hubbell.
 - b. Pass & Seymour.
 - c. Leviton.
 - 2. Occupancy sensors switches:
 - a. WattStopper
 - b. Leviton
 - c. SensorSwitch, Inc.
 - 3. Floor mounted service boxes:

- a. Hubbell.
- b. Walker.
- c. FSR Inc.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 WALL SWITCHES

A. Standards: Provide general-purpose 120/277 VAC switches that conform to NEMA WD-1 Specifications.

B. Color: Device color shall be as selected by the Architect, unless otherwise noted.

C. Wall switches:

- 1. Provide twenty ampere, 120/277 volt, Specification grade, toggle handle style, quick-make slow-break, quiet type snap switch with silver cadmium alloy contacts, binding head terminal screws, back and side wired with totally enclosed case.

D. Pilot light switches:

- 1. Provide twenty ampere, 120/277 volt, Specification grade, toggle handle, quick-make slow-break, quiet type snap switch with silver cadmium alloy contacts, binding head terminal screws, back and side wired with red handle lighted by a neon lamp which is lighted when the switch is in the 'on' position.

E. Illuminated locator switches:

- 1. Provide twenty ampere, 120/277 volt Specification grade, toggle handle, quick-make slow-break, quiet type snap switch with silver cadmium alloy contacts, binding head terminal screws, back and side wired with clear handle lighted by a neon lamp which is lighted when the switch is in the "off" position.

2.3 OCCUPANCY SENSORS

A. General:

- 1. Occupancy sensors shall comply with the latest edition of the California Building Energy Efficiency Standards, California Building Code, Part 6 and be certified by The California Energy Commission. All sensors shall be listed in the most current directory of Certified Occupancy Sensing Devices or be on file with the CEC.
- 2. Occupancy sensors shall be dual-technology type as specified herein with voltage and wattage rating equal to the lights being controlled.
- 3. All sensors shall have an adjustable time delay for turning off lights and a sensitivity adjustment.
- 4. Ceiling mounted sensors shall operate on low voltage as supplied by control unit. Control unit shall contain power supply and relays for switching loads.
- 5. Units shall be furnished to cover the areas being controlled. No allowance shall be given for providing sensors improperly sized for the square footage of the controlled area.

B. Color: Device color shall be as selected by Architect, unless otherwise noted.

C. Wall mounted single level control sensors:

1. Sensor shall be dual-technology infrared/ultrasonic type with single level switching capability and coverage up to 900 square feet.
 2. Operation shall be manual "ON" and manual or automatic "OFF".
 3. Time delay adjustment from 30 seconds to 30 minutes.
 4. Load capacity of 0 to 1800 watts at connected voltage.
- D. Wall mounted dual level control sensors:
1. Sensor shall be dual-technology infrared/ultrasonic type with dual level switching capability and coverage up to 1000 square feet.
 2. Operation shall be manual (in two levels) "ON" and manual (in two levels) or automatic (full) "OFF".
 3. Time delay adjustment from 30 seconds to 30 minutes.
 4. Load capacity of 50 to 1000 watts at connected voltages.
 5. Integral photocell, 2 circuit, compatible with electronic bi-level switching ballast. Provide with ambient light control adjustment.
- E. Ceiling mounted single-directional sensors:
1. Sensor shall be dual-technology infrared/ultrasonic type single-directional with coverage up to 900 square feet.
 2. Operation shall be automatic "ON" and automatic "OFF". Provide with a manual override switch.
 3. Time delay adjustment from 30 seconds to 30 minutes.
 4. Load capacity of 20 amps per power or slave pack at connected voltage.
 5. Power pack consisting of Class 2, 24V output transformer and relay in single housing, capable of powering up 2 sensors and mounted inside standard 4 inch square box.
- F. Ceiling mounted omnidirectional sensors:
1. Sensor shall be dual-technology infrared/ultrasonic type omnidirectional with coverage up to 1000 square feet.
 2. Operation shall be automatic "ON" and automatic "OFF". Provide with a manual override switch.
 3. Time delay adjustment from 30 seconds to 15 minutes.
 4. Load capacity of 15 amps per power or slave pack at connected voltage.
 5. Power pack consisting of Class 2, 24V output transformer and relay in single housing, capable of powering up to 2 sensors and mounted inside standard 4-inch square box.
- 2.4 RECEPTACLES
- A. Standards:

1. Provide general purpose 20 ampere, 125/250 VAC receptacles that conform to NEMA WD-1 Specifications. Specialty receptacles shall conform to NEMA WD-5 Specifications as applicable.
 2. Provide NEMA 5-20R, commercial specification grade as noted herein, 20 amp, 125 VAC, 2 pole, 3 wire grounding type receptacles.
 3. Receptacles shall be the standard conventional style device.
- B. Color:
1. Device color shall be as selected by the Architect, unless otherwise noted.
- C. General purpose single outlets:
1. Provide self-grounding back and side wired with binding head staked terminal screw.
- D. General purpose duplex receptacles:
1. Provide self-grounding, back and side wired with binding head staked terminal screws and break-off strip for two-circuit wiring.
- E. Plug load controllable receptacles:
1. Shall be provided with receptacle marking printed on the face that it is controlled and shall be NEMA approved, compliant with California Title 24, and ASHRAE Energy Efficiency Standard 90.1
- F. Tamper-resistant single outlets:
1. Provide self-grounding back and side wired with binding head staked terminal screw.
 2. Shall have tamper-resistant feature and shall conform to CEC Article 406.12.
- G. Tamper-resistant duplex receptacles:
1. Provide self-grounding, back and side wired with binding head staked terminal screws and break-off strip for two-circuit wiring.
 2. Shall have tamper-resistant feature and shall conform to CEC Article 406.12.
- H. Ground-fault circuit interrupting (GFCI) receptacles:
1. Provide 20 amp, 125 VAC, receptacles consisting of NEMA 5-20R duplex device with integral solid state sensing and signaling circuitry capable of detecting and interrupting a maximum 5 milli-amp line-to-ground fault current in approximately 1/40th of a second.
 2. Provide visual device with trip indication, manual reset and test mechanisms and with point of use and multi-outlet protection.
 3. Shall have tamper-resistant feature and shall conform to CEC Article 406.12.
- I. Weather-resistant ground-fault circuit interrupting (GFCI) receptacles:
1. Provide 20 amp, 125 VAC, receptacles consisting of NEMA 5-20R duplex device with integral solid state sensing and signaling circuitry capable of detecting and interrupting a maximum 5 milli-amp line-to-ground fault current in approximately 1/40th of a second.
 2. Provide visual device with trip indication, manual reset and test mechanisms and with point of use and multi-outlet protection.

3. Shall have tamper-resistant feature conforming to CEC Article 406.12.
 4. Shall be weather-resistant conforming to UL498.
- J. Special purpose receptacles: Provide Specification grade devices with the NEMA configuration, voltage and current rating, number of poles and ground provisions as noted on the Drawings.

2.5 FLOOR MOUNTED SERVICE BOXES

A. Single or Multi-service recessed floor box:

1. Single service or multi-service (combination power, communication, and/or audio visual) floor box with flush cover and recessed compartment for access to service device(s). Box shall be for installation concrete floors or wood floors as applicable to the application.
2. Box shall be constructed of formed steel with provisions for adjustments before and after pour. Access hatch shall be steel and provided with carpet trim and insert. Make allowances for floor finishes if other than carpet. Furnish with specified receptacle(s) and accessories called for on Drawings.

B. Poke-through floor fitting:

1. Single service or multi-service (combination power, communication, and/or audio visual) flush style, fire rated, poke-through device for installation in a 6" or 8" nominal hole through a concrete floor. Provide with finish ring, receptacle, cable access, box, etc. or any other accessories to facilitate the installation indicated on Drawings.

2.6 COVERPLATES

A. General:

1. Provide all coverplates with rounded edges and corners, smooth and free of grooves, embossing or other embellishment.
2. Provide mounting screws to match the plate finish.
3. Provide gang type coverplates where two or more devices are installed at one location. Individual gangable coverplates are not acceptable.
4. Provide plates of one design throughout the Project unless otherwise specified.

B. Color: Coverplate color shall be as specified by the Architect, unless otherwise noted.

C. Plastic coverplates:

1. Provide smooth, high impact, self-extinguishing thermoplastic coverplates and 0.100 inches thick with rounded edges and corners.
2. Provide openings to accommodate the devices indicated on the Drawings and in the Specifications.

D. Metal coverplates:

1. Provide smooth, type 430 stainless steel coverplates, 0.035" thick with rounded edges and corners.
2. Provide openings to accommodate the devices indicated on the Drawings and in the Specifications.

- E. Weatherproof coverplates:
 - 1. Provide horizontal mounted, weatherproof in-use coverplate for one duplex or one GFCI receptacle. Provide gasketed, spring loaded, vertically self-closing covers suitable for use in damp and wet locations as described in UL 514 and CEC 406. Covers shall allow the use of the device with the cover closed.
 - 2. Furnish base plates, covers, hinge pins, spring and screws of corrosion resistant type 302 stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of wiring device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

- A. Coordinate device heights in vending, kitchen and utility areas with benches and counters.
- B. Coordinate switch mounting location with Architectural details. Unless otherwise noted, locate switches on latch side of door.

3.3 INSTALLATION

- A. Install wiring devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
- B. Install devices with the vertical centerline plumb and with all edges of the device flush against the adjacent wall surfaces.
- C. Mount switches at 42 inches to center above finished floor unless otherwise noted.
- D. Mount receptacles vertically with the centerline 18 inches above finished floor and with grounding slot at bottom.
- E. Mount receptacles horizontally when mounting above counters, mount with grounding slot to the left.
- F. Mount GFCI receptacles in the following locations, whether indicated as GFCI type or not on the drawings:
 - 1. In toilet rooms.
 - 2. Where receptacles are installed within 6'0" from edge of sinks.
 - 3. In kitchens above counters.
 - 4. On rooftops.
 - 5. Outdoors.
 - 6. Where serving vending machines.
 - 7. Where serving electric drinking fountains.
 - 8. Where required by the California Electrical Code.

- G. Provide coverplates for all outlet boxes, switches, receptacles, etc.
- H. Install blank coverplates on all outlet boxes in which no device is required or installed.
- I. Provide coverplates that completely cover wall opening and seat against wall.
- J. Provide stainless steel coverplates for all devices in kitchen/food service equipment areas.

3.4 OCCUPANCY SENSORS

- A. Set time delays in sensors in accordance with Owner's directions.
- B. Where substituted occupancy sensors are used, it shall be the responsibility of the Contractor to place sensors in the proper place and with proper alignment to cover to all the area intended in the Contract Documents.
- C. Provide one power pack with each ceiling mounted occupancy sensor, whether indicated or not on plans, unless wiring details or plans indicate otherwise.
- D. Install wall mounted devices with the vertical centerline plumb and alleges of device flush against adjacent wall surfaces.

3.5 FLOOR MOUNTED SERVICE BOXES

- A. Installation:
 - 1. Install floor boxes to be level or within 1/16" below screed line.
 - 2. Make conduit connections and anchor box to sub-flooring.
 - 3. Core drill hole in floor (core sized based on Manufacturer's installation instructions) for insert of poke-through device.
 - 4. Make conduit connection to poke-through box from floor below.
- B. Coordination: Contractor shall mark the location of all floor boxes with paint prior to installation or core drilling for review and approval by Architect.

3.6 FIELD QUALITY CONTROL

- A. Electrical testing:
 - 1. Test proper polarity of all receptacles.
 - 2. Test ground continuity of all wiring devices.
 - 3. Test ground fault interrupting device operation.
- B. Visual and mechanical inspection:
 - 1. Check proper operation of all switches.
 - 2. Visually inspect and replace damaged or defective devices.

3.7 CLEANING

- A. Clean interior of all boxes from dirt and paint prior to installation of devices.
- B. Clean wiring devices and coverplates from dirt and paint over spray.

END OF SECTION

SECTION 26 28 16
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Fuses.
 - 2. Molded case circuit breakers.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Federal Specification (FS):
 - FS W-C-375; Circuit Breakers, Molded Case, Branch Circuit and Service.
 - FS W-F-870; Fuseholders (for Plug and Enclosed Cartridge Fuses.
 - 2. Underwriters Laboratories, Inc. (UL):
 - UL 248(1-16); Low-Voltage Fuses.
 - UL 489; Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
 - UL 512; Fuseholders.
 - UL 1066; Low Voltage AC and DC Power Circuit Breakers Used in Enclosures.
 - 3. National Electrical Manufacturer Association (NEMA):
 - NEMA AB 1; Molded Case Circuit Breakers.

1.3 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Describe product operation, equipment and dimensions and indicate features of each component.

3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
4. Provide factory certification of trip characteristics for each type and rating of circuit breaker.
5. Provide current let-through and melting time information for each type and rating of fuses.
6. Submit Manufacturer's installation instructions.
7. Complete bill of material listing all components.
8. Warranty.

1.4 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
 1. A detailed explanation of the operation of the system.
 2. Instructions for routine maintenance.
 3. Parts list and part numbers.
 4. Telephone numbers for authorized parts and service distributors.
 5. Final testing reports.

1.5 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Overcurrent Protective Device components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.7 WARRANTY

- A. Units and components offered under this Section shall be covered by a 1 year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

1.8 EXTRA MATERIAL

- A. Three (3) spare fuses of each size and type or a minimum of 10 percent of the number installed, whichever is greater, shall be supplied to the Owner in the specified spare fuse cabinet(s).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Fuses:
 - a. Bussmann Division, Cooper Industries.
 - b. Gould Shawmut Co.
 - c. Littlefuse Inc.
 - 2. Circuit breakers:
 - a. Eaton Electrical
 - b. Siemens
 - c. Square D
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 FUSES

- A. General: All power fuses shall be time-delay, high interrupting (300 K AIC), current limiting type, unless otherwise noted on the Drawings. All fuses shall be the product of a single Manufacturer and shall be selectively coordinated when applied in 2:1 ratios. Types of fuses shall be as follows:
 - 1. 0 - 600 amperes: UL Class J, dual element, time delay type fuse with separate overload and short-circuit elements. The fuse shall hold 500% of rated current for a minimum of 10 seconds.
 - 2. 601 - 4000 amperes: UL Class L, time delay type fuses with 99.9% pure silver fuse links and "O-rings" to seal between the end bells and the fuse barrel. Fuses shall hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in 0.01 seconds or less.
 - 3. Motor branch circuit fuses (0-600 amperes): UL Class J dual element, time delay type fuse. Motor branch circuit fuses shall be sized for Type 2 coordination for the motor controller and back-up motor overload protection and shall be coordinated with motor starter overload relay heaters.
- B. Control and instrument fuses shall be suitable for installing in blocks or fuse holders. Exact type and rating shall be as recommended by the Manufacturer of the equipment being protected.
- C. Fuses for installation in current limiting circuit breakers or motor circuit protectors shall meet the specific requirements of the Manufacturers of that equipment to ensure compatibility.

2.3 MOLDED CASE CIRCUIT BREAKERS

- A. Unless noted otherwise, circuit breakers shall be molded case, bolt on and trip indicating.
- B. Where stationary molded case circuit breakers are indicated on the Drawings to be current limiting type, they shall be current limiting as defined by UL 489 and shall not employ any fusible elements.
- C. Circuit breakers shall have interrupting capacity not less than that indicated on the Drawings or if not indicated, not less than 25,000 RMS symmetrical amps for 480 volt systems and 10,000 RMS symmetrical amps for 208 volt systems.
- D. Covers shall be sealed on non-interchangeable breakers and trip unit covers shall be sealed on interchangeable trip breakers to prevent tampering. Circuit breaker ratings shall be clearly visible after installation or engraved nameplates shall be provided stating the rating. All ferrous parts shall be plated to minimize corrosion.
- E. Circuit breakers shall be toggle, quick-make and quick-break operating mechanisms with trip-free feature to prevent contacts being held closed against overcurrent conditions in the circuit. Trip position of the breakers shall be clearly indicated by operating handles moving to a center position.
- F. Multipole breakers shall have a single handle to open and close all contacts simultaneously in both manual operation and under automatic tripping. Interpole barriers shall be provided inside the breaker to prevent any phase-to-phase flashover. Each pole of the breaker shall have means for Arc extinguishing.
- G. All terminals shall be rated for aluminum or copper wire.
- H. Unless noted otherwise, circuit breakers with trip ratings 400 amp and smaller shall be ambient temperature compensated, thermal magnetic type unless otherwise noted. Breakers shall be of full size, 1" per pole type. Panels with more than one branch breaker larger than 100 amps shall be installed in distribution type panels.
- I. Circuit breakers with trip ratings 401 amps through 800 amps shall have solid state electronic trips with true RMS reading through the 13th harmonic with 1% accuracy, interchangeable trip via front accessible current plug, adjustable instantaneous and short time be rated as indicated on Drawings at the voltage indicated.
- J. Circuit breakers with trip ratings 801 amps through 2000 amps shall have electronic trips with the following characteristics:
 - 1. Electronic true RMS sensing trip, adjustable via current plug.
 - 2. Adjustable long time setting and delay.
 - 3. Adjustable short time pick-up and delay.
 - 4. Adjustable instantaneous pick-up.
- K. Accessories: Provide accessories as noted on the Drawings, i.e. shunt-trip, auxiliary contacts, undervoltage trip, alarm switch, etc.
- L. Spaces in the boards shall be able to accept any combination of 1, 2 or 3 pole circuit breakers as indicated. Provide all necessary bus, device supports and mounting hardware sized for frame, not trip rating.

M. Series rated breakers are not acceptable unless specifically noted on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of overcurrent protective device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

A. Install overcurrent protective devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Tighten electrical connectors and terminals; including screws and bolts, in accordance with equipment Manufacturers published torque-tightening values for equipment connectors. Where Manufacturers torque requirements are not indicated tighten connectors and terminals to comply with tightening torque specified in UL Standard 486A.

C. Install overcurrent protective devices and accessories in accordance with Manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. All devices shall be installed in accordance with applicable CEC and NEMA standards for installation.

D. Circuit breakers serving "Fire Alarm Control Panel(s)" shall be red in color.

3.3 FIELD QUALITY CONTROL

A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:

1. Assure overcurrent protective device installation conforms to specified requirements and operates within specified tolerances.
2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
3. Prepare final test report including results, observations, failures, adjustments and remedies.
4. Verify ratings and settings and make final adjustments.

B. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.

C. The Contractor shall supply a suitable and stable source of electrical power to each test site. The Testing Agency shall specify the specific power requirements.

D. Testing of overcurrent protective devices shall be done only after all devices are installed and system is energized.

E. Prefunctional testing:

1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.

2. Visual and mechanical inspection:
 - a. Inspect for physical damage, defects alignment and fit.
 - b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
 - c. Compare nameplate information and connections to Contract Documents.
 - d. Check tightness of all control and power connections.
 - e. Check that all covers, barriers and doors are secure.
 3. Electrical tests:
 - a. Circuit continuity: All feeders shall be tested for continuity. All neutrals shall be tested for improper grounds.
 - b. Determine that circuit breaker will trip under overcurrent condition, with tripping time in conformance with NEMA AB 1 requirements.
 - c. Test all circuit breakers with frame size 225 amps and larger and 10 percent of all circuit breakers with frame sizes less than 225 amps in each panelboard, distribution board, switchboard, etc. unless otherwise noted.
- F. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.
- G. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.
- 3.4 ADJUSTING
- A. Adjust circuit breaker trip settings for coordination with other overcurrent protective devices in system.
 - B. Adjust circuit breaker trip settings for adequate protection from overcurrent and fault currents.
- 3.5 CLEANING
- A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean overcurrent protective devices per Manufacturer's approved methods and materials. Remove paint splatters and other spots, dirt and debris.
- 3.6 TRAINING
- A. Factory authorized service representative shall conduct a 4 hour training seminar for Owner's Representatives upon completion and acceptance of system. Instructions shall include safe operation, maintenance and testing of equipment with both classroom training and hands-on instruction.
 - B. Contractor shall schedule training with a minimum of 7 days advance notice.

END OF SECTION

SECTION 26 28 19
DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Disconnect Switches.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated on specified:
 - 1. Federal Specifications (FS):
 - FS W-F-870; Fuseholders (for plug and enclosed cartridge fuses).
 - FS W-S-865; Switch, Box (enclosed), Surface-Mounted.
 - 2. National Electrical Manufacturer Association (NEMA):
 - NEMA KS 1; Enclosed Switches.
 - 3. Underwriters Laboratories, Inc. (UL):
 - UL 512; Fuseholders.

1.3 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. As a minimum the following characteristics shall be indicated:
 - a. NEMA types.
 - b. Current rating.
 - c. Number of poles.
 - d. Fuse provisions.
 - e. Enclosure dimensions.
 - f. Voltage.
 - g. Horsepower rating (if applicable).

- h. Short circuit rating.
- 3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
- 4. Submit Manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Eaton Electrical
 - 2. Siemens
 - 3. Square D
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 DISCONNECT SWITCHES

- A. Description: Provide NEMA heavy-duty type switches with dead front construction and padlock provisions for up to three locks in the "OFF" position.
- B. Switch interior: Provide switch with switchblades that are fully visible in the "OFF" position when the door is open. Provide UL listed lugs for copper conductors, lugs to be front removable. Provide plated current carrying part.
- C. Switch mechanism: Provide switches with a quick-make, quick-break, position indicating, operating handle and mechanism and a dual cover interlock to prevent unauthorized opening of the switch door in the "ON" position or closing of the switch mechanism with the door open. Furnish an electrical interlock to de-energize control wiring when the disconnect switch is opened.
- D. Enclosures: Provide switches with hinged cover in NEMA 1 general purpose; sheet steel enclosure for dry locations and NEMA 3R weatherproof galvanized enclosures for exterior, damp or wet locations, unless otherwise noted on the Drawings. Provide an enclosure treated with a rust-inhibiting phosphate primer and finished in gray baked enamel.
- E. Ratings: Provide switches that are horsepower rated for 240 VAC or 600 VAC as required for the circuit involved and that meet "I-SQUARED-T" requirements. Fusible switches to have provisions for the types of fuses specified in Section 262816: Overcurrent Protective Devices. UL listed short circuit rating, when equipped with fuses to be 200,000 amperes RMS symmetrical. Furnish with provisions for RK-1 fuses for switches up to 600 amps. 800 amp switches and larger to have provisions for Class L fuses.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of disconnects switch installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

- A. Coordinate locations of switches and equipment in the field to provide code required clearances in front of switches and to ensure that switches are insight of the controller as described in CEC Article 430.

3.3 INSTALLATION

- A. Install disconnect switches where indicated on the Drawings.
- B. Install fuses in fusible disconnect switches.
- C. Include construction channel and mounting hardware as required to support disconnect switch.

3.4 IDENTIFICATION

- A. Provide engraved, machine screw retained type 'NP' nameplate on each disconnect switch. See Section 260553: Electrical Identification.

3.5 CLEANING

- A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean both the interior and exterior of enclosure of all construction debris, scrap wire, paint splatters, dirt, etc.

END OF SECTION

SECTION 26 29 00
MOTOR CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Manual motor starters.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. Division 09: Painting. Touch-up of painted surfaces.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
 - 1. Federal Specifications (FS):
 - FS W-F-870; Fuseholders (for plug and enclosed cartridge fuses).
 - FS W-S-865; Switch, Box, (Enclosed) Surface-Mounted.
 - 2. Underwriters Laboratories, Inc. (UL):
 - UL 198; Fuses (applicable subsections).
 - UL 486E; Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
 - UL 489; Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
 - UL 508; Industrial Control Equipment.
 - UL 508A; Industrial Control Panels.
 - 3. National Electrical Manufacturer Association (NEMA):
 - NEMA ICS 2; Industrial Control Devices, Controllers and Assemblies.
 - NEMA ICS 6; Enclosures for Industrial Controls and Systems.
 - NEMA KS 1; Enclosed Switches.

1.3 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Describe system operation, equipment and dimensions and indicate features of each component.

3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
4. Include detailed control wiring diagrams for each starter.

1.4 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
 1. A detailed explanation of the operation of the system.
 2. Instructions for routine maintenance.
 3. Pictorial parts list and part numbers.
 4. Final testing reports.

1.5 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Motor control components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.7 WARRANTY

- A. Units and components offered under this Section shall be covered by a 1 year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

1.8 EXTRA MATERIAL

- A. Provide one spray can of matching finish paint for touching up damaged surfaces after installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Square D.
 - 2. Eaton Electrical/Cutler-Hammer.
 - 3. General Electric.
 - 4. Siemens/I-T-E.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 MANUAL MOTOR STARTERS

- A. Manual motor starter: AC general purpose Class A manually operated non-reversing full-voltage controller for induction motors rated in horsepower, with overload relay, red pilot light, auxiliary contacts when indicated on Drawings and pushbutton operator. Starter size and number of poles shall be as required for connections indicated on Drawings. Furnish in conformance with NEMA ICS 2.
- B. Fractional horsepower manual starters: AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit and toggle operator. Starter size and number of poles shall be as required for connections indicated on Drawings. Furnish in conformance with NEMA ICS 2.
- C. Enclosure: NEMA ICS 6; Type 1 or 3R.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of motor control installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 GENERAL

- A. Install motor control equipment in accordance with Manufacturer's instructions, as indicated on the Drawings and as specified herein.
- B. Install equipment where indicated on the Drawings.

3.3 MOUNTING

- A. Include construction channel and mounting hardware as required to support motor control equipment.

- B. Coordinate locations of control equipment in the field to provide code clearances in front of devices.

3.4 IDENTIFICATION

- A. Provide engraved, machine screw-retained type 'NP' nameplate on each motor control device. Refer to Section 260553: Electrical Identification.

3.5 FIELD QUALITY CONTROL

- A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:
 - 1. Assure motor controls installation conforms to specified requirements and operates within specified tolerances.
 - 2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
 - 3. Prepare final test report including results, observations, failures, adjustments and remedies.
 - 4. Verify ratings and settings and make final adjustments to overcurrent protective devices.
- B. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.
- C. The Contractor shall supply a suitable and stable source of electrical power to each test site. The Testing Agency shall specify the specific power requirements.
- D. Testing of overcurrent protective devices shall be done only after all devices are installed and system is energized.
- E. Prefunctional testing:
 - 1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.
 - 2. Visual and mechanical inspection:
 - a. Inspect for physical damage, defects alignment and fit.
 - b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
 - c. Compare nameplate information and connections to Contract Documents.
 - d. Check tightness of all control and power connections.
 - e. Check that all covers, barriers and doors are secure.
 - f. Verify that motor controls meet specified requirements.
 - 3. Electrical tests:
 - a. Insulation resistance: 1000 volt DC tests for one minute on all 600 volt and lower rated equipment, components, buses, feeder and branch circuits and control circuits. Test phase-to-phase and phase-to-ground circuits showing less than 10 megohms resistance to ground shall be repaired or replaced.

- b. Circuit continuity: All feeders shall be tested for continuity. All neutrals shall be tested for improper grounds.
 - c. Ground resistance: Test resistance to ground of system and equipment ground connection.
 - d. Test overcurrent protection devices per Section 262816: Overcurrent Protective Devices.
- F. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation, the Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the Engineer's hourly rate.
- G. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.
- H. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.

3.6 CLEANING

- A. Prior to energizing of motor controls the Contractor shall thoroughly clean the interior of enclosure of all construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.
- B. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean both the interior and exterior of motor controls per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt and debris.
- C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

END OF SECTION

SECTION 26 4313

SURGE PROTECTIVE DEVICES (SPD)

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Surge protective devices (SPD).
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
 - 1. American National Standards Institute, Inc. (ANSI)/Institute of Electrical and Electronics Engineers (IEEE):
 - ANSI/IEEE C62.1; Standard for Surge Arresters for Alternating Current Power Circuits.
 - ANSI/IEEE C62.11; Standard for Metal-Oxide Surge Arrestors for AC Power Circuits.
 - ANSI/IEEE C62.41.1; Guide on the Surges Environment in Low-Voltage (1000V and Less) AC Power Circuits.
 - ANSI/IEEE C62.41.2; Recommended Practices on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits.
 - ANSI/IEEE C62.45; Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits.
 - 2. Underwriters Laboratory, Inc. (UL):
 - UL 50; Cabinets and Boxes.
 - UL 1283 Electromagnetic Interference Filters.
 - UL 1449; Surge Protective Devices, 3rd Edition.
 - 3. National Electrical Manufacturers Association (NEMA):
 - NEMA LS1; Low Voltage Surge Protective Devices.
 - NEMA PB1.1; Instructions for Safety Instruction Operation and Maintenance of Panelboards Rated 600 Volts or less.

1.3 SYSTEM DESCRIPTION

- A. Provide surge protective device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the drawings. To maximize performance

and reliability and to obtain the lowest possible let-through voltages, the ac surge protection shall be integrated into electrical distribution equipment such as switchboards and panelboards.

- B. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3rd Edition).
- C. SPD units shall be furnished in two Types. Type 1 and Type 2 as outlined below:
 - 1. Type 1: Permanently connected SPDs installed on the line or load side of main disconnect device(s), at main switchboard. This type closely relates to the devices previously referred to as secondary surge arrestors. These Type 1 SPDs should be specially suited to conduct the high energy impulses from lightning strikes.
 - 2. Type 2: Permanently connected SPD installed on the load side of the service panel main disconnect device(s). This type most closely relates to devices that were previously classified as Transient Voltage Surge Suppression (TVSS). These Type 2 SPDs are specially suited for distribution boards and panelboard applications.

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Describe system operation, equipment and dimensions and indicate features of each component.
 - 3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 4. Shop Drawings: Include elevations, cabinet dimensions, complete component listing and layout within cabinet, amperage ratings and capacities, system characteristics and wiring diagrams.
 - 5. Submit Manufacturer's installation instructions.
 - 6. Complete bill of material listing all components.
 - 7. Warranty.

1.5 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following.
 - 1. A detailed explanation of the operation of the system.
 - 2. Instruments for routine maintenance.
 - 3. Pictorial parts list and parts number.
 - 4. Telephone numbers for authorized parts and service distributors.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: SPD components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with the Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.8 WARRANTY

- A. Units and components offered under this Section shall be covered by a 5 year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 1. Current Technology.
 2. Square D SurgeLogic/EFI.
 3. Clipper Power System (Cutler-Hammer).
 4. Liebert.
 5. General Electric.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 GENERAL

- A. All Specification noted herein apply to the switchboard and panelboard units, unless otherwise noted.
- B. The SPD system utilizes diversion modules to suppress and divert transient voltage and surge currents. The system is designed to provide protection for sensitive electronic devices against the effects of surges, transients and electrical line noise.

- C. Environmental requirements:
1. Operating temperature: -40c to 60c.
 2. Relative humidity: 0 - 95%.
 3. Operating altitude: 0 - 12,000 feet.
 4. Audible noise: Less than 35 dB.
- D. Electrical requirements:
1. Unit operating voltage: The SPD system voltage shall be as indicated on the Drawings.
 2. Maximum continuous operating voltage (MCOV): The MVOC shall not be less than 125% of the nominal system operating voltage.
 3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
 4. Protection modes: The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

PROTECTION MODES TABLE				
CONFIGURATION	L-N	L-G	L-L	N-G
WYE	•	•	•	•
Delta	N/A	•	•	N/A
Single Split Phase	•	•	•	•
High Leg Delta	•	•	•	•

5. Nominal discharge current (In): All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20kA shall be rejected.
6. Voltage protection rating (VPR): The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

VOLTAGE PROTECTION RATING TABLE				
SYSTEM VOLTAGE	L-N	L-G	L-L	N-G
120/208	700V	700V	1200V	700V
277/480	1200V	1200V	2000V	1200V
346/600	1500V	1500V	3000V	1500V

- E. SPD design:
1. The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
 2. The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV.
 3. Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50dB from 10kHz to 100MHz using the MIL-STD-220A insertion loss test method.

4. No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. SPD shall provide the following integral monitoring options:
 - a. Each unit shall have a green/red solid-state indicator light that reports the status of the protection on each phase:
 - 1) For WYE configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. WYE configured units shall also contain an additional green/red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode.
 - 2) For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.
 - 3) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators shall indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights shall continue to indicate the status of the protection on all other phases and protection modes.
 - b. The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
 - c. The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.
 - d. Surge counter:
 - 1) The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location.
 - 2) The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of $50 \pm 20A$ occurs.
 - 3) A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.
 - 4) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.
6. The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

7. All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.
8. Safety requirements:
 - a. The SPD shall minimize potential arc flash hazards by containing no user serviceable or replaceable parts and shall be maintenance free. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
 - b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

2.3 SYSTEM APPLICATION

- A. The SPD applications covered under this section include switchgear, switchboards panelboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.
- B. The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

MINIMUM SURGE CURRENT CAPACITY TABLE			
CATEGORY	APPLICATION	PER PHASE	PER MODE
C	Service Entrance Locations (Switchboards)	250kA	125kA
B	High Exposure Roof Top Locations (Switchboards and Panelboards)	160kA	80kA
A	Branch Locations (Panelboards)	120kA	60kA

- C. All SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

2.4 PANELBOARDS

- A. The SPD application covered under this section includes lighting and outlet panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category A or B environments.
- B. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
- C. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
- D. The panelboard shall be capable of re-energizing upon removal of the SPD.
- E. The SPD shall be interfaced to the panelboard via a direct bus bar connection.

- F. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
- G. The SPD shall be of the same manufacturer as the panelboard.
- H. The complete panelboard including the SPD shall be UL67 listed.

2.5 SWITCHBOARDS

- A. The SPD application covered under this section is for switchboard locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.
- B. The SPD shall be of the same manufacturer as the switchboard.
- C. The SPD shall be factory installed inside the switchboard at the assembly point by the original equipment manufacturer.
- D. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
- E. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.
- F. The SPD shall be integral to switchboard as a factory standardized design.
- G. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.6 ENCLOSURES

- A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:
 - 1. NEMA 1: Constructed of a polymer (units integrated within electrical assemblies), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).
 - 2. NEMA 4: Constructed of steel, intended for either indoor or outdoor use, to provide a degree of protection from the following:
 - a. Against access to hazardous parts.
 - b. Of equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust).
 - c. With respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water).

2.7 SOURCE QUALITY CONTROL

- A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of SPD installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

- A. Install SPD in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
- B. Set cabinets plumb and symmetrical with building lines in conformance with PB1.2. Furnish and install all construction channel bolts, angles, etc., required to mount the equipment furnished under this Section.
- C. Unless otherwise indicated on the Power Single Line Diagram, provide SPDs on all service entrance switchboards, 120/208 volt distribution switchboards and 120/208 volt panelboards.
- D. Conductors from the power source to the SPD shall be minimum #4 AWG copper in switchboards. Conductors shall be routed without sharp bends and straight and short as possible. The absolute maximum of 7'-0" long for units in switchboards and 1'-0" long for units in panelboards.
- E. Conductors originating from direct bus bar connections shall be individually wrapped with electric tape in half-lapped increments for added protection of the un-protected conductors. Tie-wrap the conductors away from the bus bars without any sharp bends. All holes that the conductors pass through shall be grommets.
- F. Cabinets shall be anchored and braced to withstand seismic forces as calculated per Section 260010: Basic Electrical Requirements.

3.3 FIELD QUALITY CONTROL

- A. Prefunctional testing:
 - 1. Visual and mechanical inspection:
 - a. Inspect for physical damage, defects, alignment and fit.
 - b. Compare nameplate information and connections to Contract Documents.
 - c. Check tightness of all control and power connections.

END OF SECTION

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Interior lighting fixtures.
 - 2. Light emitting diodes (LEDs).
 - 3. LED drivers.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. Division 05: Miscellaneous. Fittings, brackets, backing supports, rods, etc. as required for support and bracing of lighting fixtures.
 - 2. Division 09: Acoustical treatment. Slack fixture support wires.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Underwriters Laboratories, Inc. (UL):
 - UL 66; Fixture Wire.
 - UL 844; Electric Lighting Fixtures for Use in Hazardous Locations.
 - UL 924; Emergency Lighting and Power Equipment.
 - UL 1598; Luminaires.
 - UL 2108; Low Voltage Lighting Systems.
 - 2. Illumination Engineering Society of North America (IESNA):
 - IESNA LM-79-2008; Approved Method for Electrical and Photometric Measurements of Solid-State Lighting Products.
 - IESNA LM-80-2008; Approved Method for Measuring Lumen Maintenance of LED Light Sources.
 - 3. Restriction of Hazardous Substances in LED (RoHS):
 - EU RoHS; Directive 2002/95/EC Restriction of Hazardous Materials.

1.3 SYSTEM DESCRIPTION

- A. Provide and install a fully functional and operating lighting fixture system as indicated, complete with, wiring, control and securely attached to support system to meet all seismic code requirements.
- B. Where catalog number and narrative or pictorial descriptions are provided, the written description shall take precedence and prevail.

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 3. Independent Testing Laboratories, Inc. or equal, photometric test report for each luminaire type listed on the fixture schedule. Test reports shall be based on Illuminating Engineering Society published test procedures and shall contain candlepower distribution curves in five lateral planes for fixtures with asymmetric distributions and fixture luminance data for vertical angles above 45 degrees from nadir.
 - 4. Shop Drawings:
 - a. Suspension details for fixtures recessed in, mounted on or suspended from hung ceilings. Details shall clearly illustrate proposed methods for complying with the requirements of CAC Title 24 and CBC Standard No. 47-18 requiring support independent of the suspended ceiling system.
 - 5. Mock-ups: Provide mock-up lighting fixture samples where "FIXTURE MOCK-UP" is indicated on the Fixture Schedule. Refer to Part 3 – Execution for requirements.
 - 6. Submit Manufacturer's installation instructions.
 - 7. Complete bill of material listing all lighting fixtures and other components.
 - 8. Warranty.
 - 9. In addition to the requirements for Substitutions, under Section 260010: Basic Electrical Requirements, all requests for approval of non-specified products must be accompanied by the following:
 - a. A list of comparable buildings where the product is currently installed and can be observed. Buildings shall be within a 100-mile radius of District's office.
 - b. Furnish a working sample complete with housing, trim, and 8' cord and plug.

1.5 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
 - 1. A detailed description and catalog cut of each lighting fixture type.
 - 2. Instructions for routine maintenance.

3. Pictorial parts list and parts number.
4. Telephone numbers for authorized parts and service distributors.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Lighting fixtures shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.8 WARRANTY

- A. Light fixtures offered under this Section shall be covered by a parts and labor warranty for malfunctions resulting from defects in materials and workmanship. The warranty period shall be no less than 5 years for LED light fixtures, 2 years for any other light fixture. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 1. Lighting fixtures: Refer to Fixture Schedule.
 2. LEDs & LED drivers: As provided by the light fixture manufacturer, and meeting the requirements herein.
 3. LED Retrofit Lamps:
 - a. Cree
 - b. Sora
 4. LED emergency battery pack:
 - a. Bodine.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 FIXTURES

- A. Refer to the fixture schedule on the plans.
- B. All fixtures shall have LED light source.
- C. Maximum color temperature shall be 3500 K.
- D. Standard lumen output shall meet or exceed the State of California Title 24 Energy Code for high efficiency luminaires.
- E. Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable luminaires with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.
- F. Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management.
- G. Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays
- H. The finish of all fixtures and trim shall be submitted to and approved by the Architect prior to ordering.
- I. All standard fixtures must bear UL label. Attaching of labels after delivery of fixtures is not acceptable.
- J. All labels affixed to the fixture shall be in a location not visible from normal viewing angles.
- K. Ferrous mounting hardware and accessories shall be finished using either a galvanic or phosphate primer/baked enamel process to prevent corrosion and discoloration of adjacent materials.
- L. Fasteners shall be manufactured of galvanized steel.
- M. Fixtures shall be free of light leaks and shall be designed to provide sufficient ventilation of LED arrays.
- N. All sheet metal Work shall be free from tool marks and dents and shall have accurate angles bent as sharp as compatible with the gauges of the required metal. All intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly. All surfaces shall be finished so as to eliminate all exposed sharp edges. All mitered corners or joints shall be accurately aligned with abutting intersecting members. Sheet metal Work shall be properly fabricated so that planes will not deform (i.e. become concave or convex) due to normal expected ambient and operating conditions.
- O. Wiring channels and LED array mountings shall be rigid and accurately constructed.
- P. Architectural Coordination
 - 1. Consult Architectural Drawings for details of ceiling construction, finish, reflected ceiling plans and other applicable details and provide lighting fixtures suitable for the particular type of ceiling at each location.
 - 2. Recessed fixtures installed in direct contact with insulation shall carry an IC rating.

3. Where fixtures are mounted in architectural coves, soffits, valances or cabinets and are given an overall length, the Contractor shall verify all lengths in the field prior to releasing fixture order.
4. Where fixtures are surface mounted or suspended to match the length of walls or other architectural elements, the Contractor shall verify all lengths in the field prior to releasing fixture order.

2.3 LIGHT EMITTING DIODES (LED):

- A. Refer to the Fixture Schedule for size and type of LED lamps required.
- B. All diodes shall come from the same manufacturer and carry the same bin number.
- C. All diodes shall be tested and tuned for the optimal Kelvin color point.
- D. Color correlated temperature: 3500K
- E. Minimum CRI (Color Rendering Index): 80
- F. Diodes shall have a minimum life of 50,000 hours and maintain at least 70% of initial lumens throughout this period.
- G. LED fixture components shall be free of all toxic materials to include lead, cadmium and mercury, and shall be RoHS compliant.
- H. Groups of three or more diodes in a single housing shall be tested for even distribution.
- I. All LED fixtures shall have an IES formatted electronic photometric report.
- J. Comply with IES LM-79-08 Approved Method for measuring lumen maintenance of LED light sources.
- K. Comply with IES LM-80-08 Approved Method for electrical and photometric measurement of SSL product.
- L. LED arrays shall be sealed, high performance, long life type; minimum 70% rated output at 50,000 hours.
- M. LEDs shall be "Bin No. 1" quality.
- N. The LED light source shall be fully dimmable with use of compatible dimmers switch designated for low voltage loads.

2.4 LED DRIVERS:

- A. LED drivers shall be integral to fixture housing or remotely located, when specified, within 15 feet of diode assembly.
- B. Drivers shall have a minimum life of 50,000 hours and maintain at least 70% of initial lumens for that period.
- C. Typical LED drivers shall be electronic, 0-10V dimming.
- D. Drivers shall be solid state and accept 120 through 277 VAC at 60 Hz input.
- E. Power Factor: 0.90 or higher.
- F. Maximum driver case temperature not to exceed driver manufacturer recommended operational parameters.

- G. Output operating frequency: 60Hz.
- H. Interference: EMI and RFI compliant with FCC 47 CFR Part 15.
- I. Total Harmonic Distortion Rating: 20% Maximum.
- J. Meet electrical and thermal conditions as described in LM-80 Section 5.0. 7.

2.5 FIXTURE TRANSFORMERS

- A. Low voltage transformers:
 - 1. Low voltage transformers shall be core and coil construction, unless otherwise noted.
 - 2. Primary voltage shall be as noted in Fixture Schedule, secondary voltage 12 VAC, unless otherwise noted.
 - 3. Where transformers are integral to the fixture, they shall be accessible from below.
 - 4. Sound rating shall be the lowest available. Replace excessively noisy transformers at no cost to the Owner.

2.6 EMERGENCY BATTERY PACKS

- A. Internal type: Self-contained, modular, battery inverter unit factory mounted within the fixture body.
 - 1. Test switch and LED indicator light: Visible and accessible without entering ceiling space.
 - 2. Battery: Sealed, maintenance-free, nickel-cadmium type, with a minimum nominal 10-year life.
 - 3. Charger: Fully automatic, solid state, constant-current type.
 - 4. The product shall meet the U.L. Standard #924 "Emergency Lighting Equipment".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of lighting fixture installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

- A. Architectural Plans shall govern exact ceiling construction and mounting conditions for all fixtures. Contractor shall be responsible for coordination of fixture mounting and compatibility with ceiling construction.
- B. Fixtures in areas where exposed or concealed pipe and ductwork prevents direct access to the structural ceiling, shall be provided with appropriate support system to suspend fixture below obstructions to avoid conflicts with same.

3.3 INSTALLATION

- A. Install lighting fixtures in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

- B. Contractor shall be responsible for all supports, hangers and hardware necessary for a complete installation.
- C. Fixtures shall be plumb, level, square, in straight lines and without distortion. Remedy light leaks that may develop after installation of recessed or enclosed fixtures.

3.4 FIXTURE SUPPORTS

A. Physical supports:

1. Recessed fixtures in framed ceilings shall be supported by joist hangers fastened to adjacent ceiling joists.
2. Recessed downlights in framed ceilings shall be supported with Manufacturers supplied bar hangers and shall be installed according to the Manufacturer's instructions.
3. Surface mounted fixtures solely supported by recessed boxes in a gypsum board ceiling shall have a 1 1/8" steel bar screwed or welded to the back of the box. This steel bar must be long enough to span two ceiling support channels and shall be attached to the channels by twisting wire around the bar and the support channel. For fixtures weighing over 50 pounds, provide fixture studs in recessed box.
4. Support surface mounted fixtures more than 18" wide at or near each corner or edge, in addition to support from outlet box.
5. Twisting wire around the bracket and two adjacent ceiling support channel runners on either side of fixture shall support recessed downlights manufactured with built-in brackets.
6. Where ceiling and/or wall construction or pipe and/or ductwork is such that mounting channels, strong-backs, trapezes, brackets, etc., are required to properly support fixtures, provide these supports under this Section, unless otherwise indicated.
7. Support outlet boxes as specified in Section 260533: Boxes. Provide all boxes with grounding pigtail.
8. On concrete ceilings, use one of the following for supporting fixtures other than by outlet box:
 - a. Preset concrete inserts, provided inserts are completely covered by the fixture canopy.
 - b. 1/4" by appropriate length wedge type anchor.

B. Seismic supports:

1. Recessed fixtures in suspended ceilings shall be supported by connecting two fixture support wires to the fixture at diagonal opposite corners for fixtures weighing 56 pounds or less. Connect four wires, one at each corner for fixtures weighing more than 56 pounds.
2. Surface mounted fixtures on suspended ceilings shall be attached to the main ceiling runner with at least two positive clamping devices and shall have a fixture support wire attached to each clamping device and to the structure above.
3. Recessed downlight fixtures in suspended ceilings shall be supported by connecting one fixture support wire to the fixture housing.

4. All suspended fixtures shall be able to swing 45 degrees from vertical in any direction without obstruction. Furnish suspended fixtures with universal joint type hanger canopy and longitudinal sway adapter at each stem, to permit 45-degree swivel on 360-degree circle at canopy and 45-degree longitudinal movement at sway adapter. Submit Drawings of hanger assembly for review prior to ordering. If suspended fixture is not free to swing 45 degrees in any direction, without obstructions, provide fixture seismic restraint to prevent contact in conform to DSA IR 16-9.
5. Unless fixtures are cable hung, Contractor shall, provide for all suspended fixtures a safety wire or cable attached to the fixture and structure at each support capable of supporting four times the supported load.
6. All recessed fixtures shall be furnished with earthquake clips where installed in tee bar ceiling.

3.5 IDENTIFICATION SYSTEM

- A. All junction box coverplates for the lighting branch circuit system shall be clearly marked with a permanent black ink felt pen identifying the branch circuit (both panel designation and circuit number) contained in the box.

3.6 FIELD QUALITY CONTROL

- A. Visual and mechanical inspection.
 1. Inspect for physical damage, defects, alignment and fit.
 2. Perform operational test of each lighting fixture after installed, circuited and energized.
 3. Perform emergency operational test of all lighting fixtures connected to emergency circuiting by interrupting normal power source.
- B. Contractor shall replace at no cost to the Owner all equipment which is found defective or do not operate within factory specified tolerances.
- C. Mock-ups:
 1. Where noted in the Fixture Schedule, the Contractor shall provide sample(s) for use in full-size field mockup of specific lighting fixtures. The Contractor shall allow time in the bid and be responsible for installing a sample fixture on the Project for review, prior to acceptance and final installation of lighting fixture. This mock-up will be required to be coordinated and reviewed with the Owner's Representative and the Architect or Engineer. The Contractor shall be responsible for providing the labor and materials for the field mock-up including, but not limited to, special rigging or scaffolding and adjusting fixtures in field, as directed by the Architect or Engineer.
 2. The mock-up installation shall closely conform to the conditions of the actual final installation as to: height, distance from adjacent surfaces, material, color, etc. The Contractor shall submit a written description of each proposed mock-up with Drawings in order to obtain Architect's approval prior to commencement of each mock-up.
 3. The purpose of the mock-up is to study the general appearance and performance of and to make comparisons between the various lighting systems. At that time, certain minimal test variations may be requested as to reflector shape, color, etc. Final modifications, if

any, shall be considered a part of these Specifications and shall be accomplished with no additional cost to the Owner.

3.7 ADJUSTING

- A. Field aiming: Where any adjustable light fixture is specified, the Contractor shall allow time in the bid and be responsible upon the installation of the light fixtures, for aiming as described in the fixture schedule. This aiming will occur at night under the direction of the Owner's Representative and the Architect or Engineer. The Contractor shall be responsible for providing the labor and materials for field aiming. This shall include, but not limited to, special rigging or scaffolding, adjusting fixtures in field, and testing of various lenses or louvers with fixtures, as directed by the Architect or Engineer.

3.8 CLEANING

- A. Clean lighting fixtures prior to Project closeout in accordance with Manufacturer's recommended materials and methods.

END OF SECTION

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Site lighting fixtures.
 - 2. Diodes
 - 3. LED Drivers
 - 4. Pole standards.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. Division 03: Cast-in-place concrete. Light pole foundations and backboxes.
 - 2. Division 05: Miscellaneous. Fittings, brackets, backing supports, rods, etc. as required for support and bracing of lighting fixtures.
 - 3. Division 09: Painting. Field painting of lighting fixtures.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Underwriters Laboratories, Inc. (UL):
 - UL 66; Fixture Wire.
 - UL 1598; Luminaires.
 - UL 2108; Low Voltage Lighting Systems.
 - 2. Illumination Engineering Society of North America (IESNA):
 - IESNA LM-79-2008; Approved Method for Electrical and Photometric Measurements of Solid-State Lighting Products.
 - IESNA LM-80-2008; Approved Method for Measuring Lumen Maintenance of LED Light Sources.
 - 3. Restriction of Hazardous Substances in LED (RoHS):
 - EU RoHS; Directive 2002/95/EC Restriction of Hazardous Materials.

1.3 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Independent Testing Laboratories, Inc. or equal, photometric test report for each luminaire type and lamp combination listed on the fixture schedule. Test reports shall be based on Illuminating Engineering Society published test procedures and shall contain candlepower distribution curves in five lateral planes for fixtures with asymmetric distributions and fixture luminance data for vertical angles above 45 degrees from nadir.
4. Shop Drawings:
 - a. Where noted in the Fixture Schedule, submit Shop Drawings of special mounting details, including fixture support, attachment methods, etc. Shop Drawings shall include plan and section views indicating all structural members being used for support.
5. Samples of fixture finish where "FINISH AS SELECTED BY THE ARCHITECT" is indicated on the Fixture Schedule. The Engineer or Architect must approve samples in writing prior to ordering. With each submitted sample provide the paint formula used to achieve the color finish.
6. Submit Manufacturer's installation instructions.
7. Complete bill of material listing all lighting fixtures and components.
8. Warranty.

1.4 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
 1. A detailed explanation of the operation of the system.
 2. Instructions for routine maintenance.
 3. Pictorial parts list and part numbers.
 4. Telephone numbers for the authorized parts and service distributors.

1.5 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Lighting fixtures shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.7 WARRANTY

- A. Units and components offered under this Section shall be covered by a 1 year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Lighting fixtures: Refer to Fixture Schedule.
 - 2. LEDs & LED drivers: As provided by the light fixture manufacturer, and meeting the requirements herein.
 - 3. Emergency battery pack:
 - a. Bodine.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 FIXTURES

- A. Refer to the fixture schedule on the plans.
- C. Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable luminaires with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.
- D. Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management
- E. Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays
- F. The finish of all fixtures and trim shall be submitted to and approved by the Architect prior to ordering.
- G. All standard fixtures must bear UL label. Attaching of labels after delivery of fixtures is not acceptable.
- H. All labels affixed to the fixture shall be in a location not visible from normal viewing angles.
- I. Ferrous mounting hardware and accessories shall be finished using either a galvanic or phosphate primer/baked enamel process to prevent corrosion and discoloration of adjacent materials.

- J. Fasteners shall be manufactured of galvanized steel.
- K. Fixtures shall be free of light leaks and shall be designed to provide sufficient ventilation of lamps and ballasts, including vent holes where required.
- L. All sheet metal Work shall be free from tool marks and dents and shall have accurate angles bent as sharp as compatible with the gauges of the required metal. All intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly. All surfaces shall be finished so as to eliminate all exposed sharp edges. All mitered corners or joints shall be accurately aligned with abutting intersecting members. Sheet metal Work shall be properly fabricated so that planes will not deform (i.e. become concave or convex) due to normal expected ambient and operating conditions.
- M. Wiring channels and LED mountings shall be rigid and accurately constructed.

2.3 LIGHT EMITTING DIODES (LED):

- A. Refer to the Fixture Schedule for size and type of LED lamps required.
- B. All diodes shall come from the same manufacturer and carry the same bin number.
- C. All diodes shall be tested and tuned for the optimal Kelvin color point.
- D. Color correlated temperature: No greater than 3000K
- E. Minimum CRI (Color Rendering Index): 70
- F. Diodes shall have a minimum life of 50,000 hours and maintain at least 70% of initial lamp lumens throughout this period.
- G. LED fixture components shall be free of all toxic materials to include lead, cadmium and mercury, and shall be RoHS compliant.
- H. Groups of three or more diodes in a single housing shall be tested for even distribution.
- I. All LED fixtures shall have an IES formatted electronic photometric report.
- J. Comply with IES LM-79-08 Approved Method for measuring lumen maintenance of LED light sources.
- K. Comply with IES LM-80-08 Approved Method for electrical and photometric measurement of SSL product.
- L. LED arrays shall be sealed, high performance, long life type; minimum 70% rated output at 50,000 hours.
- M. LEDs shall be "Bin No. 1" quality.
- N. The LED light source shall be fully dimmable with use of compatible dimmers switch designated for low voltage loads.

2.4 LED DRIVERS:

- A. LED drivers shall be integral to fixture housing or remotely located, when specified, within 15 feet of diode assembly.
- B. Drivers shall have a minimum life of 50,000 hours and maintain at least 70% of initial lamp lumens for that period.

- C. Typical LED drivers shall be electronic, 0-10V dimming.
- D. Drivers shall be solid state and accept 120 through 277 VAC at 60 Hz input.
- E. Power Factor: 0.90 or higher.
- F. Maximum driver case temperature not to exceed driver manufacturer recommended insitu operation.
- G. Output operating frequency: 60Hz.
- H. Interference: EMI and RFI compliant with FCC 47 CFR Part 15.
- I. Total Harmonic Distortion Rating: 20% Maximum.
- J. Meet electrical and thermal conditions as described in LM-80 Section 5.0. 7.

2.5 FIXTURE TRANSFORMERS

- A. Low voltage transformers:
 - 1. Low voltage transformers shall be encapsulated, core and coil construction, for use in outdoor location, unless otherwise noted.
 - 2. Primary voltage shall be as noted in Fixture Schedule, secondary voltage 12 VAC, unless otherwise noted.
 - 3. Where transformers are integral to the fixture, they shall be accessible.
 - 4. Sound rating shall be the lowest available. Replace excessively noisy transformers at no cost to the Owner.

2.6 POLES

- A. Wind-load strength: 80 mph and 1.3 gust factor for total support assembly, including pole, base and anchorage, where used, to carry the fixtures, supports and appurtenances at the indicated heights above grade without deflection or whipping.
- B. Arm, bracket and tenon mount materials: Match the poles.
- C. Mountings, fastenings and appurtenances: Corrosion-resistant components compatible with the poles and fixtures that will not cause galvanic action at contact points. Provide mountings that will correctly position the luminaire to provide the indicated light distribution.
- D. Pole shafts: Provide straight steel poles, round or square as required by the luminaire.
- E. Handhole: Provide handhole and cover near base of pole shaft for access to wiring compartment.
- F. Grounding lug: Provide grounding lug for grounding conductor with access through handhole.
- G. Pole bases: Anchor type with galvanized steel hold-down or anchor bolts, leveling nuts and bolt covers.
- H. Steel poles: Steel tubing conforming to ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psi. Poles are 1-piece construction up to 40 feet in length and have access handhole in wall.

- I. Pole-top tenons: Fabricated to support the fixture indicated and securely fastened to the pole top.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of site lighting fixture installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

- A. Consult Architectural or Landscape Drawings for details of ceiling and wall construction, finish, landscape features and other applicable details and provide backboxes and trims suitable for the particular type of ceiling or wall at each location.

3.3 INSTALLATION

- A. Install lighting fixtures in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
- B. Contractor shall be responsible for all supports, hangers and hardware necessary for a complete installation.
- C. Fixtures shall be plumb, level, square, in straight lines and without distortion. Remedy light leaks that may develop after installation of recessed or enclosed fixtures.
- D. Turn over Project with all lamps in new and operating condition. Lamps that are burned less than 100 hours at Project closeout are considered new.

3.4 FIXTURE SUPPORTS

- A. Support outlet boxes as specified in Section 260533: Boxes. Provide all boxes with grounding pigtail.

3.5 IDENTIFICATION SYSTEM

- A. All junction box coverplates for the lighting branch circuit system shall be clearly marked with permanent black ink felt pen identifying the branch circuit (both panel designation and circuit number) contained in the box.

3.6 INSTALLATION OF POLES

- A. General: Store poles on decay-resistant treated skids at least 1 ft. above grade and vegetation. Support pole to prevent distortion and arrange to provide free air circulation.
- B. Metal poles: Retain factory-applied pole wrappings until just before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.
- C. Pole installation: Use fabric web slings (not chain or cable) to raise and set poles.

3.7 CONCRETE FOUNDATIONS

- A. Construct concrete foundations with 3000 pound, 28 day concrete conforming to Division 03, Section "Cast-In-Place Concrete." Comply with details and Manufacturer's recommendations for reinforcing, anchor bolts, nuts and washers.

- B. Light pole bases shall have a sloped top for drainage; and, the exposed concrete shall be finished (sacked and patched).

3.8 FIELD QUALITY CONTROL

- A. Visual and mechanical inspection:
 - 1. Inspect for physical damage, defects, alignment and fit.
 - 2. Perform operational test of each lighting fixture after installed, circuited and energized.
 - 3. Perform emergency operational test of all lighting fixtures connected to emergency circuiting by interrupting normal power source.
- B. Contractor shall replace at no cost to the Owner all equipment which is found defective or do not operate within factory specified tolerances.

3.9 ADJUSTING

- A. Field aiming: Where any aimable/adjustable light fixture is specified, the Contractor shall allow time in the bid and be responsible upon the installation of the light fixtures, for aiming and lamping fixtures as described in the fixture schedule. This aiming will be performed at night under the direction of the Owner's Representative and the Architect or Engineer. The Contractor shall be responsible for providing the labor and materials for field aiming. This will include, but not limited to, special rigging or scaffolding, adjusting fixtures in field, testing of various lamps with each fixture and/or testing of various lenses or louvers with fixtures, as directed by the Architect or Engineer.

3.10 CLEANING

- A. Clean lighting fixtures prior to Project closeout in accordance with Manufacturer's recommended materials and methods.

END OF SECTION

SECTION 26 6116

FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Fire Alarm Fire Life Safety Control Panel
 - 2. Fire Alarm Control Panel Programming.
 - 3. Initiating devices.
 - 4. Duct mounted smoke detectors.
 - 5. Notification devices.
 - 6. Communication systems.
 - 7. Record Drawings.
 - 8. Pretesting and final testing.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
- C. Division 23: HVAC System.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. American National Standards Institute, Inc. (ANSI):
 - ANSI C62.41; Guide for Surge Voltage in Low-Voltage AC Power Circuits.
 - 2. National Fire Protection Association (NFPA):
 - NFPA 72; National Fire Alarm Code.
 - NFPA 101; Life Safety Code.
 - 3. Underwriters Laboratories, Inc. (UL):
 - UL 38; Manual Signaling Boxes Fire Alarm Systems.
 - UL 268; Smoke Detectors for Fire Alarm Signaling Systems.
 - UL 268 A; Smoke Detectors for Duct Application.
 - UL 464; Audible Signal Appliances.
 - UL 497B; Protectors for Data Communications and Fire Alarm Circuits.
- B. UL 521; Heat Detectors for Fire Protective Signaling Systems.
 - UL 864; Control Units and Accessories for Fire Alarm Systems.
 - UL 1424; Cables for Power-Limited Fire-Alarm Circuits.
 - UL 1480; Speakers for Fire Alarm, Emergency and Commercial and Professional Use.

- | | |
|----------|---|
| UL 1481; | Power Supplies for Fire-Protective Signaling Systems. |
| UL 1638 | Visual Signaling Appliances Standard. |
| UL 1711; | Amplifiers for Fire Protective Signaling Systems. |
| UL 1971 | Signal Devices for Hearing Impaired. |
1. International Engineering Consortium (IEC)
IEC 60849 Voice Inteligibility Testing
 2. Factory Mutual System (FM) approval guide.
FM P7825 Approval Guide.

1.3 DEFINITIONS

- A. Addressable device: A fire alarm system component with discrete identification that can have its status individually identified or that is used to individually control other functions.
- B. Alarm signal: A signal that indicates a state of emergency requiring immediate notification of the fire department and building occupants.
- C. Annunciator: A unit containing one or more indicator lamps, alphanumeric displays or other equivalent means in which each indication provides status information about a circuit, condition or location.
- D. Supervisory signal: A signal that indicates the impairment of a fire protection system, which may prevent its normal operation.
- E. Trouble signal: A signal that indicates that a fault, such as an open circuit or ground, has occurred in the fire alarm system or in a separate subsystem monitored by the fire alarm system.
- F. Initiating device: A system component that originates transmission of a change of state condition, which initiates an appropriate response via the fire alarm system.
- G. Notification appliances: A fire alarm system component such as a bell, horn, speaker, light or text display that provides audible, tactile or visible outputs or any combination thereof.
- H. Notification device circuit: A circuit to which notification devices are connected to visually and audibly indicate an alarm signal.
- I. Signaling line circuit: A circuit to which any combination of circuit interfaces, control units or transmitters are connected and over which multiple system input signals or output signals are carried.
- J. Class B wiring: A circuit that is monitored for integrity such that a single break, a single wire-to-wire short or a single loss of carrier condition will be indicated by a trouble signal on the LSCP no matter where the break, short or loss of carrier condition occurs, but which would prohibit devices beyond the fault, short or carrier loss from remaining operational. This would be Style 3 wiring for signaling line circuits, Style B for initiating device circuits and Style Y for notification device circuits.

1.4 SYSTEM DESCRIPTION

- A. Provide a new zone non-coded addressable fire alarm system with integrated emergency communication. The system shall be 24 VDC closed circuit, electronically supervised, voice evacuation/relocation, device indicating, auxiliary control system, automatic alarm type; operating from manual pull stations, smoke detectors, and heat detectors.
- B. The system shall include all wiring, raceways, pull boxes, terminal cabinets, outlet and mounting boxes, alarm and supervisory signal initiating devices, alarm notification devices and all other accessories required for a complete operating system.
- C. Provide system with the following circuit functions:
 - 1. Style B for initiating device circuits.
 - 2. Style 4 for signaling line circuits interconnecting the riser loop or network.
- D. Style Y for notification device circuits.
- E. For overall system description based on system input signals and output controls and monitoring, refer to Sequence of Operation Matrix on the Drawings.
- F. In addition to the above sequence of operation, the FACP shall perform the following functions:
 - 1. Identify every addressable device by location, priority and device type.
 - 2. Read and display at FACP the sensitivity of addressable smoke and heat detection devices.
 - 3. Remain 100% operational and capable of responding to an alarm condition while in the routine maintenance mode.
 - 4. Be capable of supporting non-addressable as well as addressable devices.
 - 5. Allow individual programmable control of each connected remote or panel mounted relay.
 - 6. Provide the user with the field programmability to add or change addressable device types and custom messages on-site via the system printer/terminal.
 - 7. Display up to 127 alarms and/or up to 127 trouble indications, one at a time, as a list on the system printer/terminal.
 - 8. Change the status of configured circuits (arming or disarming) and change status of relays.
 - 9. Generate an addressable detector sensitivity report providing a chamber voltage listing (device testing) for each detector.

1.5 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Describe system operation, equipment and dimensions and indicate features of each component.
 - 3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 4. Shop Drawing package shall include:
 - a. Basic:

- 1) Name of Owner and occupant.
 - 2) Address of the building.
 - 3) Contractor's name, address, telephone number and license number.
 - b. Symbols legend.
 - c. Equipment list showing quantity, make, model and CSFM listing number for each device.
 - d. Wire and cable schedule.
 - e. Scope of Work with overall system description.
 - f. Sequence of operation matrix with system inputs signals and output functions.
 - g. Code summary and Building type.
 - h. Assignment of Class and/or Style designation for device circuits.
 - i. Plot plan and floor plans of building with partitions, walls and room identification, showing locations of each device and control/monitoring equipment, communication equipment, air sampling pipe routing, conduit routing and size and cable/conductor type and quantity. Field devices shall all have a discrete identification designation located adjacent to each device on the Drawings.
 - j. Point-to-point wiring diagram in block or riser format showing all fire alarm components, device designations, conduit, wire types and sizes, and air sampling pipe sizes.
 - k. Provide 1/4" scale plan of equipment layout in main fire control room.
 - l. Include elevations of control panels, fireman's fan and damper control panel, voice communications panel, graphic annunciator panel and remote annunciator panel.
 - m. Overall description of smoke control system based on Smoke Control Report, developed by others.
 - n. Smoke control operation matrix by individual initiating device for fan and damper control/monitoring as well as ancillary equipment controlled.
 - o. Elevation indicating mounting heights for manual pull stations, audible and visual devices and combination audible/visual devices.
 - p. Rated penetration details.
 - q. Typical wiring diagram details of field devices.
 - r. Detector mounting details at HVAC ducts.
 - s. Battery standby calculations showing total standby power needed to meet the specified system requirements.
 - t. Voltage drop calculations for system wiring circuits.
 - u. Data sheets and CSFM listings for all components and devices.
 5. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
 6. Submit Manufacturer's installation instructions.
 7. Complete bill of materials listing all components.
- B. Provide California State Fire Marshal 'CSFM' listing sheet for each device.
1. Warranty.
- C. Contractor shall submit approved Shop Drawings for review prior to the purchase and installation of equipment.
- D. Record Drawings:

1. Furnish Record Drawings as described in Section 260010: Basic Electrical Requirements, utilizing Shop Drawing submissions with updated field conditions. These Drawings shall include but not be limited to the following:
 - a. Plot plans and building floor plans, showing point-to-point wiring location of and conduit routing to all devices.
 - b. Block diagram/riser diagram showing the FACP, system components and all conduit and wire type/sizes between each.
2. Drawings shall be incorporated into the Record Drawing submission.
3. Final acceptance will not be made until the State Fire Marshal has approved the Record Drawings.
4. Record drawings shall be submitted in AutoCad 2012 and PDF.

1.6 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
 1. A detailed explanation of the operation of the system.
 2. Instructions for routine maintenance.
 3. Pictorial parts list and part numbers.
 4. Schematic Drawings of wiring system, including all initiation and annunciation devices, control panel, annunciators, communication system, fan control system, door locking control system, printer/terminal, etc.
 5. Telephone numbers for the authorized parts and service distributors.

1.7 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Fire alarm/life safety system components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.9 WARRANTY

- A. The fire alarm work shall be free from defects of workmanship and materials for two years after filing notice of completion and remedy any defects developing during this period, free of charge. Manufacturers whose equipment has a longer guarantee period shall provide a written guarantee.
- B. Units and components offered under this Section shall be covered by a minimum 2 year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. If manufacturers offer a longer standard warranty, the warranty shall be provided in writing. Warranty shall begin upon acceptance by the Owner.
- C. The warranty package shall include, but not be limited to the following:
 - 1. Provide required inspection, testing, and maintenance services at least every six months throughout the warranty period.
 - 2. Emergency maintenance service.
 - 3. Service by factory trained service representative of system Manufacturer.
 - 4. Replacement of any defective components.

1.10 SYSTEM START-UP

- A. Upon completion of installation, a factory trained dealer service representative shall perform initial start-up of the fire alarm/life safety system. Sufficient time shall be allowed to properly check the system out and perform required minor adjustments before the Engineer's witnessed test shall begin.

1.11 MAINTENANCE

- A. Extra Material:
- B. Provide the following fire alarm system components as extra materials, matching the products installed and packaged for storing.
- C. Manual pull station: Furnish a quantity equal to 10 percent of the number installed.
- D. Detectors: Furnish a quantity equal to 10 percent, for each type, of the number installed.
- E. Strobes, Speaker/strobes: Furnish a quantity equal to 10 percent of the number installed.
- F. Speakers: Furnish a quantity equal to 10 percent of the number installed.
- G. Maintenance Service:
 - 1. For a period of two years following acceptance the equipment Supplier shall have a person(s) familiar with this Project attend semi-annual meetings with the Owner's Representative to review system performance, operation and any system problems. That person shall provide a written summary of the items discussed in each meeting and a schedule of when the system problems will be corrected. The report is due within 7 working days after each meeting.
 - 2. During the 6th, 12th, 18th, and 24th month following system acceptance, on a weekend day, the equipment Supplier shall perform a complete tests of the system, in a manner

similar to the acceptance test. A written report shall be submitted to the Owner certifying that each initiating device has been tested. A copy of these test forms shall be submitted to the Engineer for review and acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
- B. Silent Knight
- C. System Sensor
- D. Gentex

2.2 CONDUIT AND WIRE:

- A. Conduit:
 - 1. Conduit shall be in accordance with the California Electrical Code (CEC).
 - 2. Where required, all wiring shall be installed in conduit. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
 - 3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per CEC Article 760-29.
 - 4. Wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
 - 5. Conduit shall not enter the fire alarm control panel or any other remotely mounted control panel equipment or back boxes, except where conduit entry is specified by the LSCP manufacturer.
 - 6. Conduit shall be 3/4 inch (19.1 mm) minimum.
 - 7. Connectors shall be compression type fittings to join EMT to a box or enclosure and to couple two ends of EMT conduit. Fittings shall be: Zinc plated, steel UL listed concrete tight, and thread less where connecting to conduit. Male hub threads -NPSM where connecting to box or cabinet with steel locknuts.
- B. Wire:
 - 1. All fire alarm system wiring shall be new.
 - 2. Wiring shall be in accordance with state and national codes (e.g., CEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less

- than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
 4. Wire and cable shall be installed in conduit.
 5. Wiring used for the multiplex communication circuit (SLC) shall be twisted and support a minimum wiring distance of 10,000 feet when sized at 12 AWG. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.
 6. All field wiring (with exception of external communications Ethernet) shall be electrically supervised for open circuit and ground fault.
 7. The life safety control panel shall be capable of T-tapping NFPA Style 4 (Class B) Signaling Line Circuits (SLCs). Systems which do not allow or have restrictions in, for example, the amount of T-taps, length of T-taps etc., is not acceptable.
- C. Terminal Boxes, Junction Boxes and Cabinets: All boxes and cabinets shall be UL listed for their use and purpose.
- D. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Life safety control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod. The control panel enclosure shall feature a quick removal chassis to facilitate rapid replacement of the LSCP electronics.

2.3 FIRE ALARM AND DETECTION SYSTEM

- A. Control panel:
1. Fire Life Safety Control Panel.
 2. Addressable devices shall be individually identified by the system and any quantity of addressable devices may be in alarm at any time up to the total number connected to the system.
 3. The panel shall monitor the addressable smoke detectors in such a manner that if the detectors become dirty and reach and maintain 80% of alarm threshold for five (5) consecutive hours, a trouble condition indicating exactly which device needs service shall be automatically annunciated. If the device becomes too insensitive for a period of 10 seconds, the trouble indication will read: "Input device response too low."
 4. The panel shall report, by specific device number, any device removed from an addressable initiating circuit and all other devices shall continue to function.
 5. The panel shall automatically indicate the total quantity of alarms and troubles that have occurred prior to reset at the control unit.
 6. No alarm or trouble indication shall be resettable until it has been acknowledged. It shall not be possible to reset the system until all alarms have been acknowledged.
 7. Each addressable device shall report its condition to the panel control unit every three (3) seconds in a manner such that failure of the connections to or internal electronics of the device will result in a trouble signal that identifies the specific device involved.
- B. Initiation/notification modules:

1. All modules shall be plug-in, dynamically supervised and easily replaceable. Field wiring shall be connected to the panel with removable multi-conductor connectors to facilitate rapid removal and replacement of both the module and wiring for ease of serving the panel. The modules shall be system interconnected by a card edge connector.
 2. Provide zone input addressable modules for monitoring non-addressable initiating circuits.
 3. Provide programmable signal modules on output circuits for operation of DC audible devices.
 4. Provide, as needed, programmable supplementary relay modules containing four independent relays fitted with form "C" contacts, rated at 120 VAC, 5 amps inductive.
- C. Power supply: Adequate to serve panel modules, initiating devices, annunciating devices, remote annunciators, door hold-open/closure devices, roll-down fire doors or shutters, fire/smoke dampers. All power connections whether AC or DC shall be separately fused within panel.
- D. Uninterruptible power supply (batteries):
1. Provide an uninterruptible power source for all volatile system components including control panel, peripherals and remote annunciators. Power source shall consist of but not be limited to all necessary conduit, wire, outlets, transformers, panels and connections to each piece of equipment as required.
 2. Uninterruptible power shall be required such that loss of power shall not cause the system operator to be required to restart the system or any part thereof upon return of power. The uninterruptible power supply shall be NFPA approved for applications and shall provide a 24 hour backup of the system; an then, at the end of that period, operate all alarm indicating devices used for evacuation for 5 minutes.
 3. Provide a dual rate battery charger capable of recharging batteries to 80% capacity in 8 hours.
- E. Remote station signal transmitter: Electrically supervise, capable of transmitting alarm and trouble signals over telephone lines to remote monitoring station receiver.
- F. Auxiliary relays: Provide sufficient SPDT auxiliary relay contacts for each initiating device zone to provide accessory functions specified.

2.4 INITIATING DEVICES

- A. Manual pull stations: Shall conform to the applicable requirements of UL 38. Addressable manual stations shall be connected into addressable initiating circuits. Stations shall be single action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Control panel shall monitor the station by address and function. The use of a key or wrench shall be required to reset the station. Stations shall have a separate screw terminal for each conductor and be capable of field programming for its "address" location on an initiating circuit.
- B. Heat detectors: Shall conform to the applicable requirements of UL 521. Addressable detectors shall be electronic designed for detection of fire by combination fixed temperature and rate-of-rise principle. Detectors shall be connected into addressable initiating circuits. All electronics

shall be contained within detector head and shall plug-in to terminal base. Detector shall be field programmable and contain external indication that is readily visible. The detector shall be dynamically supervised and individually identified by LSCP, as well as sensitivity adjustable. Rating for fixed temperature portion shall be 135 degrees. Detectors shall have screw terminals in base for making all wiring connection. Attic Heat Detector: Rated for 190 degrees F conventional detectors. Each detector group shall be provided with an addressable monitoring module.

- C. Smoke Detectors: Shall conform to the applicable requirements of UL 268.
- D. Photoelectric detectors: Addressable detectors shall be electronic designed for detection of abnormal smoke densities. Detectors shall consist of separate transmitter and receiver units. The transmitter unit shall emit an infrared beam to the receiver unit. When the signal at the receiver falls below a preset sensitivity, the detector shall initiate an alarm. The receiver shall contain an LED that is powered upon an alarm condition. Long-term changes to the received signal caused by environmental variations shall be automatically compensated. Detectors shall be connected into addressable initiating circuits. All electronics shall be contained within detector head and shall plug-in to terminal base. Detectors shall be field programmable and contain external indication that is readily visible. The detector shall be dynamically supervised and individually identified by LSCP, as well as sensitivity adjustable. Detectors shall have multiple sensitivity settings in order to meet UL listings for the different distances covered by the beam. Detectors shall have screw terminals in base for making all wiring connections.
 - 1. Duct smoke detectors: Addressable detector shall have a duct housing, mounted exterior to the duct and with perforated sampling tubes. Activation of a detector shall cause shutdown of the associated air-handling unit via auxiliary contact base. Detectors shall be rated for the air velocity to be expected.
- E. Interface modules: Addressable interface module shall be connected into addressable initiating circuits. This device shall be used for interfacing normally open or normally closed direct shorting contact devices to an addressable initiating circuit (i.e. water flow, tamper switches, non-addressable initiating devices, etc.). Module shall be dynamically supervised and individually identified by LSCP.

2.5 NOTIFICATION DEVICES

- A. Speakers, strobes and combination speaker strobes:
 - 1. These units shall be mounted flush in all finished areas and surface mounted in unfinished equipment areas. White enamel grill for units mounted in finished (public) areas; red for units mounted in unfinished (mechanical) areas.
 - 2. Maximum loading: The loading on both the strobe and audio circuits shall not exceed 75% of its rated capacity. Verify that strobe in-rush currents are safely within the maximum rated capacity of the circuit.
 - 3. Speaker: Wall and ceiling mounted units shall include a blocking capacitor for line supervision and screw terminals for in and out wiring. The back of the speaker cone shall be covered to protect the cone from damage and dust. The speakers shall operate over a frequency range of 400 - 4000Hz and shall have field selectable power taps of 1/8 to 8 watts with sound output up to 92dBA at 10 feet measured per UL standard 1480 when set on the 8 watt tap. Speaker shall be rated for operation on a 70.7-volt audio system.

- a. System Sensor Wall Speaker, Model SPV
- b. System Sensor Ceiling Speaker, Model SPCV
4. Strobe: Wall mounted units shall incorporate 15, 30, 75, 110 candela strobe lights that flash once per second with 24 VDC input with a maximum current draw of .088 amps.
 - a. Gentex Corp or equal
5. Strobe/speaker: Wall mounted units with speaker Specifications listed above and shall incorporate 15, 30, 75, 110 candela strobe lights that flash once per second with 24 VDC input with a maximum current draw of .088 amps.
 - a. Gentex Corp or equal
6. Remote power supplies for strobe circuits:
 - a. Remote power supply. Provide Back-up emergency batteries as required:
 - 1) Back-up emergency batteries, sized per NFPA standards. Provide separate enclosure for batteries if required to prevent damage from corrosive gases.

2.6 AUXILIARY EQUIPMENT CONTROL AND SUPERVISION

- A. Under this Section, provide connections to the following equipment to activate control sequence of operation:

2.7 LIFE SAFETY COMMUNICATIONS AND PUBLIC ADDRESS SYSTEM

- A. System operation:
 1. Provide a modular, fully supervised, zone selective voice communication system in the Life Safety Command Center Room. The page alarm system shall be utilized for automatic pre-recorded voice signaling and manual voice override paging.
 2. Output zones shall be as indicated on the drawings.
 3. All zone selector switches shall be toggle type with adjacent on/off LED light and clearly identified by floor, elevator or stairwell number.
 4. Manual override via the hand-held microphone shall take priority over any and all alarm signals to assure communication of one-way voice instructions.
- B. Communication amplifiers:
 1. The total harmonic distortion shall be less than 2% at 100% of rated output.
 2. Amplification equipment shall be sized to provide sufficient power to drive one speaker per 1,000 square feet of building area on each floor with the speakers set on a wattage tap that allows 15dB above the ambient noise level in all areas of a normal 45dB office environment. Plus an additional 25 percent per amplifier. I.E. provide amplifiers rated for the maximum number of speakers possible in the building plus 25 percent spare capacity.
 3. Provide output terminals mounted on a heavy-duty terminal strip for making all required connections.
 4. Outputs shall be compatible with multi-tap speakers as required.
 5. Electronic circuit protection shall be incorporated in the amplifier that provides automatic limiting against short circuits and overloads on its outputs. A thermostatic control shall protect the amplifier from operation at excessive temperatures and a circuit breaker for over current protection shall be provided.
 6. The front panel of the amplifier shall have a power indicator and a thermal overload indicator.

7. The amplifier shall operate from a 105 - 125 volt 60 Hz power source.
8. The unit shall be ruggedly constructed, temperature stable and be capable of operating in ambient temperatures ranging from -20 degrees C to +55 degrees C. The power transformers shall be heavy duty, fully enclosed and designed for continuous operation. The chassis shall be heavy-gauge steel with a perforated enclosure and both shall be finished in low luster black enamel.
9. Provide speaker zone supervision such that any zone in "trouble" shall be annunciated at the remote annunciator and the printer.
10. The amplifiers shall be mounted in the same room as the Life Safety Remote Power Supply.
11. Amplifiers shall be provided in 120 or 250-watt RMS increments at 70VRMS output voltage levels. Amplifiers shall be continuously supervised and be configured for single channel operation and redundancy for backup. All amplifiers shall have 60 to 15 KHz frequency response and be equipped with a battery saver feature to minimize supervisory current drain when operating on the 24VDC standby batteries.
12. Each speaker circuit shall be electrically supervised for opens and ground faults in the wiring and for short circuit faults on the speaker circuit wiring and shall be so arranged that a fault condition in any circuit or groups of circuits will not cause an alarm to be sounded. A short circuit on the speaker circuit wiring will automatically disconnect only the affected circuit thereby insuring the integrity of all other speaker circuits to receive an alarm signal and protect the system amplifiers, pre-amplifiers and taped voice or tone generators. The occurrence of any fault will light a trouble LED and sound the Sonalert but will not interfere with the proper operation of any circuit that does not have a fault condition. Initiating and speaker circuits shall be wired using Class B supervised circuits (a break or ground fault in any conductor will be reported as a trouble condition).
13. Digital message repeater module (DRM) shall be provided for a pre-recorded general instruction message. The standard operating sequence shall be thirty seconds of alarm tone, followed by a 30 - 60 second digitized general instruction message. After the message is sent or has been interrupted by the hand-held microphone, before the tape message is completed or failure of the MRM, the alarm tone will again sound continuously until the system is reset or the tone silenced. The DRM will be supervised for EPROM memory and general status. Message shall be settable to be continuous repeatable or 1 - 3 times.
14. Redundant tone generators (RTM) shall be provided for alarm and auxiliary tone generation (slow whoop). RTM's shall be continuously supervised for operation and placement.

2.8 VOICE COMMUNICATION BACK-UP POWER SUPPLY (BATTERIES)

- A. Provide a back-up power source for all system components including but not limited to, amplifiers, digital message units and microphone circuits. Power source shall consist of but not be limited to all necessary conduit, batteries, wire, outlets, transformers, panels and connections to each piece of equipment as required.
- B. Back-up power shall be required such that loss of utility power shall not cause the system operator to be required to restart the system or any part thereof upon return of power. The back-up power supply shall be NFPA approved for life safety applications and shall provide a 4-hour backup of the maximum load possible on the system as required by NFPA 72.

- C. During power failure the amplifiers shall be automatically shut off to minimize drain on batteries but will turn on automatically during alarm or manual activation.
- D. Provide an automatic dual rate (high rate and float charge) battery charger capable of recharging batteries to 80% capacity in 8 hours. The charger output shall be supervised and fused.
- E. If the system loses AC power, a system trouble shall occur.
- F. A solid-state power transfer circuit that shall switch to standby power automatically and instantaneously if normal power fails or falls below 15% of normal ("brown out" conditions). This electronic circuit shall allow the batteries to be effectively "floated" on the operating system to avoid upsetting the normal microprocessor scan and minimize resultant nuisance

2.9 BATTERIES:

- A. Upon loss of Primary (AC) power to the control panel, the batteries shall have sufficient capacity to power the fire alarm system for required standby time 60 hours followed by 15 minutes of alarm battery backup.
- B. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.
- C. If necessary to meet standby requirements, external battery/charger systems may be used.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of fire alarm/life safety system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

- A. General:
 - 1. The 120/208-volt, 3 wire, 60 cycles AC emergency power supply required to power the system. Connect to red colored circuit breaker(s) in panel board. Identify circuit as "Fire Alarm Circuit Control".
- B. Wiring:
 - 1. Refer to Section 260519: Building Wire and Cable.
 - 2. Individual input and output device addressability as well as remote sensitivity measurement, supervision and power shall all be performed on the same pair of wires. Wiring shall be Class B.
 - 3. Each Class B initiating circuit shall consist of a two (2)-wire circuit. allowing a maximum of 20 T-taps and not requiring any end-of- line device for supervision. Each

- initiating circuit shall accommodate up to 75% of the manufacturers maximum addressable programmable initiating devices, to allow for future expansion.
4. Wiring for shielding certain conductors from others or routing in separate raceways, shall be as recommended by the Manufacturer's current requirements.
- C. All wiring shall be installed in a continuous steel conduit system. All conduit fittings shall be steel compression. Conduit shall be of the size recommended by the equipment Supplier. Refer to Section 260546: Signal Systems Raceway.
1. Wire color-coding shall remain the same throughout the system.
 2. No wiring other than that directly associated with life safety/fire alarm detection, alarms or auxiliary fire protection functions (no 120 VAC), shall be permitted in life safety/fire alarm conduits.
 3. Make conduit and wiring connections to sprinkler flow switches, PIV's, sprinkler valve monitors, door hold-open/closure devices, smoke management fans, smoke dampers, elevator controller, emergency generator, etc.
 4. All wiring shall be checked and tested to ensure that there are no grounds, opens or shorts.
 5. All life safety/fire alarm junction boxes shall be color-coded and marked per Section 260553: Electrical Identification.
 6. Wire nut splices are not allowed.
 7. Wires shall be numbered at each connection, termination and junction point. Wire numbering tags shall be Brady Perma-Code, Westline or equal wire makers. Each group of wires shall be tagged with its destination at each panel, terminal box or junction box.
 8. All wire used on the life safety/fire alarm and communication system shall have a minimum insulation rating of 105 degrees C. Bell wire or thermostat wire is not acceptable.

3.3 FIELD QUALITY CONTROL

- A. Refer to Division 1 for commissioning requirements.
- B. Manufacturer's field service: Contractor shall arrange and pay for the services of a factory-authorized service representative to supervise the initial start-up, pretesting and adjustment of the fire alarm/life safety system.
- C. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:
 1. Assure fire alarm/life safety system installation conforms to specified requirements and operates within specified tolerances.
 2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
 3. Prepare final test report including results, observations, failures, adjustments and remedies.
 4. Apply label on fire alarm/life safety system control panel upon satisfactory completion of tests and results.
 5. Verify settings and make final adjustments.

- D. Engineer witnessed testing: Allow a period of 8 hours for Engineer review and final check.
- E. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.
- F. Pre-functional testing:
 - 1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.
 - 2. Visual and mechanical inspection:
 - a. Inspect for physical damage, defects alignment and fit.
 - b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
 - c. Compare nameplate information and connections to Contract Documents.
 - d. Check tightness of all control and power connections.
 - e. Check that all covers, barriers and doors are secure.
 - f. Visually check all sampling pipes to ensure that all joints, fittings, bends, sampling points, etc., comply with the Specification.
 - g. Check the air sampling system to ensure the following features are operational and programmed in accordance with the specification.
 - 1) Alarm threshold levels
 - 2) Pipes in use
 - 3) Detector address
 - 4) Clock and date
 - 5) Time delays
 - 6) Air flow fault thresholds
 - 7) Display buttons operable
 - 8) Check to ensure that all ancillary warning devices operate as specified.
 - 9) Check interconnection with Life Safety Control Panel to ensure correct operation.
 - 3. Electrical tests:
 - a. The system shall be completely tested prior to final acceptance testing. All points shall be tested from point of initiation to the final point or points of annunciation. All circuits shall be tested for continuity and ability to transmit the required signal correctly to the LSCP. Any problem due to wrong wire type, wire twist, impedance, mismatches, noise filtering or shielding shall be completely corrected during pretesting and prior to any final acceptance tests.
 - b. Testing shall include each and every device in the system. Coordinate with other trades as necessary for testing.
 - 1) Sprinkler flow switches: Record time delay from water flow to alarm and adjust as necessary for a 30-50 second delay.
 - 2) Tamper switches: Verify "trouble "signal is received and alarmed on closing of each valve.
 - 3) Smoke detectors and duct smoke detectors: Test with actual or approved artificial smoke. Verify that reset does not occur when devices are cleared of smoke. Verify supervisory circuit function. Perform pressure differential test on all duct-mounted smoke detectors.

- 4) Door release: Verify that proper alarm activates every held-open door, roll-down doors and shutters, to ensure doors close completely to the closed position.
 - 5) Elevator recall: Verify that elevators recall to designated floor by testing elevator lobby detectors with smoke. This is necessary on the ground floor and one other only.
 - 6) Voice communication systems: Verify that each floor can be selected.
 - 7) Intelligibility testing shall be per IEC 60849 and verified and tested by a third party testing organization.
 - 8) Tone and prerecorded message generation: Activate by means of an alarm initiating device on each floor and verify that they are clearly audible in all occupied spaces including elevator lobbies, toilets, core areas, stairwells, mechanical rooms and garage. Adjust power taps at speakers to obtain proper +15 dBA level above ambient noise. Verify the override capability of the microphone paging system.
 - 9) FFCP: Verify correct fan and damper control and status annunciation for each life safety fan and damper.
 - 10) Central station notification: Verify that one set of conductors in the terminal cabinet becomes a short circuit on any "trouble" condition and that the other set becomes a short circuit on any "alarm" condition. Verify that the conductor groups are labeled properly.
 - 11) Printer and remote annunciators: Verify that all alarm and trouble conditions print on the printer and annunciate at the remote annunciation panels.
 - 12) Emergency generator power status: Verify this annunciate their respective "Trouble" and "Running" conditions.
- c. Third Party Testing:
- 1) A third party shall be provided by the contractor to perform voice audibility testing to verify performance per IEC 60849.
- d. Test Report:
- 1) Provide a complete report listing every device, the date it was tested, the results and the date retested (if failure occurred during the previous test). The test report shall indicate that every device tested successfully.
 - 2) Submit two typed copies of the test report on 8- 1/2" x 11" paper in a neatly bound folder to the Engineer for approval. Failure to comply with this will result in a delay of final testing and acceptance.

G. Functional performance testing:

H. After the approval of the test report, provide a schedule of final testing to be done in the presence of the State Fire Marshal and Owner's Representative. The schedule must be received by the Engineer a minimum of 2 weeks prior to the Final Test Date and must list the dates and time slots in which the various systems can be tested.

1. Coordination of the Final Test dates with all parties (General Contractor, Mechanical Contractor, Electrical Contractor, Owner and others) shall be the sole responsibility of the Contractor. If a party is required to be present during any phase of testing to activate a device, ensure that the party or a qualified representative of the party is present throughout that phase of the testing.

- I. Functional performance testing air sampling system:
 - 1. Introduce Smoke into the Detector Assembly to provide a basic functional test.
 - 2. Introduce smoke to the least favorable Sampling Point in each Sampling Pipe.
 - 3. If more than two bar graph divisions illuminate under normal conditions (no smoke test), review event log for two (2) weeks from date of commissioning and make appropriate adjustments to the alarm and delay thresholds.
 - 4. Activate the appropriate Fire Alarm zones and advise all concerned that the system is fully operational. Fill out the log book and commissioning report accordingly.
 - J. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation. The Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the Engineer's hourly rate.
 - K. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.
 - L. Contractor shall submit the Testing Agency's final report to the Engineer for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.
- 3.4 TRAINING
- A. Factory authorized service representative shall conduct an 8 hour training seminar for Owner's Representatives upon completion and acceptance of system. Instructions shall include safe operation, maintenance and testing of equipment with both classroom training and hands-on instruction.
 - B. Contractor shall schedule training with a minimum of 7 days advance notice.

END OF SECTION

SECTION 26 6516

SECURITY ALARM MONITORING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Main controller/communicator panel.
 - 2. Passive infrared detector "PIR."
 - 3. Door position contact switches.
 - 4. Digital keypad arming/disarming stations.
 - 5. Remote terminal cabinets.
 - 6. System printer.

- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. Division 08: Door Hardware.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Underwriters Laboratories, Inc. (UL):
 - UL 13; Power-Limited Circuit Cables.
 - UL 294; Access Control System Units.
 - UL 603; Power Supplies for Use with Burglar-Alarm Systems.
 - UL 639; Intrusion-Detection Units.
 - UL 1076; Proprietary Burglar Alarm Units and Systems.
 - 2. Electronics Industries Alliance (EIA):
 - EIA: Testing standards.

1.3 SYSTEM DESCRIPTION

- A. General requirements:
 - 1. Provide a complete security alarm monitoring/keypad access control system as described herein.
 - 2. The system shall comprise all necessary supervision, processing, display and printout circuitry and/or devices.
 - 3. The system shall comprise redundant circuitry to ensure that no single independent failure of any component or component group shall cause consequential failure of the system.

- B. System overview:
1. Passive infrared detectors shall be installed in all interior spaces indicated on the Drawings.
 2. Flush mounted magnetic contact switches will be provided on all exterior doors to monitor and annunciate "open," "closed," "forced," and "held" positions.
 3. Both passive infrared detectors and door position switches shall transmit an alarm condition when the buildings are "armed" and system is violated.
 4. Keypads shall be installed at each common building to provide individual zone control of a building. Keypads shall allow access to programmed zones via a 1 to 5 digit access code. They shall be capable of "disarming" or "arming" functions. A delay feature shall be built into the system to provide personnel sufficient time to disarm system upon entering a building prior to activation of an alarm sequence.
 5. The monitoring and control panel shall include a programmable microprocessor and related circuitry capable of interpreting signals from the detection circuits and initiating appropriate alarms.
 6. Activation of an intrusion alarm sensor shall cause a signal to be transmitted to a Central Station via telephone lines. A built-in dialer unit shall initiate signal transmission. In addition to alarm reporting, system shall report trouble, low battery and shunted zone indications.

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 2. Describe system operation, equipment and dimensions and indicate features of each component.
 3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 4. Shop Drawings:
 - a. Plot plans and building floor plans, showing location of and conduit routing to all devices.
 - b. Point-to-point wiring diagram in block or riser formats showing all components, conduit and wire types and sizes with cable legend.
 - c. Include elevations of control panel and remote terminal cabinet(s).
 5. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
 6. Submit Manufacturer's installation instructions.
 7. Complete bill of materials listing all components.
 8. Warranty.

1.5 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
1. A detailed explanation of the operation of the system.
 2. Instructions for routine maintenance.

3. Pictorial parts list and part numbers.
4. Schematic Drawings of wiring system, including all devices, control panel, terminal cabinets, etc.
5. Telephone numbers for the authorized parts and service distributors.
6. Final testing reports.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Security monitoring and control system components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.8 WARRANTY

- A. Units and components offered under this Section shall be covered by a 1 year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 1. Bosch
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 MAIN CONTROLLER/COMMUNICATOR PANEL

- A. Control Panel: Control Panel shall be surface mounted, NEMA 1 enclosure, having a key operated locking, hinged door. Opening the main door shall expose all components for inspection or adjustment without further dismantling of the cabinet, control units or wiring. Unit shall be complete with the following features:
- B. Sixty (60) alarm zones, hardwired to devices including zone expander modules.
 - 1. All functions keypad programmable. One hundred (100) user codes, 1 - 5 digits.
 - 2. 12 Volt, 6 amp/hour emergency back-up battery.
 - 3. System shall be programmable remotely using an IBM PC compatible computer with standard modem.
 - 4. System shall have programmable auto-arm feature at a preset time of day.
 - 5. System shall be capable of custom arming configurations.
 - 6. Automatic zone verification.
 - 7. 96 event history and reporting.
 - 8. Programmable exit and entrance delay times.
 - 9. Digital communicator:
 - a. Transmit all major formats.
 - b. DPDT line seizure.
 - c. Pulse or touch-tone dialing.
 - d. Anti-jam feature.
 - e. Hexadecimal reporting.
 - f. Dial two (2) different 30 digit telephone numbers for reporting.
 - g. Report by zone.
 - h. Expanded or single line reporting.
 - i. Open and close reports by user code.
 - j. Exception opening report.
 - k. Restore reporting.
 - l. Cancel reporting.
 - m. Trouble reporting.
 - n. Low battery reporting.
 - o. Stunted-zone reporting.
- C. EEPROM (non-volatile) memory. Will not lose programmed features during total loss of power.
 - 1. Restore to previous arm/disarm status after total loss of power.
 - 2. Lightning/transient protection.
 - 3. Heavy-duty 1.5 amp power supply:
 - a. Regulated 10.2 - 14.0 volts DC.
 - b. 2 amps available for powering auxiliary devices.
 - c. Battery float-charge circuit.
- D. 12 volt 6 AH sealed lead-acid batteries.
 - 1. One (1) general-purpose 2 amp SPDT relays.
 - 2. Operating temperature range of 32 to 120 degrees F. (0 to +48.8 degrees C.)
 - 3. Install one keypad in panel door.
 - 4. Provide additional power supplies and batteries to power quantity of infrared detectors as required.
 - 5. Include system printer to document all system activities.

- E. Remote station signal transmitter: Furnish with auto-dialer/modem device capable of transmitting alarm signals over telephone lines to remote monitoring station receiver.

2.3 PASSIVE INFRARED DETECTOR "PIR"

- A. Wall mounted wide-angle infrared detector with dual element pyro-electric sensor and directional pulse count.
- B. Tamper switch shall protect against removal of front cover or unit from wall and shall alarm upon loss of power.

2.4 DIGITAL KEYPAD

- A. Wall mounted keypad to interface with controller to remotely "arm" and "disarm" designated alarm zones of the security monitoring system.

2.5 DOOR POSITION CONTACT SWITCH

- A. Concealed, flush mounting, magnetic contact switch, with self-locking housing, six-inch wire leads and single-pole/double-throw contacts. Sentrol Model #1706 series.

2.6 TERMINAL CABINETS

- A. Provide 18" X 18" X 6" deep hinged door lockable terminal cabinet in NEMA 1 enclosure. All conduits for security system shall terminate in these boxes. Provide engraved nameplate on each box marked "Security System Wiring".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of the security system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 COORDINATION

- A. Coordinate all installation requirements for door contacts with other trades prior to ordering of doors and frames.
- B. Install contacts, boxes, conduits and connections to doors and frames for complete operating installation. All connections shall be concealed.

3.3 INSTALLATION REQUIREMENTS

- A. Alarm circuits shall be terminated on screw terminals. Terminal blocks shall be Allen-Bradley with 600 volt screw terminals for #22 to #10 conductors, mounted to type M22 channel or

approved equal. Submittal shall show internal elevation of terminal cabinets with equipment laid out.

- B. All cables shall be run through fanning strip to terminals on terminal blocks.
- C. All cables entering terminal cabinet shall be identified with Brady or E-Z code wire markers. Upon completion of installation, six (6) copies of one-line "as-built" wiring diagram shall be furnished to the Owner.
- D. Each cable run on wiring diagram shall be identified with exact wire marker code (numerical or alphabetical) as appears in terminal cabinets.
- E. Station locations shall be identified by architectural room numbers and in all ways one-line wiring diagram shall relate as closely as possible to architectural Drawings.
- F. No splices shall occur in underground pullboxes. System wiring shall be continuous, without splices, from terminal cabinet to terminal cabinet and control panel to devices. All interior junction boxes shall be accessible and locations shall be recorded or "As-Built" Drawings.
- G. Door contacts shall be located 6" from hinge side of door and both the switch and magnet shall be epoxy in place.
- H. After all equipment is installed and operational, Contractor shall set angle settings, sensitivity settings, etc., of each detector to ensure optimum performance and minimal false alarms. Mask out areas, of each detector, to remove sources of false alarms (windows, heaters, air diffusers, etc.), from detection zones.

3.4 WIRING

- A. Wiring from devices in building to terminal block at the same building shall be West Penn #241 or approved equal.
- B. Wiring from each building terminal block to the control panel shall be West Penn #244 or approved equal.
- C. Wiring from each keypad to the control panel shall be West Penn #244 or approved equal.
- D. Low voltage AC Power wiring shall not run close to or parallel to fluorescent lighting fixtures. If necessary run conduit perpendicular to the lighting conduit with as much separation as possible.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's field service: Contractor shall arrange and pay for the services of a factory-authorized service representative to supervise the initial start-up, pretesting and adjustment of the security system.
- B. Pretesting objectives shall be to:

1. Assure security system installation conforms to specified requirements and operates within specified tolerances.
 2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
 3. Prepare final test report including results, observations, failures, adjustments and remedies.
 4. Apply label on security system control panel upon satisfactory completion of tests and results.
 5. Verify settings and make final adjustments.
- C. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.
- D. Prefunctional testing:
1. Visual and mechanical inspection:
 - a. Inspect for physical damage, defects alignment and fit.
 - b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
 - c. Compare nameplate information and connections to Contract Documents.
 - d. Check tightness of all control and power connections.
 - e. Check that all covers, barriers and doors are secure.
 2. Electrical tests:
 - a. The system shall be completely tested prior to final acceptance testing. All points shall be tested from point of initiation to the final point or points of annunciation. All circuits shall be tested for continuity and ability to transmit the required signal correctly to the controller. Any problem due to wrong wire type, wire twist, impedance, mismatches, noise filtering or shielding shall be completely corrected during pretesting and prior to any final acceptance tests.
 - b. Testing shall include each and every device in the system. Coordinate with other trades as necessary for testing.
 - 1) Door contact switches: Verify alarm signal received and annunciated at control panel.
 - 2) PIR detection devices: Adjust device sensitivity as required for coverage and location. Verify alarm signal received and annunciated at control panel.
 - 3) Keypads: Ensure that keypads function properly to "arm" and "disarm" the system.
 - 4) Remote station monitoring: Verify that the alarm condition is transmitted via telephone lines to remote monitoring station from auto-dialer/modem device within the control panel.
 - c. Test report:
 - 1) Provide a complete report listing every device, the date it was tested, the results and the date retested (if failure occurred during the previous test). The test report shall indicate that every device tested successfully.
 - 2) Submit two typed copies of the test report in a neatly bound folder for review and approval. Failure to comply with this will result in a delay of final testing and acceptance.

- E. In the event that the system fails to function properly during the testing, as a result of inadequate pretesting or preparation, the Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the Engineer's hourly rate.
- F. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.
- G. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.

3.6 TRAINING

- A. Factory authorized service representative shall conduct a 4 hour training seminar for Owner's Representatives upon completion and acceptance of system. Instructions shall include safe operation, maintenance and testing of equipment with both classroom training and hands-on instruction.
- B. Contractor shall schedule training with a minimum of 7 days advance notice.

END OF SECTION

SECTION 26 7113

TELECOMMUNICATION CABLING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
1. Equipment rooms.
 2. Equipment bonding.
 3. Backbone fiber optic cabling.
 4. Backbone twisted pair cabling.
 5. Horizontal twisted pair cabling.
 6. Telecommunication testing.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
- B. ANSI
1. ANSI/TIA-526-7-A (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
 2. TIA-526.2-A (July 2015) Effective Transmitter Output Power Coupled into Single-Mode Fiber Optic Cable - Adoption of IEC 61280-1-1 ed. 2 Part 1-1: Test Procedures for General Communication Subsystems – Transmitter Output Optical Power Measurement for Single-Mode Optical Fibre Cable
 3. ANSI/TIA-4994 (March 2015) Standard for Sustainable Information Communications Technology
 4. ANSI/TIA-526-14-C (April 2015) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
 5. ANSI/TIA-568.0-D (September 2015) Generic Telecommunications Cabling for Customer Premises (supersedes TIA-568-C.0 and TIA-568-C-1)
 6. ANSI/TIA-568-C.2 (August 2009) Balance Twisted Pair Communications and Components Standards
 7. TIA-568-C.2-1 (July 2016) Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Addendum 1: Specifications for 100 Next Generation Cabling
 8. TIA-568-C.2-2 (November 2014) Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Addendum 2: Additional Considerations for Category 6A Patch Cord Testing
 9. TIA-568-C.3 (June 2008) Optical Fiber Cabling Components Standard (will be superseded by ANSI/TIA-568.3-D after default ballot)

10. TIA-568-C.3-1 (October 2011) Optical Fiber Cabling Component Standard-Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors (will be superseded by ANSI/TIA-568.3-D after default ballot)
11. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
12. ANSI/TIA-568.1-D (September 2015) Commercial Building Telecommunications Infrastructure Standard (supersedes ANSI/TIA-C.1)
13. ANSI/TIA-569-D (April 2015) Telecommunications Pathways and Spaces
14. ANSI/TIA-598-D (July 2014) Optical Fiber Cable Color Coding
15. ANSI/TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
16. ANSI/TIA-606-B (June 2012) Administration Standard for Telecommunications Infrastructure
17. ANSI/TIA-606-B-1 (December 2015) Administration Standard for Telecommunications Infrastructure Addendum 1 - Automated Infrastructure Management Systems - Addendum to ANSI/TIA-606-B
18. ANSI/TIA-607-C (November 2015) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
19. ANSI/TIA-758-B (March 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
20. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems
21. ANSI/TIA-942-A (March 2014) Telecommunications Infrastructure Standard for Data Centers (will be superseded by ANSI/TIA-942-B after balloting)
22. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics (will be superseded by ANSI/TIA-942-B after balloting)
23. ANSI/TIA-1005-A (May 2012) Telecommunications Infrastructure Standard For Industrial Premises
24. ANSI/TIA-1005-A-1 (January 2015) Telecommunications Infrastructure Standard For Industrial Premises, Addendum 1- M12-8 X-Coding Connector - Addendum to TIA-1005-A
25. ANSI/TIA-1183 (August 2012) Measurement Methods and Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
26. ANSI/TIA-1183-1 (January 2016) Measurement Methods and Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Extending Frequency Capabilities to 2 GHz - Addendum to TIA-1183
27. ANSI/TIA-1152 (September 2009) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
28. ANSI/TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard
29. ANSI/TIA-4966 (May 2014) Telecommunications Infrastructure Standard for Educational Facilities
30. TIA-455-104-B (February 2016) FOTP 104- Fiber Optic Cable Cyclic Flexing Test (supersedes TIA-455-104-A)
31. TIA/EIA-455-25-D (February 2016) FOTP-25 Impact Testing of Optical Fiber Cables
32. TIA-604-18 (November 2015) FOCIS 18 Fiber Optic Connector Intermateability Standard – Type MPO-16

33. TIA-604-5-E (November 2015) FOCIS 5 Fiber Optic Connector Intermateability Standard- Type MPO
34. TIA-5017 (March 2016) Telecommunications Physical Network Security Standard
35. TIA-TSB-155-A (Reaffirmed 10-6-2014) Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T
36. TSB-184 (July 2009) Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling
37. TSB-4979 (August 2013) Practical Considerations for Implementation of Multimode Launch Conditions in the Field
38. TSB-190 (June 2011) Guidelines on Shared Pathways and Shared Sheaths
39. TIA-TSB-162-A (November 2013) Telecommunications Cabling Guidelines for Wireless Access Points
40. TSB-5018 (July 2016) Structured Cabling Infrastructure Guidelines to support Distributed Antenna Systems
41. TIA-492AAAE (June 2016) Detail Specification for 50- μ m Core Diameter/125- μ m Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers with Laser-Optimized Bandwidth Characteristics Specified for Wavelength Division Multiplexing
42. TIA-492AAAB-A (November 2009) Detail specification for 50- μ m core diameter/125- μ m cladding diameter class 1a graded-index multimode optical fibers
43. TIA-455-243 (March 2010) FOTP-243 Polarization-mode Dispersion Measurement for Installed Single-mode Optical Fibers by Wavelength- scanning OTDR and States-of-Polarization Analysis
44. TSB-172-A (February 2013) Higher Data Rate Multimode Fiber Transmission Techniques

C. ISO/IEC

1. ISO/IEC TR 11801-99-01 Information technology – Generic cabling for customer premises: Guidance for balanced cabling in support of at least 40 GBit/s data transmission: Parts 1 and 2
2. ISO/IEC TR 29106 AMD 1 Information technology -- Generic cabling -- Introduction to the MICE environmental classification
3. ISO/IEC 14763-3 Ed 2.0 Information technology -- Implementation and operation of customer premises cabling -- Part 3: Testing of optical fibre cabling
4. ISO/IEC 24764 AMD 1 Information technology – Generic cabling for data centres
5. ISO/IEC 11801 AMD 1 AMD 2 Information technology – Generic cabling for customer premises
6. ISO/IEC 15018 AMD 1 Information technology – Generic cabling for homes
7. ISO/IEC 24702 AMD 1 Information technology – Generic cabling – Industrial premises
8. ISO/IEC 14763-1 AMD 1 Information technology – Implementation and operation of customer premises cabling – Part 1: Administration
9. ISO/IEC 14763-2 Information technology – Implementation and operation of customer premises cabling – Part 2: Planning and installation
10. ISO/IEC 14763-2-1 Information technology – Implementation and operation of customer premises cabling – Part 2-1: Planning and installation – Identifiers within administration systems
11. ISO/IEC TR 24704 Information technology – Customer premises cabling for wireless access points

12. ISO/IEC TR 24750 Information technology – Assessment and mitigation of installed balanced cabling channels in order to support 10GBASE-T
 13. ISO/IEC TR 29125 IT Telecommunications cabling requirements for remote powering of terminal equipment
- D. ELECTRIC CODES
1. National Electrical Safety Code (NEC) (IEEE C2-2012)
 2. NFPA 70-2016, California Electrical Code© (CEC©)
 3. ANSI/IEEE C2-207, California Electrical Safety Code®
 4. NFPA 72 National Fire Alarm and Signaling Code
- E. OSHA STANDARDS AND REGULATIONS – ALL APPLICABLE
- F. LOCAL CODES AND STANDARDS – ALL APPLICABLE
- G. BICSI
1. BICSI – Building Industry Consultative Services International – Published Standards
 2. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
 3. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
 4. ANSI/BICSI-003-2014 Building Information Modeling (BIM) Practices for Information Technology Systems
 5. BICSI 004-2012, Information Technology Division Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
 6. ANSI/BICSI 005-2016, Electronic Safety and Security (ESS) System Design and Implementation Best Practices
 7. BICSI 006-2015 Distributed Antenna System (DAS) Design and Implementation Best Practices
 8. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
 9. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
 10. Telecommunications Distribution Methods Manual, 13th Edition
 - a. BICSI – Building Industry Consultative Services International – Manuals
 11. Telecommunications Distribution Methods Manual, 13th Edition
 12. Information Transport Systems Installation Methods Manual (ITSIMM), 6th Edition
 13. Outside Plant Design Reference Manual, 5th Edition
 14. BICSI's ICT Terminology Handbook, Version 1.0
 15. Telecommunications Project Management Manual (TPMM), 1st edition
 16. Telecommunications Project Management Reference Document (TPMRD), 2nd Edition
 17. BICSI's Special ICT Design Considerations, Version 1.0
 18. Essentials of Bonding and Grounding, Version 1.0
 19. Information Transport Systems Installation Methods Manual (ITSIMM), 6th Edition
 20. ANSI/BICSI 002-2011, Data Center Design and Implementation Best Practices
 21. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
 22. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

23. AV Design Reference Manual, 1st Edition
24. Network Design Reference Manual, 7th Edition
25. Outside Plant Design Reference Manual, 5th Edition
26. Wireless Design Reference Manual, 3rd Edition

1.3 DEFINITIONS

- A. Adapter: Shall mean a connecting device joining two fiber connectors, either like or unlike.
- B. Cabling: A system comprised of cables, wires, cords, and connecting hardware.
- C. Channel: End-to-end transmission path, i.e. the entire portion of the horizontal cabling to each outlet consisting of the Permanent Link, line cord (at the workstation), patch cord, and, if a full cross connection is implemented, the cross connect termination/connecting apparatus and equipment cord.
- D. Connect: To install required patch cords, equipment cords, cross-connect wires, etc. to complete an electrical or optical circuit.
- E. Cord: Shall mean length of cordage having connectors at each end. The term “cord” is synonymous with the term “jumper” and “lead.”
- F. Identifier: A unique code assigned to an element of the telecommunication infrastructure that links it to its corresponding record.
- G. Passive link segment: Shall mean the cable, connectors, couplings, and splices between two fiber optic termination units.
- H. Permanent link: Test configuration for a horizontal cabling link excluding test cords, connections at the ends of the test cords, patch cords, equipment cords, line cords, etc. The “permanent” portion of the horizontal cabling to each outlet consisting of cable, consolidation point (if used), termination/connecting apparatus in equipment rooms, and the connectors at outlets.
- I. Abbreviations:
 1. BEP: Building Entrance Protection, for termination of OSP twisted pair cabling.
 2. CAT: Category, used when identifying the performance characteristics of twisted pair cabling.
 3. CMP: Communication Media Plenum, rating applied to ISP twisted pair cable.
 4. CMR: Communication Media Riser, rating applied to ISP twisted pair cable.
 5. IDF: Intermediate Distribution Facilities, telecommunication equipment rooms housing network equipment and containing termination fields for backbone cabling from MDF and horizontal cabling from outlet devices.
 6. ISP: Inside Plant, cable installation within building.
 7. MDF: Main Distribution Facilities, telecommunication equipment room housing possible service entrance facilities for interbuilding backbone cabling, network equipment, house voice system equipment headend, backbone cabling distribution headend, termination fields for backbone and horizontal cabling.

8. MM: Multimode, fiber cable.
9. MPOE: Minimum Point of Entry, for serving telecommunications utility terminations. House's service provider's termination field(s) and interfaces between utility's facilities and premises facilities.
10. NAM: Network Access Module, workstations.
11. OFN: Optical Fiber Non-conductive, general purpose indoor non-plenum rated.
12. OFNP: Optical Fiber Non-conductive Plenum, plenum rated cable.
13. OFNR: Optical Fiber Non-conductive Riser, non-plenum rated riser cable.
14. OSP: Outside Plant, cable installation outside of building.
15. PIC: Plastic Insulated Conductors.
16. PVC: Polyvinyl Chloride.
17. SM: Singlemode, fiber cable.
18. UTP: Unshielded Twisted Pair, copper cable type.

1.4 SYSTEM DESCRIPTION

- A. Provide a complete telecommunication structured cabling system installation as specified herein, as shown on the Drawings, and detailed in the district structured cabling (standard is available upon request). In general, system shall include, but not be limited to, the following:
 1. OSP backbone fiber optic cabling:
 - a. Backbone fiber optic cable shall route underground between each buildings main distribution facility (MDF), in a star topology, and shall consist of one 12-strand multimode OM4 and one 12-strand singlemode, OSP, fiber optic cable(s).
 - b. OSP backbone fiber optic cables shall terminate on full height rack in MDF rooms for cable interface with ISP backbone fiber optic cables. Terminate cables on backside of rack mounted 24-port patch panels at each IDF.
 - c. Include full height rack(s) at MDF room(s) for fiber termination with 96-port patch panels as required and patch cord management placed above and below each patch panel.
 - d. OSP backbone fiber optic patch panel field shall interface with ISP backbone fiber optic patch panel field at MDF via fiber patch cords between modular connectors on front side of patch panels.
 - e. Fiber optic cable connector standard shall be Type LC. Connectors shall be duplex type.
 2. OSP backbone twisted pair cabling:
 - a. Backbone twisted pair cable shall route underground between each buildings main distribution facility (MDF), in a star topology, and shall consist of one multi-conductor 25-pair, Category 3, UTP, OSP, filled copper cable.
 - b. Terminate backbone twisted pair cables on Category 3, wall-mounted, 110 style, BEP blocks at each MDF. BEP shall include a splice chamber.
 3. Horizontal twisted pair cabling:
 - a. Horizontal twisted pair cables shall route between MDF or IDF's and workstation outlets, and shall consists of two Category 6A, 4-pair, UTP, plenum rated copper cables.
 - b. Horizontal twisted pair cables shall terminate on back of rack mounted, Category 6A, 48-port, 19" wide patch panels with modular 8-pin connector front for interface with Owner furnished routers/switches or voice patch panel field via

- Category 6A patch cords. Patch panels shall have 110 type terminations at rear for horizontal cable terminations.
- c. Wire management shall be provided above and below, 2 RU, for each 48-port patch panel.
 - d. Copper jack standard is Category 6A, RJ-45 connectors at patch panels and workstation outlets.
4. Patch cords:
- a. Patch cords shall match the physical and performance criteria of the specified horizontal twisted pair cable and be terminated at each end with 8-position modular plugs.
 - b. Patch cords shall be furnished in varying lengths as required.
 - c. Patch cord quantities shall match the following:
 - 1) One patch cord for data field per every standard workstation outlet.
 - 2) One patch cord for voice field per every standard workstation outlet.
 - 3) One patch cord for voice field per every telephone only outlet.
- B. Workstation outlets:
1. Standard telecommunication outlets shall consist of the following, unless otherwise noted on the Drawings:
 - a. Two blue horizontal twisted pair cable(s) per outlet.
 - b. Single-gang coverplate with 4-ports.
 - c. Two Red RJ-45 connector jacks for twisted pair terminations.
 2. Telecommunication outlets denoted for Wireless Access Points shall consist of the following, unless otherwise noted on the Drawings:
 - a. Two blue horizontal twisted pair cable(s) per outlet.
 - b. Single-gang coverplate with 4-ports.
 - c. Two red RJ-45 connector jacks for twisted pair terminations.
 3. Wall mounted telephone outlets shall consist of the following, unless otherwise noted on the Drawings:
 - a. One blue horizontal twisted pair cable per outlet.
 - b. Single-gang metal coverplate with 1-port and two support studs.
 - c. One red RJ-45 connector jack for twisted pair terminations.
 4. Wall mounted pay telephone outlets shall consist of the following, unless otherwise noted on the Drawings:
 - a. One blue horizontal twisted pair cable per outlet.
 - b. Single-gang metal coverplate with 1-port.
 - c. One RJ-45 red connector jack for twisted pair terminations.
- C. Required System Colors
1. Cat 6A Horizontal Cable Colors
 - a. Red -- Wireless Access Points
 - b. Red -- Data
 - c. Red - Phone VOIP/Digital/
 - d. Red - HVAC/ Alarms, ect...
 - e. Red - Security Cameras / Access Control
 2. CAT 6A Patch Cord Colors
 - a. Red -- Wireless Access Points
 - b. Red -- Data

- c. Red - Critical Connections
- d. Red - Phone VOIP/Digital/ HVAC/ ect...
- e. Red - Security Cameras / Access Control
- 3. Cat 6A Jack Colors (Rack and Workstation)
 - a. Red -- Wireless Access Points
 - b. Red -- Data
 - c. Red - Phone VOIP/Digital/ HVAC/ ect...
 - d. Red - Security Cameras / Access Control
- D. Refer to Drawings for complete documentation of above requirements and all additional requirements.

1.5 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Describe system operation, equipment, dimensions and indicate features of each component.
 - 3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 4. Shop Drawings prepare in AutoCAD Release 2012 or later, to include the following:
 - a. Building floor plans showing location of all outlets, raceways, cable trays, conduits and cable routing to each device at same scale as construction documents.
 - b. Riser diagram(s) indicating all major components of system with required cable interties and backbone cable identification labels.
 - c. Provide 1/4" scale plans of equipment layout in MPOE, MDF and IDF rooms.
 - d. Provide wall elevations of MPOE, MDF and IDF rooms at 1/2" scale.
 - e. Provide equipment rack elevations at 1" scale.
 - f. Use identical symbols as those used in construction documents.
 - g. Text shall be a minimum of 3/32" high when plotted at full scale.
 - h. Screen all background information.
 - 5. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
 - 6. Complete bill of materials listing all components.
 - 7. Warranty.
- B. Installer's qualifications: Furnish satisfactory proof of required experience specified herein for system installer.
- C. Record Drawings:
 - 1. Furnish Record Drawings as described in Section 260010: Basic Electrical Requirements, utilizing Shop-Drawing submissions with updated field conditions. These Drawings shall include but not be limited to the following:
 - a. Plot plans and building floor plans, showing point-to-point wiring location of all devices.

- b. Block Diagram/Riser Diagram showing the system components and all conduit and wire type/sizes between each.
2. Drawings shall be incorporated into the Record Drawing submission.
3. Final acceptance will not be made until the Engineer has approved the Record Drawings.

1.6 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
 1. A detailed explanation of the operation of the system.
 2. Pictorial parts list and part numbers.
 3. Schematic wiring diagrams.
 4. Telephone numbers for the authorized parts and service distributor.
 5. Final testing reports.

1.7 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this section may be used on the Project unless otherwise submitted.
- C. Manufacturer qualifications: Manufacturer must have a minimum 5 continuous years of experience in design and manufacturing of the materials and equipment specified herein.
- D. Installer's qualifications:
 1. Installer must have a minimum 5 continuous years of experience in satisfactory completion for Projects similar in scope and cost. Provide backup information on 5 such Projects.
 2. Installer shall possess a current, active and valid C7 or C10 California State Contractors License.
 3. The installer shall be the Manufacturer's certified reseller/installer of the telecommunication equipment provided. Provide evidence of this certification.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Telecommunication system components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipping shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic.

- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal components damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.9 WARRANTY

- A. Units and components offered under this Section shall be covered by a 15 year product and application warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

1.10 MAINTENANCE

- A. Maintenance services:
 - 1. Distributor of the major system components shall maintain a replacement parts department and provide testing equipment when needed. A complete parts department shall be located close enough to supply replacement parts within a 4 hour period.
 - 2. Service must be rendered within 4 hours of system failure notification.

PRODUCTS

1.11 MANUFACTURERS

- A. Refer to the District Structured Cabling Standards for detailed product requirements. Standards are available upon request.
1. Equipment racks and cable runways:
 - a. Hoffman Wall Cabinets
 - b. Panduit Equipment Racks
 2. Bonding strap:
 - a. Chatsworth Product Inc. "CPI."
 - b. Cooper/B-Line.
 - c. Panduit.
 3. Bonding connectors and lugs:
 - a. Panduit.
 - b. Thomas & Betts.
 - c. O-Z/Gedney.
 4. Backbone fiber optic cable:
 - a. General Cable
 5. Backbone fiber optic termination panels:
 - a. Panduit
 6. Fiber optic terminations:
 - a. Panduit
 7. Backbone twisted pair cable:
 - a. General Cable.
 8. Backbone twisted pair terminations:
 - a. Porta Systems (OSP).
 - b. Circa (OSP).
 9. Horizontal twisted pair and modular patch cord cable:
 - a. Panduit
 10. Horizontal twisted pair and modular patch cord terminations:
 - a. Panduit.
 11. Innerduct and duct plugs:
 - a. TVC Communications.
 - b. Tyco "Allied Electrical Group."
 - c. MaxCell
 12. Test equipment:
 - a. Corning Cable Systems
 - b. Fluke Networks.
 - c. Agilent Technologies WireScope 350 Test Set.
 - d. Laser Precision.
 - e. Tektronix.
- B. Substitutions: The district structured cabling system standard for fiber and category 6A cabling is Panduit/General. Any Contractor wishing to offer structured cabling products or associated hardware other than those specified should submit a request for product substitution in writing no less than one week in advance of bid.

1. Written requests for substitution should be accompanied by all drawings, specification sheets and engineering documents, as well as third party laboratory performance test results proving equivalency in transmission performance and mechanical function.
2. This written documentation should be accompanied by three (3) each samples of the substitution product being offered for evaluation by CHICO USD.
3. Equal product acceptance must be received from CHICO USD in writing.
4. Contractor shall be responsible for and assume all costs for removal and replacement of any substituted product installed without prior written approval. Such costs should include but not be limited to labor, materials as well as any penalties, fees or costs incurred for late completion.
5. All requests for substitution must be submitted in writing and approved by John Sclare, CHICO USD 2455 Carmichael, Chico, CA 95928 jsclare@chicousd.org.

1.12 EQUIPMENT ROOMS

A. Equipment racks, 2-channel type:

1. Application: Suitable for the support of termination apparatus, cable and cord management apparatus, network equipment, and other similar equipment within a telecommunication room.
2. Material: High-strength, lightweight, #6061-T6 extruded aluminum construction 11 Ga. ASTM A570 steel uprights and ASTM A36 steel angles.
3. Channel:
 - a. Size: 3" deep with flanges on each side (double sided).
 - b. Flange: 1.265" wide by 0.25" thick with mounting holes.
 - c. Mounting holes: Threaded mounting holes at #12-24 rolled and spaced 5/8"-5/8"-1/2", compatible with ANSI/EIA-310-D.
 - d. RMU markings: The RMU markings shall be permanently stamped on the outside of both flanges on both channels.
4. Assembled rack: Rack shall be complete with two mounting channels, two base angles (3.5" high by 6" deep by 0.375" thick), two top angles (1.5" high by 1.5" deep by 0.375" thick). Rack shall be 7'-0" high (overall) by 19" mounting width (20.25" width overall) and shall contain 45 EIA mounting spaces (1.75" on center).
5. Load rating: 1000 lbs, when evenly distributed for the height of rack.
6. Finish: Powder coat, black.
7. Accessories: Include required accessories, such as floor installation kits, mounting hardware, etc. for a complete installation.
8. Manufacturer: Panduit
 - a. Part Number: R2P

B. Wall Mount Equipment Cabinet

1. Double hinge Wall Mount cabinet with Window Door
2. Cabinet shall have lockable locks at front door and at wall Hinge.
3. The cabinet shall be 26 RU
4. Manufacturer: Hoffman
 - a. P/N: EWMW482430

C. Vertical management sections:

1. Application: Suitable for cable routing (back) and cord slack storage (front) vertically within a rack bay, from bottom of rack to the top.
 2. Configuration: The vertical management sections shall be double-sided having covered cable guides on the front and flip-retainers on the rear.
 3. Size and capacity: 8'-0" high by 10" wide, having at least 7" deep cable storage capacity in back and 7" deep cord storage capacity in front.
 4. Mounting: The vertical management sections shall have matching bolt holes for attachment to equipment rack.
 5. Finish: Black, guide and cover.
- D. Horizontal cable support bar:
1. Application: Suitable to horizontally support cables at termination points on back of patch panels.
 2. Finish: Shall match the rack.
- E. Horizontal management panels:
1. Application: Suitable to horizontally support cord management within rack bay on front of patch panels.
 2. Configuration: The horizontal management panels shall be single-sided and located at the top, middle and bottom of the rack..
 3. Size: 2U high by 19" mounting width.
 4. Finish: Black, guide and cover.
- F. Cable runway:
1. Application: Suitable for the support and management of cabling, either overhead or mounted vertically on walls, within equipment rooms. Also, provides overhead equipment rack bracing.
 2. Construction:
 - a. Runway shall be constructed of two longitudinal side elements known as "stringers" and crossing members known as "rungs." Rungs are spaced 9" on center and are welded to stringers on both sides.
 - b. Stringers and rungs are constructed of rectangular tube steel, 1-1/2" by 3/8" by 0.65" wall thickness.
 - c. Size: 10'-0" straight section by 12" wide.
 3. Accessories: Provide accessories for a complete installation as shown on the drawings to include 45° and 90° junctions, "T" junctions, butt splices, swivel butt splices, end caps, end closing kits, vertical wall brackets, wall angle supports, triangle supports, rack-to-runway attachments, drop-out kits, bonding straps, etc.
- G. Label plates for equipment racks:
1. Label plates shall be suitable to affix onto top angle of equipment rack.
 2. Label plate shall be "engraved-able" stock melamine plastic laminate substrate.
 3. Size: 1/2" high by 6" long by 1/16" thick.
 4. Lettering shall be white, engraved, 1/8" high.

1.13 EQUIPMENT BONDING

A. General:

1. The telecommunication system grounding backbone is covered under Section 260526: Grounding and Bonding and shown on the drawings in Riser Diagram format. It includes grounding bus bars, grounding riser conductors, connections to main service ground system, ground lugs and clamps, etc.
 2. The work outlined in this Section covers the bonding of all telecommunication equipment and apparatus in the equipment rooms to the telecommunication system grounding backbone.
- B. Bonding conductor:
1. Refer to Section 260519: Building Wire and Cable.
 2. Conductor: #6 AWG (or larger), copper, stranded.
 3. Insulation: THHN/THWN, green in color.
- C. Cable runway bonding straps:
1. Refer to Section 260526: Grounding and Bonding.
 2. Conductor: Flexible braided copper strap with factory installed termination connectors.
- D. Connectors and lugs:
1. Conductor to conductor connector: C-type copper compression tap, heavy-wall, for tapping into unbroken continuous conductors as a splice, wire joint, "T" tap, or making parallel wire connections. Connector can be used with stranded or solid conductors.
 2. Conductor to busbar, racks, cabinets, or other equipment/component connector: Two-hole, copper, compression type lugs for #6 AWG conductors.
 3. Conductor to cable runway connector: Cable tray ground clamp, Extruded aluminum/tin-plated, mechanical type connector with set screws for tightening both tray and bonding conductor.
- 1.14 BACKBONE FIBER OPTIC CABLING
- A. OSP backbone fiber optic cable:
1. Application:
 - a. Suitable for outdoors, in underground PVC conduit installations where protection against water and moisture entry is required.
 - b. Optical transmission performance is not significantly affected by environmental fluctuations, installation or aging.
 - c. Materials do not evolve hydrogen in quantities that will increase light attenuation.
 2. Multimode OM4, 50/125 μ m fiber strands shall meet or exceed the following physical criteria:
 - a. Core diameter: 50 μ m, \pm 2.5 μ m.
 - b. Cladding diameter: 125 μ m, \pm 1.0 μ m.
 - c. Core/cladding offset: \leq 1.5 μ m.
 - d. Coating diameter: 254 μ m, \pm 7.0 μ m.
 - e. Coating/cladding concentricity: 6.0 μ m.
 - f. Minimum tensile strength: 100,000psi.
 3. Multimode OM4, 50/125 μ m fiber strands shall meet or exceed the following performance criteria:
 - a. Fiber Type: 850-nm 10G Laser Optimized 50 micron (OM4)

- b. Attenuation: 3.0dB/km at 850nm and 1.0dB/km at 1300nm wavelengths, maximum.
- c. Overfilled bandwidth: 3,500MHz•km at 850nm and 500MHz•km at 1300nm wavelengths, minimum.
- d. Laser bandwidth: 4,700MHz•km at 850nm and 500MHz•km at 1300nm wavelengths, minimum.
4. Singlemode fiber strands shall meet or exceed the following physical criteria:
 - a. Core diameter: 9 μ m.
 - b. Cladding diameter: 125 μ m, \pm 0.7 μ m.
 - c. Core/cladding offset: \leq 0.5 μ m.
 - d. Coating diameter: 254 μ m, \pm 7.0 μ m.
 - e. Coating/cladding concentricity: 12.0 μ m.
 - f. Minimum tensile strength: 100,000psi.
5. Singlemode fiber strands shall meet or exceed the following performance criteria:
 - a. Attenuation: 0.45dB/km at 1310nm and 0.25dB/km at 1550nm wavelengths, maximum.
 - b. Mode field diameter: 9 μ m \pm 0.6 μ m at 1310nm and 8.9 μ m \pm 0.6 μ m at 1550nm.
 - c. Cutoff wavelength: \leq 1260nm.
 - d. Dispersion: 8.0ps/nm•km at 1310nm and 2.6-6.0ps/nm•km at 1530-1565nm.
 - e.
6. Buffering:
 - a. Fibers shall be loosely buffered, either in a core tube or in multiple tubes around central member.
 - b. Buffering tube(s) shall be filled with compound to protect against moisture penetration. Filling compound shall be non-hygroscopic and non-nutritive to fungus ("FLEXGEL," or equivalent). The compound shall be easily removed with conventional nontoxic solvents.
 - c. Fibers and buffer tube(s) shall be individually color-coded to meet the requirements of ANSI/TIA/EIA-598-A-1995 (also reference ANSI/ICEA S-83-596-1994 and EIA-230).
7. Cable and sheath:
 - a. Central member: Dielectric rod (glass-reinforced plastic, GRP).
 - b. Fillers (where required to maintain circularity): Plastic rods matched to buffer tube diameter.
 - c. Water blocking tape: Applied longitudinally over the central member/buffer tube(s)/filler core.
 - d. Strength element: The cable shall have an internal strength element such as aramid yarn.
 - e. Rip cord: Nylon or similar (to aid splitting the outer jacket).
 - f. Outer jacket: The cable shall have a seamless outer jacket, high or medium density polyethylene or equal, applied to and completely covering the internal components (central member, buffer tube(s), fillers, strength element, etc.). The outer jacket shall contain UV inhibitors for stable performance in direct sunlight. The outer jacket shall be non-hygroscopic and non-nutritive to fungus.
 - g. Printing: The jacket shall be printed/permanently marked with the manufacturer, sequential length (feet), fiber type, month and year or quarter and year of manufacture.
8. Tensile strength: The cable shall have a 600 lb minimum rated load.

9. Operating temperature range: -40° to 158°F.
 10. General Cable Multimode Indoor/Outdoor P/N:
 - a. 12 Strand MMF OM4: BL0121ANU.BK
 - b. 24 Strand MMF OM4: BL0241ANU.BK
 - c. 48 Strand MMF OM4: BL0481ANU.BK
 11. General Cable Singlemode Indoor/Outdoor P/N:
 - a. 12 Strand SMF: AP0121ANR.BK
 - b. 24 Strand SMF: AP0241ANR.BK
 - c. 48 Strand SMF: AP0481ANR.BK
- B. Backbone fiber optic terminations:
1. Fiber optic patch panels:
 - a. Patch panels shall be an enclosed housing for protecting, storing and organizing the termination of fiber cables and fiber strands. Shall also contain facilities to store fiber slack and provide patch cord management.
 - b. Patch panels shall be passive physical equipment and apparatus used in terminating, interconnecting and cross-connecting fiber optic cabling. Panel shall possess a minimum fire resistant rating of UL94V-1 and shall conform to existing OSHA Health and Safety Laws.
 - c. Patch panels shall come equipped with safety labels such as laser identification or warning labels as required by system considerations.
 - d. Panels shall be 1U, and 2U 19" rack mountable, accepting up to 3 or 6 adapter panels. Panels shall contain rear fiber entry slots, wire retainers and fiber storage drums. Furnish with slide out rails for front access and jumper troughs for cable management. Panels shall be suitable for multimode or singlemode fiber cable terminations.
 - e. Panels shall be provided with LC couplings for termination of fiber cables with matching connectors.
 - f. Provide patch panel and port quantities as required for cable terminations.
 - g. Panduit P/N:
 - 1) 1U Panel: FRME1U
 - 2) 2U Panel: FRME2U
 - h. Fiber Optic Connector Panels P/N:
 - 1) Multimode: FAP12WAQDLC
 - 2) Singlemode: FAP12WBUDDCZ
 - 3) Blank: FAPB
 2. Fiber optic connectors:
 - a. Multimode:
 - 1) ILSINTECH Splice On LC Connectors
 - a) P/N: LCS-OM4-UPC-09/SA
 - 2) Connector shall have an integral strain relief feature, including a bend limiting rear boot.
 - 3) Connector shall be installable via either epoxy or anaerobic method.
 - b. Singlemode:
 - 1) ILSINTECH Splice On LC Connectors
 - a) P/N: LCS-SM-UPC-09/SA
 - 2) Connector shall have an integral strain relief feature, including a bend limiting rear boot.

- 3) Connector shall be installable via either epoxy or anaerobic method.
- C. Fiber optic patch cords:
1. Suitable for indoor installations within equipment rooms.
 2. Cords shall be factory-assembled from a single, continuous length of cordage, homogenous in nature, and terminated at both ends via connectors as required. Splices are not permitted anywhere.
 3. Cordage:
 - a. Conductors: 2 optical conductors/strands, matching physical and optical performance parameters of the multimode and singlemode cable plant specified above.
 - b. Construction: "Mini Zipcord" type with strength member (aramid yarn) and jacket of PVC.
 - c. Flame rating: CEC OFN rated or higher, and UL Listed as such.
 4. Connectors:
 - a. OM4 Multimode patch cords shall be terminated with duplex LC connectors at both ends for connection with the cable plant and connection to equipment at other end.
 - b. Singlemode patch cords shall be terminated with duplex LC connectors at both ends for connection with the cable plant and connection to equipment at other end.
 5. Manufacturer: Panduit
 - a. Multimode P/N: FZ2ERLNLNSNMxxx (xxx=Length) length as required.
 - b. Singlemode P/N: F92ERLNLNSNMxxx (xxx=Length) length as required.
- D. Labels:
1. Easy Mark labeling Software is the owners standard.
 2. Refer to Owners Structured Cabling Standards for requirements and part numbers.
- E. Innerduct:
1. Suitable for outdoor installations within underground duct banks to create multiple "cells" within a single conduit for fiber optic cables installed during the same phase of construction or for future installations of cables.
 2. Innerduct shall be manufactured from internally processed polyester and nylon resins, factory lubricated. Materials shall be halogen-free.
 3. Innerduct shall be flexible engineered fabric sub-ducting, stitched into multi-cell a design. Cells shall come equipped with pulling tape/rope and shall be color-coded via printing and/or stitching.
- F. Duct plugs:
1. Suitable for installation within exterior conduits at terminations within inground vaults/pullboxes and where entering buildings from underground at equipment rooms. Duct plugs shall provide a watertight (up to 20 psi) seal around innerducts and cables.
 2. Duct plugs shall be sized per conduit trade/actual size, per innerduct trade/actual size, and per cable outside diameter, as required per instance.
 3. Duct plugs shall be re-enterable and re-usable.
- G. Miscellaneous:

1. Fiber slack storage reel.
2. Velcro cable ties:
 - a. Width: 0.75”.
 - b. Color: Same color as the cable to which it is being applied.

1.15 BACKBONE TWISTED PAIR CABLING

A. ISP backbone twisted pair cable:

1. Application:
 - a. Suitable for indoor installations, between floors exposed in equipment rooms as vertical risers, or above suspended ceilings and below raised floors exposed in cable trays, hangers or on deck. If space is used as an air plenum, cable shall either be plenum rated or installed in EMT conduit.
 - b. Each cable run shall be continuous single cable, homogenous in nature, without splices.
 - c. Twisted pair PIC type cable, air core, with an “ALVYN” sheath, compatible with Bell System type “ARMM.”
 - d. Multipair cable shall be non-plenum rated.
2. Conductors:
 - a. Annealed solid copper, 24 AWG.
 - b. Fully insulated conductors consisting of an inner layer of expanded polyolefin and covered with an outer layer (skin) of solid PVC.
 - c. Conductors shall be twisted into pairs. Twisted pairs shall be stranded into 25-pair bundles and into larger units of 25-pair increments, to make up the specified pair count, as well as supper units (if required by pair count).
 - d. Twisted pairs and units shall be color-coded to industry standards, ANSI/ICEA Publication S-80-576 and EIA-230.
3. Core and sheath:
 - a. Cable core (twisted pairs) shall have a tape applied longitudinally, wrapped around its entirety. Tape material shall be non-hydroscopic polypropylene film or equivalent.
 - b. Sheath type shall be “ALVYN” consisting of an inner shield and an outer jacket:
 - 1) Shield: 0.008” aluminum corrugated tape applied longitudinally with an overlap.
 - 2) Jacket: Flame-retardant PVC, adhesively bonded to shield.
4. Cable shall be CEC rated as CMR cable and UL listed as such.
5. Electrical performance of the twisted pairs and overall cable shall comply with TIA/EIA-568-B Part 2 requirements for Category 3 UTP cabling, minimum.

B. OSP backbone twisted pair cable:

1. Application:
 - a. Suitable for outdoors, in underground PVC conduit installations where protection against water and moisture entry is required.
 - b. Each cable run shall be continuous single cable, homogenous in nature, without splices.
 - c. Twisted pair PIC type cable, filled core, with an “ASP” sheath, compatible with Bell System type “ANMW” or Rural Utilities Service type “PE89.”
2. Conductors:

- a. Annealed solid copper, 24 AWG.
 - b. Fully insulated conductors consisting of an inner layer of expanded polyolefin and covered with an outer layer (skin) of solid polyolefin.
 - c. Conductors shall be twisted into pairs. Twisted pairs shall be stranded into 25-pair bundles and into larger units of 25-pair increments, to make up the specified pair count, as well as supper units (if required by pair count).
 - d. Twisted pairs and units shall be color-coded to industry standards, ANSI/ICEA Publication S-80-576 and EIA-230.
3. Core and sheath:
- a. Cable core (twisted pairs) shall have a tape applied longitudinally, wrapped around its entirety. Tape material shall be non-hydroscopic polypropylene film or equivalent.
 - b. Cable core and sheath shall be flooded with filling compound "FLEXGEL," or equal, to protect against moisture penetration.
 - c. Sheath type shall be "ASP" consisting of a two layer inner shield and an outer jacket:
 - 1) Shield:
 - a) 0.008" corrugated aluminum tape applied longitudinally over the core wrap.
 - b) 0.006" corrugated steel tape applied longitudinally over the aluminum tape with an overlap.
 - 2) Jacket: Black, linear low density polyethylene, bonded to shield.
- C. Backbone twisted pair terminations:
1. Inside plant:
 - a. Suitable for installation within equipment rooms for termination of twisted pair backbone cables, either wall or rack mounted, vertically oriented in wall mount column configuration.
 - b. 110 block type. Provide kits as required for 100, 300 or 900-pair, 5-pair based.
 - c. Insulated displacement connector blocks consisting of oxygen free mechanical fastening system, arranged in a flame-retardant molded plastic, and fastened to a mounting bracket.
 - d. Tower mounting construction with legless 110 blocks mounted to steel riser trough.
 - e. Termination apparatus accompanied by the quantity of management panels for routing of both horizontal and vertical cords or cross-connect wires. Horizontal wiring management between block sections and crossconnect trough at bottom.
 - f. Blocks shall meet Category 3 and conform to REA PE-87.
 - g. Include both standard blocks and pre-wired blocks as noted on drawings. Pre-wired terminal blocks shall be wired to an RJ-21C (50 Pin) connector either on block or on end of pigtail stub cable.
 2. Outside plant:
 - a. Termination of outside plant cables with building entrance protection "BEP":
 - 1) BEP terminals:
 - a) Suitable for indoor installations, within equipment rooms (such as MPOE). BEP terminals shall provide termination of outside plant twisted pair backbone cables, shall protect premise equipment against

- induced voltages and stray currents, and shall accept 5-pin protector modules.
 - b) BEP terminals shall be designed for wall mounted configurations and shall have the capacity to accept 50 to 100-pair incoming and/or outgoing cable pairs.
 - c) 710-type input splice modules.
 - d) 110-type output punch down blocks.
 - 2) BEP modules:
 - a) Standard 5-pin type BEP, suitable for installation into BEP terminals.
 - b) Gas tube overvoltage device with DC breakdown voltage of 230-350V.
 - c) Heat coil sneak current device with 1 amp of sneak current and response time less than 15 seconds.
- D. Labels:
- 1. Labels type shall be durable plastic (PE or equal) tags, suitable for indoor and/or outdoor use, and shall contain UV inhibitors. The tags shall attach to the cable via an integrated tie or via a separate steel or plastic tie wrap.
 - 2. Printable area shall be 1.50" by 2.62", minimum.
 - 3. Tags shall be gray. Tie wraps for indoor locations shall be white. Tie wraps for outdoor locations shall be black.

1.16 HORIZONTAL TWISTED PAIR CABLING

- A. Horizontal cables:
- 1. Application:
 - a. Suitable for indoor installations, exposed within equipment rooms, above suspended ceilings and below raised floors in cable trays, hangers or on deck, or within walls. If space is used as an air plenum, cable shall either be plenum rated or installed in EMT conduit.
 - b. Each cable run shall be continuous single cable, homogenous in nature, without splices.
 - c. Cables shall meet CAT6A performance criteria.
 - d. Cables shall be plenum rated.
 - 2. Conductors:
 - a. Insulated conductors: Eight #23 AWG, solid copper wire insulated with fluorinated-ethylene-propylene (FEP) for plenum rated applications.
 - b. Twisted pairs: Two insulated conductors twisted together to form a pair and four such paired cables to form a unit with individually color-coded pairs to conform to industry standards (ANSI/ICEA Publication S-80-576-1994 and EIA-230).
 - 3. Cable sheath:
 - a. Outer jacket: Seamless outer jacket, flame-retardant PVC (low smoke for plenum application), applied to and completely covering the internal components (twisted pairs).
 - b. Flame rating: CMP according to CEC Article 800, tested to NFPA 262 and UL Listed as such.
 - 4. Electrical performance: Meet or exceed TIA/EIA-568-C .2-10 Augmented and ISO 11801 Edition 2.1 Class E specifications for CAT6A UTP cabling.

2.5 BACKBONE TWISTED PAIR CABLING

A. ISP backbone twisted pair cable:

1. Application:
 - a. Suitable for indoor installations, between floors exposed in equipment rooms as vertical risers, or above suspended ceilings and below raised floors exposed in cable trays, hangers or on deck. If space is used as an air plenum, cable shall either be plenum rated or installed in EMT conduit.
 - b. Each cable run shall be continuous single cable, homogenous in nature, without splices.
 - c. Twisted pair PIC type cable, air core, with an "ALVYN" sheath, compatible with Bell System type "ARMM."
 - d. Multipair cable shall be non-plenum rated.
2. Conductors:
 - a. Annealed solid copper, 24 AWG.
 - b. Fully insulated conductors consisting of an inner layer of expanded polyolefin and covered with an outer layer (skin) of solid PVC.
 - c. Conductors shall be twisted into pairs. Twisted pairs shall be stranded into 25-pair bundles and into larger units of 25-pair increments, to make up the specified pair count, as well as super units (if required by pair count).
 - d. Twisted pairs and units shall be color-coded to industry standards, ANSI/ICEA Publication S-80-576 and EIA-230.
3. Core and sheath:
 - a. Cable core (twisted pairs) shall have a tape applied longitudinally, wrapped around its entirety. Tape material shall be non-hydroscopic polypropylene film or equivalent.
 - b. Sheath type shall be "ALVYN" consisting of an inner shield and an outer jacket:
 - 1) Shield: 0.008" aluminum corrugated tape applied longitudinally with an overlap.
 - 2) Jacket: Flame-retardant PVC, adhesively bonded to shield.
4. Cable shall be NEC rated as CMR cable and UL listed as such.
5. Electrical performance of the twisted pairs and overall cable shall comply with TIA/EIA-568-B Part 2 requirements for Category 3 UTP cabling, minimum.

B. OSP backbone twisted pair cable:

1. Application:
 - a. Suitable for outdoors, in underground PVC conduit installations where protection against water and moisture entry is required.
 - b. Each cable run shall be continuous single cable, homogenous in nature, without splices.
 - c. Twisted pair PIC type cable, filled core, with an "ASP" sheath, compatible with Bell System type "ANMW" or Rural Utilities Service type "PE89."
2. Conductors:
 - a. Annealed solid copper, 24 AWG.
 - b. Fully insulated conductors consisting of an inner layer of expanded polyolefin and covered with an outer layer (skin) of solid polyolefin.

- c. Conductors shall be twisted into pairs. Twisted pairs shall be stranded into 25-pair bundles and into larger units of 25-pair increments, to make up the specified pair count, as well as super units (if required by pair count).
 - d. Twisted pairs and units shall be color-coded to industry standards, ANSI/ICEA Publication S-80-576 and EIA-230.
3. Core and sheath:
- a. Cable core (twisted pairs) shall have a tape applied longitudinally, wrapped around its entirety. Tape material shall be non-hydroscopic polypropylene film or equivalent.
 - b. Cable core and sheath shall be flooded with filling compound "FLEXGEL," or equal, to protect against moisture penetration.
 - c. Sheath type shall be "ASP" consisting of a two layer inner shield and an outer jacket:
 - 1) Shield:
 - a) 0.008" corrugated aluminum tape applied longitudinally over the core wrap.
 - b) 0.006" corrugated steel tape applied longitudinally over the aluminum tape with an overlap.
 - 2) Jacket: Black, linear low density polyethylene, bonded to shield.
- C. Backbone twisted pair terminations:
- 1. Inside plant:
 - a. Suitable for installation within equipment rooms for termination of twisted pair backbone cables, either wall or rack mounted, vertically oriented in wall mount column configuration.
 - b. 110 block type. Provide kits as required for 100, 300 or 900-pair, 5-pair based.
 - c. Insulated displacement connector blocks consisting of oxygen free mechanical fastening system, arranged in a flame-retardant molded plastic, and fastened to a mounting bracket.
 - d. Tower mounting construction with legless 110 blocks mounted to steel riser trough.
 - e. Termination apparatus accompanied by the quantity of management panels for routing of both horizontal and vertical cords or cross-connect wires. Horizontal wiring management between block sections and crossconnect trough at bottom.
 - f. Blocks shall meet Category 3 and conform to REA PE-87.
 - g. Include both standard blocks and pre-wired blocks as noted on drawings. Pre-wired terminal blocks shall be wired to an RJ-21C (50 Pin) connector either on block or on end of pigtail stub cable.
 - 2. Outside plant:
 - a. Termination of outside plant cables with building entrance protection "BEP":
 - 1) BEP terminals:
 - a) Suitable for indoor installations, within equipment rooms (such as MPOE). BEP terminals shall provide termination of outside plant twisted pair backbone cables, shall protect premise equipment against induced voltages and stray currents, and shall accept 5-pin protector modules.

- b) BEP terminals shall be designed for wall mounted configurations and shall have the capacity to accept 50 to 100-pair incoming and/or outgoing cable pairs.
- c) 710-type input splice modules.
- d) 110-type output punch down blocks.
- 2) BEP modules:
 - a) Standard 5-pin type BEP, suitable for installation into BEP terminals.
 - b) Gas tube overvoltage device with DC breakdown voltage of 230-350V.
 - c) Heat coil sneak current device with 1 amp of sneak current and response time less than 15 seconds.

D. Labels:

- 1. Labels type shall be durable plastic (PE or equal) tags, suitable for indoor and/or outdoor use, and shall contain UV inhibitors. The tags shall attach to the cable via an integrated tie or via a separate steel or plastic tie wrap.
- 2. Printable area shall be 1.50" by 2.62", minimum.
- 3. Tags shall be gray. Tie wraps for indoor locations shall be white. Tie wraps for outdoor locations shall be black.

2.6 HORIZONTAL TWISTED PAIR CABLING

A. Horizontal cables:

- 1. Application:
 - a. Suitable for indoor installations, exposed within equipment rooms, above suspended ceilings and below raised floors in cable trays, hangers or on deck, or within walls. If space is used as an air plenum, cable shall either be plenum rated or installed in EMT conduit.
 - b. Each cable run shall be continuous single cable, homogenous in nature, without splices.
 - c. Cables shall meet CAT6A performance criteria.
 - d. Cables shall be plenum rated.
- 2. Conductors:
 - a. Insulated conductors: Eight #23 AWG, solid copper wire insulated with fluorinated-ethylene-propylene (FEP) for plenum rated applications.
 - b. Twisted pairs: Two insulated conductors twisted together to form a pair and four such paired cables to form a unit with individually color-coded pairs to conform to industry standards (ANSI/ICEA Publication S-80-576-1994 and EIA-230).
- 3. Cable sheath:
 - a. Outer jacket: Seamless outer jacket, flame-retardant PVC (low smoke for plenum application), applied to and completely covering the internal components (twisted pairs).
 - b. Flame rating: CMP according to NEC Article 800, tested to NFPA 262 and UL Listed as such.
- 4. Electrical performance: Meet or exceed TIA/EIA-568-C .2-10 Augmented and ISO 11801 Edition 2.1 Class E specifications for CAT6A UTP cabling.
- 5. Manufacturer:
 - a. General Cable: GenSpeed 10, Blue

1) Plenum P/N: 7141819

B. Modular patch cords:

1. Application: Suitable for indoor installations within equipment rooms or workstation environments.
2. Cords assembled from a single, continuous length of cordage, homogenous in nature and terminated at both ends via 8-position modular plugs. Splices are not permitted anywhere.
3. Cordage:
 - a. Insulated conductors: Eight solid copper wire insulated with thermoplastic polyethylene or high-density polyolefin for non-plenum rated applications.
 - b. Twisted pairs: Two insulated conductors twisted together to form a pair and four such paired cables to form a unit with individually color-coded pairs to conform to industry standards (ANSI/ICEA Publication S-80-576-1994 and EIA-230).
4. Cable sheath:
 - a. Outer jacket: Seamless outer jacket, flame-retardant PVC, applied to and completely covering the internal components (twisted pairs).
 - b. Flame rating: CM according to NEC Article 800, tested to UL listed as such.
5. Electrical performance: Meet or exceed TIA/EIA-568-C.2-10 Augmented and ISO 11801 Edition 2.1 Class E specifications for CAT6A UTP cabling.
6. Manufacturer:
 - a. Panduit: small diameter 6A cords
 - 1) P/N: UTP28SP*RD
 - a) (*=length as required at patch panel)
 - b) (*=length, Minimum length at workstation 10 ft.)

C. Crossconnect wires:

1. Crossconnect wires shall be suitable for installation within equipment rooms and fully compatible with the termination apparatus specified within this Section.
2. Crossconnect wires shall be manufactured from a single, continuous length of insulated wire, homogenous in nature. Splices are not permitted anywhere.
3. Conductors:
 - a. Insulated conductors: #24 AWG, solid copper wire insulated with thermoplastic polyethylene or high-density polyolefin for non-plenum rated applications.
 - b. Twisted pairs: Two insulated conductors twisted together to form a pair with individually color-coded pairs to conform to industry standards (ANSI/ICEA Publication S-80-576-1994 and EIA-230).

D. Modular patch panels:

1. Application:
 - a. Modular patch panels shall be suitable for installation within a equipment room for the terminations of horizontal cables specified within this Section.
 - b. Patch panels shall be horizontally oriented for rack-mounted configuration within a 19" rack.
 - c. Patch panels shall be capable of supporting, organizing, labeling and patching/crossconnecting between the horizontal termination field and the equipment termination field.
2. Modular patch panels shall have 110-type terminations on back for horizontal cabling.

3. Patch panels shall be angled and have 24 or 48 ports on front and each port shall be an 8-position modular jack, compliant to TIA/EIA 568-C.2 Chapter 5.
 4. Each port shall be T568A wired.
 5. Electrical performance: Meet or exceed TIA/EIA-568-C.2-10 Augmented and ISO 11801 Edition 2.1 Class E specifications for CAT6A UTP cabling.
 6. Also, include 24 or 48 port modular patch panels with pre-wired RJ-21C (50 Pin) connectors. Panels shall conform to all above requirements, except performance shall meet TIA/EIA-568-B.2 for CAT3 UTP cabling.
 7. Manufacturer: Panduit
 - a. 24 Port Panel P/N: DPA246X88TGY
 - b. 48 Port Panel P/N: DPA486X88TGY
- E. Modular connectors:
1. Modular connectors shall be 8-position jacks, compliant to TIA/EIA-568-C.2 Addendum 10, and shall be compatible with the specified cable within this Section, both electrically and physically
 2. Modular connectors shall be T568A wired.
 3. Electrical performance: Meet or exceed TIA/EIA-568-C.2-10 Augmented and ISO 11801 Edition 2.1 Class E specifications for CAT6A UTP cabling.
 4. Manufacturer: Panduit
 - a. P/N: CJ6X88TGRD
- F. Outlets:
1. Application:
 - a. Outlet faceplates and mounting frames shall be suitable for indoor installations to standard single or double-gang flush wall mounted outlet box plaster rings, furniture partition outlets and floor boxes.
 - b. Refer to Specification Section 262726: Wiring Devices for device cover plate finish.
 2. Standard wall mounted faceplates:
 - a. Modular faceplates shall have 4-ports and shall include required accessories, such as icons, blank inserts, label windows and labels.
 - b. Faceplates shall be single-ganged.
 - c. Faceplates shall be flush mounted.
 - d. Faceplates shall be single-gang decora-style to match power wiring devices.
 - e. Panduit P/N: CFPL4IWxxY
 3. Modular outlet frame:
 - a. Modular outlet frame shall have 234-ports and shall include required accessories, such as icons, blank inserts, label windows and labels.
 - b. Outlet frame shall be decora-style.
 - c. Outlet frame shall attach like a duplex receptacle strap attaches to a box.
 4. Wall mounted phone faceplates:
 - a. Faceplate shall be single-gang, flush mounted with 1 port and shall include required accessories.
 - b. Faceplate shall include two mounting studs for standard wall phone instrument.
 - c. Faceplate shall be stainless steel.
 5. Surface mounted outlets:

- a. Surface outlets shall be fully compatible with the specified modular connector/jacks.
 - b. Surface outlets shall have 2 or 4-ports.
 - c. Panduit P/N
 - 1) 2 Port: CBXJ2IW-A
 - 2) 4 Port: CBXJ4IW-A
6. Partition furniture mounted faceplates:
- a. Faceplates shall be single-gang type with 2346-ports and shall include required accessories, such as icons, blank inserts, label windows and labels.
 - b. Faceplates shall be black.

G. Labels:

1. Labels shall be machine printable with a laser printer, ink jet printer, thermal transfer printer or hand-held printer.
2. Labels for horizontal cables:
 - a. Adhesive backed labels and self-laminating feature.
 - b. Fit the horizontal cables specified herein by fully wrapping around the cable jacket.
 - c. Size: 2" x .05" printable area, minimum.
 - d. Color: White.

H. Miscellaneous components:

1. Velcro cable ties:
 - a. Width: 0.75".
 - b. Color: Velcro cable ties the same color as the cable to which it is applied.
2. Plenum cable ties:
 - a. Suitable for use in plenums or air handling spaces.
 - b. Color: Maroon or other distinctive non-white color.

2.7 CABLE TESTING EQUIPMENT

A. Fiber optic cabling:

1. Fiber optic light source:
 - a. Connection interfaces shall be factory installed.
 - b. Output shall be continuous wavelengths.
 - c. The light sources may contain internal lenses, pigtails, and modal conditioners, provided they meet the launch conditions as described in "Post-Installation" Passive Link Attenuation Testing Procedures.
 - d. LASER-based light source for multimode fiber testing shall have the following:
 - 1) Center wavelength of 850nm \pm 30nm and 1300nm \pm 20nm
 - 2) Special width (FWHM) of \leq 50nm at 850nm and \leq 150nm at 1300nm.
 - 3) Minimum output power level of \geq 20dBm.
 - e. LASER-based light source for singlemode fiber testing shall have the following:
 - 1) Center wavelength of 1320nm \pm 20nm and 1550nm \pm 20nm
 - 2) Special width (FWHM) of \leq 5nm at 1310nm and \leq 5nm at 1550nm.
 - 3) Minimum output power level of \geq 3dBm.

2. Fiber optic power meter:
 - a. Power meter for multimode and singlemode testing shall be capable of measuring relative of absolute power (or both) and must be independent of modal distribution.
 - b. Power meters used must be calibrated and traceable to the National Bureau of Standards.
 - c. Power meter used shall have the following:
 - 1) Dynamic range of 0dBm to -40dBm minimum.
 - 2) Accuracy of ± 0.2 dBm.

3. Fiber optic mandrel:
 - a. Mandrel diameter for 50/125 μ m jacketed (3.0mm) fiber shall be 22mm.
 - b. Mandrel diameter for 50/125 μ m unjacketed (0.9mm) fiber shall be 25mm.

4. Fiber optic OTDR:
 - a. Multimode source module:

Wavelength	Dynamic Range	Attenuation Deadzone	Reflective Deadzone	Loss Resolution	Distance Accuracy
850nm	24dB	6.5mt	3.0mt	0.001dB	0.1mt
1300nm	27dB	7.0mt	3.0mt	0.001dB	0.1mt

- b. Singlemode source module:

Wavelength	Dynamic Range	Attenuation Deadzone	Reflective Deadzone	Loss Resolution	Distance Accuracy
1310nm	40dB	6.0mt	3.5mt	0.001dB	0.1mt
1550nm	28dB	12.0mt	3.5mt	0.001dB	0.1mt

- c. Reader software: Windows-based software capable of reading stored traces and is fully functional with the testing equipment.

5. Fiber optic test cords:
 - a. Multimode fiber optic test cords:
 - 1) The fiber of the multimode test cords shall have the core diameter and numerical aperture nominally equal to that of the multimode fiber optic passive link.
 - 2) Test cord length for testing insertion loss: 1m to 5m.
 - 3) Connectors of the test cords shall be compatible with the connector types of the light source and the power meter, and with the cabling plant.
 - 4) The connectors shall exhibit ≤ 0.5 dB loss per connection @ both 850nm and 1300nm, as measured per FOTP-171 D2.
 - b. Singlemode fiber optic test cords:
 - 1) The fiber of the singlemode test cords shall have the core diameter and numerical aperture nominally equal to that of the singlemode fiber optic passive link.
 - 2) Test cord length for testing insertion loss: 1m to 5m.
 - 3) Connectors of the test cords shall be compatible with the connector types of the light source and the power meter, and with the cabling plant.

- 4) The connectors shall exhibit ≤ 0.5 dB loss per connection @ both 1300 nm and 1550 nm, as measured per FOTP-171 D3. The connectors shall inhibit Fresnel reflections (i.e. have a "PC" finish).
- B. Twisted pair cabling:
1. Backbone cable tester: Areas of test measurement shall be Wire Map for continuity, opens, shorts, crossed pairs and split pairs, as a minimum.
 2. Horizontal cable tester:
 - a. Equipment shall meet TIA/EIA-568B.2 Addendum 1 requirements for Level III accuracy, as applicable for cable type specified herein.
 - b. Test standards: ISO/IEC 11801 Class C and D; ISO/IEC 11801-2000 Class C and D, 1000Base-Y, 100Base-TX; IEEE 802.3 10Base-T; ANSI TP-PMD; IEEE 802.5.
 - c. Areas of test measurement (minimum):
 - 1) Wire Map.
 - 2) Length.
 - 3) Insertion Loss.
 - 4) The following at both master unit and remote unit:
 - a) Near End Crosstalk (NEXT) loss.
 - b) Power Sum NEXT (PSNEXT) loss.
 - c) Equal Level Far End Crosstalk (ELFEXT).
 - d) Power Sum ELFEXT.
 - e) Return Loss (RL).
 - f) Attenuation-to-Crosstalk Ratio (ACR).
 - g) Power Sum ACR (PSACR).
 - 5) Propagation Delay and Delay Skew.
 - 6) Characteristic Impedance.
 - 7) DC Loop Resistance.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of the telecommunication cabling system installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.
- B. Verify that pathways and supporting devices are properly and completely installed prior to cable installation.
- C. Verify dimensions of pathways to include length, i.e. "true tape" conduit runs.
- D. Prior to installation, verify that equipment rooms are ready to accept cables and terminations.

3.2 INSTALLATION

- A. Equipment rooms:
1. Rack bays:
 - a. Equipment racks:
 - 1) Provide parts and accessories required to complete each rack per manufacturer's instructions and as detailed on drawings.
 - 2) Anchoring and bracing:
 - a) Anchor racks to the floor using structural engineer approved concrete anchors.
 - b) Each rack must be attached to the floor at four points.
 - c) If required for seismic bracing, provide bracing devices (i.e. brackets, threaded rod with strut, etc.) attached to wall or structure above using appropriate fasteners.
 - 3) Tolerances:
 - a) Verify dimensions to establish proper clearances as follows:
 - (1) Front: 40" clearance from channel front mounting flange.
 - (2) Back: 57" clearance from channel back mounting flange.
 - b) Provide the correct amount of space between each rack for proper installation (according to manufacturer's written instructions) of the vertical management sections.
 - b. Vertical management sections:
 - 1) Provide vertical management sections mounted to racks with one between each rack and one on both ends.
 - 2) Bolt sections to the racks at the points designed by the manufacturer and per the manufacturer's instructions.
 - c. Horizontal management panels:
 - 1) Provide the horizontal management panels mounted to racks with one above each patch panel and one below the bottom patch panel in each rack bay where patch panels occur.
 - 2) Provide fasteners and parts required to complete the installation.
 - d. Accessories: Provide all accessories as required for a complete installation. Include one bag of rack mounting screws, as come packaged with rack product. Attach the screws directly to the rack, which shall constitute turn-over to the Owner.
 2. Overhead cable runway support:
 - a. Provide support devices (i.e. brackets, threaded rod with strut, etc.) attached to wall or structure above using appropriate fasteners. Installation shall meet manufacturer's instructions and layout on the drawings.
 - b. Provide all parts and accessories required for a complete installation.
 - c. Cable runway support shall be centered over equipment racks where shown running parallel.
 - d. Coordinate the installation of the overhead cable runway support with other trades having Work in same area.
 3. Vertical cable runway support:
 - a. Install cable runway vertically on walls where noted and/or shown on the drawings. Runway shall be for the support of cables routed vertically on walls within the equipment rooms.
 - b. Provide parts and accessories as required for a complete installation.

- c. Install the cable runway such that the rungs are facing outward (the greater distance from the rung to the stringer edge is facing inward).
- B. Equipment bonding:
 1. Provide telecommunication bonding conductor and appropriate hardware between the telecommunication system grounding backbone bus in each equipment room and the equipment racks/rack bays, overhead cable support, vertical cable support, telecommunication conduits, primary pathways that exit/enter the rooms (if applicable), and all other metallic telecommunication infrastructure components.
 2. Telecommunication bonding conductor:
 - a. The minimum size for the bonding conductor shall be #6 AWG THHN/THWN.
 - b. Install the bonding conductors in a manner that will protect them from physical and mechanical damage.
 - c. Route the bonding conductors in the shortest possible path, using right angles for turns and routed parallel to building lines.
 - d. Utilize a minimum of 1'-0" bending radius.
 - e. At the backbone ground busbar:
 - 1) Thoroughly clean the busbar prior to attaching connectors and terminating conductors.
 - 2) Attach connectors to the busbar with appropriate size cadmium bronze bolt, flat washer and Belleville washer.
 - 3) Torque all connectors.
 3. Rack bays:
 - a. Bond equipment racks, frames, frame bays, cabinets, server racks, and all other similar support systems located within the same equipment room or space to the backbone ground busbar in same room.
 - b. Rack bays may be bonded in series using either of the following configurations:
 - 1) Provide a bonding conductor from the backbone busbar to the closest rack and route through ground lug connected to rack, extending the conductor the full length of the rack bay. Each individual rack shall have a ground lug attached that the bonding conductor passes through. Insulation on bonding conductor, where it passes through the lug, shall be removed prior to tightening connection around conductor.
 - 2) Provide a bonding conductor from the backbone busbar to the closest rack and then along the entire length of rack bay. "T" tap a pigtail, sized the same as the bonding conductor, from the bonding conductor to each individual rack and terminate on ground lug connected to rack.
 4. Overhead and vertical cable runway support:
 - a. Bond cable runway located within the same equipment room or space to the backbone ground busbar in same room.
 - b. Provide a "ground kit" (straps and connectors) to bond sections of the runway for ground continuity. This requirement applies to runway sections and junctions within the same equipment room.
- C. ISP backbone fiber optic cabling:
 1. Cabling:
 - a. Cable runs shall have continuous sheath continuity, homogenous in nature, without any splices.

- b. Maximum cable length of 1,600 feet (500m) between the terminations at MPOE, MDF's and IDF's.
 - c. Placement:
 - 1) Place cables within designated pathways.
 - 2) Maintain a minimum bend radius of 20 times the cable diameter during installation and a minimum bending radius of 10 times the cable diameter after installation.
 - 3) Maintain pulling tension within manufacturer's limits.
 - 4) Place and suspend cables in a manner to protect them from physical interference or damage. Place cables with no kinks, twists, or impact damage to the sheath. Replace cables damaged during installation.
 - 5) Do not use cable-pulling compounds for indoor installations.
 - 6) Provide 20 to 30 feet minimum sheath cable slack at each end of the run within the equipment rooms. Store cable slack in the fiber slack storage reel mounted on wall.
 - 7) Place a pull rope along with cables where run in conduit and spare capacity still exists in the conduit. Tie off ends of pull rope.
 - d. Routing:
 - 1) Within equipment rooms, neatly dress and organize cables on designated cable routing facilities and fasten cables to routing facilities via tie wraps or Velcro type straps.
 - 2) When routing horizontally within equipment rooms, utilize the overhead cable support system. When routing vertically within equipment rooms, utilize the vertical cable support system and provide approved cable straps at 24" intervals.
 - e. Terminations:
 - 1) Properly relieve strain from cables at termination points, at or within the fiber optic termination panels) per manufacturer's instructions.
 - 2) Provide breakout kits to furcated fibers from buffer tubes. Provide required accessories and consumables for the complete termination of fiber strands.
 - 3) Terminate fiber strands at both ends using the specified finer optic connectors appropriate for the mode type of the fiber. Perform termination in accordance with manufacturer's instructions.
 - 4) Provide 3 feet of unsheathed fiber (tight buffer) slack within the patch panel/termination enclosure at each end of the link. Properly store fiber slack in rear of patch panel into the routing rings, per manufacturer's instructions.
2. Termination apparatus:
- a. Provide fully assembled termination patch panels in designated equipment racks, located a top of rack. "Fully assembled" includes installation and mounting components and accessories such as adapter panels, coupling adapters, etc. required for operation.
 - b. Provide accessories required for proper installation of each termination patch panel, including connector panels and adapters.
 - c. Termination sequence:
 - 1) Rack-mount panels: Terminate singlemode fibers first (upper left-most position), then multimode fibers, all in sequential strand order.

- D. OSP backbone fiber optic cabling:
1. Innerduct:
 - a. Provide innerduct and accessories for all conduits containing outside plant fiber optic cables. Innerducts shall consist of either three 1.25" or four 1" innerducts per 4" conduit. Assume the latter unless indicated otherwise on the Drawings.
 - b. Install innerduct per manufacturer's instructions. Use pulling equipment and consumables (such as lubricants) allowed by the manufacturer. Place multiple innerduct using pulling harness designed specifically for the use and also using pulling swivel.
 - c. At each vault or pullbox, building entrance, and equipment room, secure innerducts with triplex (for use with three 1.25" innerducts) or quadplex (for use with four 1" innerducts) duct plugs.
 2. Cabling:
 - a. Cable runs shall have continuous sheath continuity, homogenous in nature, between either termination points or designated splice points. Only splices as noted on the Construction Documents are permitted.
 - b. Maximum cable length of 4,900 feet (1,500m) between the terminations at MPOE or MDF's.
 - c. Placement:
 - 1) Place cables within designated pathways.
 - 2) Maintain a minimum bend radius of 20 times the cable diameter during installation and a minimum bend radius of 10 times the cable diameter after installation.
 - 3) Maintain pulling tension within manufacturer's limits.
 - 4) Place and suspend cables in a manner to protect them from physical interference or damage. Place cables with no kinks, twists, or impact damage to the sheath. Replace cables damaged during installation.
 - 5) Only use UL approved cable-pulling compounds when necessary to reduce pulling tension.
 - 6) Provide 20 to 30 feet minimum sheath cable slack at each end of the run within the equipment rooms. Store cable slack in the fiber slack storage reel mounted on wall.
 - 7) Place a pull rope along with cables where run in conduit and spare capacity still exists in the conduit. Tie off ends of pull rope.
 - d. Routing:
 - 1) Route cables in innerduct between points of termination throughout entire length, except at the fiber take up reel.
 - 2) Within equipment rooms, neatly dress and organize cables on designated cable routing facilities and fasten cables to routing facilities via tie wraps or Velcro type straps.
 - 3) When routing horizontally within equipment rooms, utilize the overhead cable support system. When routing vertically within equipment rooms, utilize the vertical cable support system and provide approved cable straps at 24" intervals.
 - e. Terminations:
 - 1) Properly relieve strain from cables at termination points, at or within the fiber optic termination panels) per manufacturer's instructions.

- 2) Provide breakout kits to furcated fibers from buffer tubes. Provide required accessories and consumables for the complete termination of fiber strands.
 - 3) Terminate fiber strands at both ends using the specified fiber optic connectors appropriate for the mode type of the fiber. Perform termination in accordance with manufacturer's instructions.
 - 4) Provide 3 feet of unsheathed fiber (tight buffer) slack within the patch panel/termination enclosure at each end of the link. Properly store fiber slack in rear of patch panel into the routing rings, per manufacturer's instructions.
3. Duct plugs:
- a. Install plugs per manufacturer's instructions.
 - b. Provide duct plugs at conduit ends, both within inground vaults/pullboxes and at building entrances. Provide fillers in each used duct port.
4. Termination apparatus:
- a. Provide fully assembled termination patch panels in designated equipment racks, located a top of rack. "Fully assembled" includes installation and mounting components and accessories such as adapter panels, coupling adapters, etc. required for operation.
 - b. Provide accessories required for proper installation of each termination patch panel, including connector panels and adapters.
 - c. Termination sequence:
 - 1) Rack-mount panels: Terminate singlemode fibers first (upper left-most position), then multimode fibers, all in sequential strand order.
- E. OSP backbone twisted pair cabling:
1. Cabling:
 - a. Cable runs shall have continuous sheath continuity, homogenous in nature, between either termination points or designated splice points. Only splices as noted on the Construction Documents are permitted.
 - b. Maximum cable length of 4,900 feet between the terminations at MPOE or MDF's.
 - c. Placement:
 - 1) Place cables within designated pathways.
 - 2) Maintain a minimum bend radius of 6 times the cable diameter during and after installation.
 - 3) Maintain pulling tension within manufacturer's limits. Only use UL approved cable pulling compounds when necessary to reduce pulling tensions.
 - 4) Place and suspend cables in a manner to protect them from physical interference or damage. Place cables with no kinks, twists, or impact damage to the sheath. Replace cables damaged during installation.
 - 5) Neatly dress and organize cables in the cable routing facilities and fasten to support devices via tie wraps.
 - 6) Place a pull rope along with cables where run in conduit and spare capacity still exists in the conduit. Tie off ends of pull rope.
 - d. Routing:
 - 1) When routing horizontally within equipment rooms, utilize the overhead cable support system. Within overhead cable support, route backbone

- cables to avoid crossing over horizontal cabling or horizontal cabling crossing over backbone cables. When routing vertically within equipment rooms, utilize the vertical cable support system and provide approved cable straps at 24" intervals.
- 2) Route cables a minimum of 6" away from power sources to reduce interference from EMI.
- e. Terminations:
- 1) Provide 15 feet cable slack loop at each end of the cable run. Store slack in overhead cable support system or on backboard.
 - 2) Properly relieve strain from cables at termination points per manufacturer's recommendations.
 - 3) Bond metallic components of the cable sheath (i.e. shield) to the telecommunication ground system in accordance with the NEC and manufacturer's instructions.
 - 4) Terminate twisted pairs at both ends onto the specified BEP terminals. Perform terminations in accordance with manufacturer's latest instructions and TIA/EIA-568-B standard installation practices.
2. Building entrance protection:
- a. Provide BEP system to include terminals, modules and accessories required for a complete installation. Install BEP per manufacturer's written instructions.
 - b. Install BEP terminals plumb and square with building lines. Install such that the bottom row of terminations is no lower than 24" above finished floor and the top row of terminations is no higher than 60" above finished floor.
 - c. Grounding and bonding:
 - 1) Bond BEP terminals to the telecommunication ground system in accordance with the NEC and per the manufacturer's instructions.
 - 2) Provide #6 AWG bonding conductor.
 - d. Provide quantity of protector modules to completely populate terminals.
- F. Horizontal twisted pair cabling:
1. Horizontal cable installation and routing:
 - a. Cable runs shall have continuous sheath continuity, homogenous in nature with no splicing.
 - b. No cabling shall exceed a cable length of 295' (90m) from the termination point at the equipment room to the termination at the workstation outlet, including service slack, when measured using test equipment.
 - c. Place cables within the designated pathways, such as cable tray or basket tray, cable runway, cable hangers, etc. Do not fasten, support or attach cables to other building infrastructures (i.e. ducts, pipes, conduits, etc.), other systems (i.e. ceiling support wires, wall studs, etc.), or to the outside of conduits, cable trays and nonapproved pathway systems.
 - d. Place and suspend cables during installation and termination in a manner to protect them from physical damage or interference. Place cables with no kinks, twists, or impact damage to the sheath. Replace cables damaged during installation or termination at no additional cost.
 - e. Route cables at 90° angles, allowing for bending radius.
 - f. Do not exceed pulling tension of 25 lbs.
 - g. Do not use cable-pulling compounds.

- h. Do not exceed a minimum bend radius of 6 times the cable diameter during and after installation.
 - i. Route cables beneath other building infrastructures (i.e. ducts, pipes, conduits, etc.) in above ceiling applications. Do not route cables over building infrastructures. The installation shall result in easy accessibility to the cables in the future.
 - j. Place cables 6” minimum away from power sources to reduce interference from EMI.
 - k. Do not set 360° service loops in place for slack storage. Instead, set slack as forward-and-back or as figure eights.
 - l. Place a pull string along with cables where run in conduits and spare capacity in conduit remains. Tie off ends of the pull string to prevent the string from falling onto the conduit.
 - m. When exiting the primary pathway, such as cable or basket tray, to the workstation outlets, exit via the top of the pathway. Secure the cables to the pathway using an approved cable tie.
2. Cable routing and dressing within equipment rooms:
- a. Within equipment rooms, only use Velcro type straps.
 - b. Place cables within the overhead cable support system. When routing vertically on walls, fasten the cables onto vertical supports every 24” on center.
 - c. Provide 12” minimum sheath cable slack, length not to exceed permanent link maximum length requirement. Place the slack in the overhead cable support system.
 - d. At the rack bay, route and neatly dress cables from the overhead cable support system into the back of the vertical management sections. Divide the cables equally between both sides of an equipment rack such that a cable does not travel past the midpoint of the rack prior to termination. Fasten the cables to the cable support bar at the back of the patch panel using approved ties.
3. Termination in the equipment rooms:
- a. Provide termination apparatus and accessories required for a complete installation. Install and assemble termination apparatus, accessories and associated management apparatus according to the manufacturer’s instructions.
 - b. Properly relieve strain from the cables to and at termination points per manufacturer’s instructions. Provide a strain relief bar at the back of the modular patch panels for proper strain relief.
 - c. Terminate cables and twisted pairs in accordance with manufacturer’s latest installation requirements and TIA/EIA-568-B standard installation practices. Terminate cable pairs onto the termination apparatus compliant to T568A wiring.
 - d. Modular patch panels and horizontal management panels:
 - 1) Provide quantity of modular patch panels to support the terminations of cables served from respective IDF. Provide quantity of horizontal management panels based on the quantity of patch panels.
 - 2) Install and assemble modular patch panels and horizontal management panels according to the manufacturer’s instructions.
 - 3) Install the patch panels and the horizontal management panels as shown on the Drawings.
 - 4) Terminate cables in sequential order using the link’s identifier starting at the top left and completing a panel before moving to the next panel below.
4. Cable routing and dressing at workstations:

- a. Provide 12" to 18" cable slack at each workstation outlet, length not to exceed permanent link maximum length requirement. Place the slack within ceiling space neatly on a cable hanger or other approved cable support device.
 - b. Route to partition furniture mounted faceplates:
 - 1) Route cables from primary or secondary pathway within ceiling through the furniture partition feed pathway (stub from wall or floor box) into opening at bottom of furniture system. Exercise caution to prevent scraping, cutting or other damage to cable jacket.
 - 2) Provide spiral wrap around cables from furniture-feed pathway to point where cables enter furniture.
5. Termination at the workstation outlets:
- a. Provide device components, connectors, and accessories required for a complete installation. Install and assemble connectors, jacks, adapters, termination apparatus, accessories and associated management apparatus according to the manufacturer's instructions.
 - b. Connector color shall match the faceplate.
 - c. Provide "fog white" connectors for data links and "dark blue" connectors for voice links.
 - d. Wall mounted standard devices:
 - 1) Install devices at heights indicated on drawings.
 - 2) Mount faceplates plumb, square and at the same level as adjacent power receptacles.
 - 3) Patch gaps around faceplates so that faceplate covers the entire wall opening.
 - e. Partition furniture mounted devices:
 - 1) Coordinate installation of the faceplate adapters with the furniture contractor, including color.
 - 2) Mount faceplate adapters into the designated openings for horizontal cables.
 - f. Terminate cables and twisted pairs in accordance with the manufacturer's latest installation requirements and TIA/EIA-568-B standard installation practices. Terminate cable pairs onto the connector compliant to T568A wiring.
6. Patching and crossconnecting:
- a. In equipment rooms, provide one modular patch cord for the first data connector in each workstation outlet. Install from the horizontal termination field to the network switches/equipment. Neatly dress patch cords within the horizontal and vertical cable management components.
 - b. In equipment rooms, provide one modular patch cord for the first voice connector in each workstation outlet. Install from the horizontal termination field to the voice field. Neatly dress patch cords within the horizontal and vertical cable management components.
 - c. Provide one 1-pair crossconnect for each workstation outlet. Install from backbone twisted pair 110 terminal blocks to the pre-wired 110 terminal blocks. Neatly dress patch cords within the horizontal and vertical cable management components.

3.3 LABELING

- A. General requirements:
 - 1. Labeling, label colors, and identifier assignments shall conform to EIA/EIA-606-A Administration Standards and as approved by the Owner.
 - 2. Provide permanent and machine-generated labels. Hand written labels will not be accepted.

- B. Equipment room labeling:
 - 1. Equipment rack: Provide one label plate per rack and cabinet/frame. Permanently affix label plate centered on the rack's top angle or the cabinet's top front frame.
 - 2. Identifier assignment for equipment racks:
 - a. Prefix: "RACK"
 - b. First field: The IDF identity.
 - c. Second field: The rack number.

- C. Backbone fiber optic cable labeling:
 - 1. Cables:
 - a. Text color shall be black with #10 font size.
 - b. Identifier assignment:
 - 1) First field: Type of cable.
 - 2) Second field: Total strand count.
 - 3) Third field: Cable number.
 - 4) Fourth field: Strands in use and dead strands.
 - 5) Fifth field: Source and destination.
 - 6) Sixth field: Terminal number (MPOE, MDF, IDF).
 - c. Label installation:
 - 1) Provide labels on both ends of cables.
 - 2) Install such that they are visible by a technician from normal stance.
 - 3) Fully wrap label around the cable jacket (self lamination).
 - 4) Provide one label within 12" of the termination apparatus.
 - 5) Provide one label at the point where the cable enters/exits the equipment room.
 - 6) Provide one label at the approximate mid-point between where the cable enters/exits the room and the termination apparatus.
 - 2. Fiber patch panels:
 - a. Text color shall be black, #10 font size.
 - b. Label installation:
 - 1) Provide labels at each port.
 - 2) Install labels into label window.

- D. Backbone twisted pair cable labeling:
 - 1. Cables:
 - a. Text color shall be black with #10 font size.
 - b. Identifier assignment:
 - 1) First field: Type of cable.
 - 2) Second field: Total number of pairs.
 - 3) Third field: Cable number.
 - 4) Fourth field: Active cable count and "dead" pairs.
 - 5) Fifth field: Source and destination.

- 6) Sixth field: Terminal number (MPOE, MDF, IDF).
 - c. Label installation:
 - 1) Provide labels on both ends of cables.
 - 2) Install such that they are visible by a technician from normal stance.
 - 3) Fully wrap label around the cable jacket (self lamination).
 - 4) Provide one label within 12" of the termination apparatus.
 - 5) Provide one label at the point where the cable enters/exits the equipment room.
 - 6) Provide one label at the approximate mid-point between where the cable enters/exits the room and the termination apparatus.
 2. BEP terminals:
 - a. Text color shall be black with #10 font size.
 - b. Identifier assignment:
 - 1) First field: Building identifier.
 - 2) Second field: Building zone identifier.
 - 3) Third field: Incoming cable pair identifier.
 - 4) Fourth field: Outgoing cable pair identifier.
 - c. Label installation:
 - 1) Install labels such that they are visible by technician form normal stance.
 - 2) Provide one label on the terminal cover or housing.
 3. Modular patch panels:
 - a. Text color shall be black, #10 font size.
 - b. Label installation:
 - 1) Provide labels at each port.
 - 2) Install labels into label window.
 4. Label installation in manholes/vaults/pullboxes:
 - a. Provide at least one label within the manholes/vaults/pullboxes.
 - b. Install labels such that they are visible by technician from above grade.
 5. Label installation at splice points:
 - a. Provide one label on each side of splice case.
 - b. Install labels such that they are visible by technician from above grade.
- E. Horizontal twisted pair labeling:
 1. Cables:
 - a. Text color shall be black, #10 font size.
 - b. Label installation:
 - 1) Provide labels on both ends of cable.
 - 2) Install labels such that they are visible by technician from a normal stance.
 - 3) Fully wrap label around the cable jacket (self lamination).
 - 4) Provide one label within 4" of the termination apparatus.
 2. Modular patch panels:
 - a. Text color shall be black, #10 font size.
 - b. Label installation:
 - 1) Provide labels at each port.
 - 2) Install labels into label window.
 3. Outlets:
 - a. Text color shall be black, #10 font size.
 - b. Label installation:

- 1) At faceplates, provide labels above and below jacks.
- 2) At surface boxes, provide labels on the top of the box.

3.4 FIELD QUALITY CONTROL AND TESTING

A. General:

1. Calibrate test sets and associated equipment per the manufacturers instructions at the beginning of each day’s testing and after each battery charge. Fully charge the test sets prior to each day’s testing to ensure proper operation.
2. Ensure test equipment and test cords are clean and undamaged during testing activities. Per the Engineer’s discretion, halt testing activity and clean testing equipment, test cords and related apparatus.
3. Permanently record test results electronically within test equipment at the time of testing.

B. Fiber optic testing:

1. Test fiber optic passive links as follows:

TESTS FOR FIBER OPTIC CABLING TABLE				
Subsystem	Type	Test	Direction	Wavelength
OSP backbone	Multimode	Characterization, passive link insertion loss	Both	850nm and 1300nm
OSP backbone	Singlemode	Characterization, passive link insertion loss	Both	1310nm and 1550nm
ISP backbone	Multimode	Passive link insertion loss	Both	850nm and 1300nm
ISP backbone	Singlemode	Passive link insertion loss	Both	1310nm and 1550nm

2. Precautions:

- a. Adhere to the equipment manufacturer’s instructions during testing.
- b. Prior to testing activity or measurements taken, complete the following activities:
 - 1) Ensure the test equipment is at room temperature, approximately 70°F.
 - 2) Turn the light source and power meter power on for at least 5 minutes.
 - 3) Clean test/launch cords and system cords, if applicable, connectors and the cabling system adapters with a lint-free wipe and 90% (or higher) isopropyl alcohol.
- c. Do not power off OTDR’s light source during testing activity.
- d. Do not remove launch cord from the OTDR’s light source at any time (unless the testing is complete or the equipment is being put away for the evening or during trouble shooting).
- e. Do not bend the launch cord smaller than 20 times the cord diameter during testing activities, as this may induce loss into the cord reducing the accuracy of the measurements).

- C. Fiber optic characterization testing:
1. Equipment settings/measurement parameters:
 - a. Index of refraction: Match cable-under-test fiber parameters, default settings as follows:
 - 1) Multimode: 1.481 – 1.483 @ 850nm and 1.476-1.478 @ 1300nm.
 - 2) Singlemode: 1.466-1.467 @ 1310nm and 1.467-1.4677 @ 1559nm.
 - b. Pulse width (20ns for multimode and 50ns for singlemode):
 - 1) Multimode: 4ns for cable lengths up to 980 feet (300m); 20ns for cable lengths between 980 feet (300m) and 6,560 feet (2,000m).
 - 2) Singlemode: 10ns for cable lengths up to 6,560 feet (2,000m); 50ns for cable lengths between 6,560 feet (2,000m) and 32,800 feet (10,000m).
 - c. Backscatter:
 - 1) Multimode: -67dB @ 850nm, -74dB @ 1300nm.
 - 2) Singlemode: -74dB @ 1310nm and 1550nm.
 - d. Event threshold: 0.05dB.
 - e. Reflection threshold:
 - 1) Multimode: -45dB.
 - 2) Singlemode: -60dB.
 - f. Fiber break/end-of-fiber: 3dB.
 2. Waveform: The waveform shall be real-time and normal density.
 3. Obtain measurements using a “launch” cord connected to the test instrument and the cable under test.
 - a. The fiber of the launch cord shall match the fiber of the cable under test in physical and performance parameters (i.e. type, core/cladding size, index of reflection, refraction profile, etc.). The fiber of the launch cord should match the fiber of the cable under test in manufacturer and product.
 - b. Use launch cord length between 25 and 100 meters.
- D. Fiber optic passive link insertion loss testing:
1. Test cords performance verification:
 - a. Connect test cord #1 between the light source and the power meter.
 - b. The value displayed on the power meter is the Reference Power (Pref) measurement. If the power meter has a Relative Power Measurement Mode, enter this Reference Power Measurement (Pref) value into the meter. If it does not, hand-write Pref onto the record document for future reference.
 - c. Disconnect test cord #1 from the power meter. Do not disconnect test cord #1 from the light source.
 - d. Connect the “open” end of test cord #1 to an adapter of matching connector type. Connect one end of test cord #2 to the adapter and the other end to the power meter.
 - e. The value displayed on the power meter is the Power Measurement (Psum). If the power meter is in Relative Power Measurement Mode, the meter reading represents the test cord #2 connection attenuation. If the meter does not have a Relative Power Measurement Mode, perform the following calculation to determine the connection attenuation:
 - 1) If Psum and Pref are in the same logarithmic units (dBm, dBu, etc.):
Connection attenuation (dB) = (Psum - Pref)

- 2) If Psum and Pref are in watts: Connection attenuation (dB) = [10 x log10 (Psum/Pref)]
- 3) The measured connection attenuation must be less than or equal to the value found in the Table below.
- f. Flip the ends of test cord #2, so that the end connected to the power meter is now connected to the adapter, and the end connected to the adapter is now connected to the power meter.
- g. The meter reading is the reversed Power Measurement (Psum). Perform the proper calculations if not using Relative Power Measurement Mode.
- h. Verify that both connection attenuation measurements are less than or equal to the value found in the following Table:

ACCEPTABLE TEST CORD CONNECTION ATTENUATION	
Cable Type	LC (or other Mini-Connector) Cord
Multimode	0.20dB maximum
Singlemode	0.30dB maximum

- i. If both measurements are found to be less than or equal to the values found in the Table, then test cord #1 is acceptable for testing purposes. Unacceptable attenuation measurements may be attributable to test cord #1 or #2. Examine each cord with a portable microscope and clean, polish or replace as necessary.
- j. Repeat this test procedure from the beginning, reversing the test cords in order to verify the performance of test cord #2.
- 2. Test equipment set-up:
 - a. Follow the test equipment manufacturer’s initial adjustment and set-up instructions.
 - b. If the meter has a Relative Power Measurement Mode, select this mode.
 - c. If the meter can display power levels in dBm, select this unit of measurement to simplify subsequent calculations.
 - d. Set the light source and power meter to the same wavelength.
- 3. Multimode passive link insertion loss testing procedure:
 - a. Determine launch conditions (from the light source as Category 1 per OFSTP-14):
 - 1) General: The launch category of a light source can be determined by measuring its Coupled Power Ratio “CPR.” The CPR is a measurement of the modal power distribution launched into a multimode fiber. A light source that launches a higher percentage of its power into the higher order modes of a multimode fiber produces a more over-filled condition and is classified as a lower Category than a light source that launches more of its power into just the lower order modes producing an under-filled condition. Under-filled conditions result in lower link attenuation, while over-filled conditions produce higher attenuation. Therefore, adjusting the acceptable link attenuation to compensate for a light source’s launch characteristic increases the accuracy of the test procedure.
 - 2) Provide two test cords, one multimode (test cord #1) and one singlemode (test cord #2). Directly terminate both cords on connectors that are compatible with the light source and power meter.

- a) The fiber of the multimode test cord shall have the core diameter and numerical aperture nominally equal to those of the permanent link.
 - b) The fiber of the singlemode test cord shall contain Class IVa singlemode fiber with a mode field diameter of $5.0\mu\text{m} \pm 0.5\mu\text{m}$ for 850nm tests and $9.0\mu\text{m} \pm 1.0\mu\text{m}$ for 1300nm tests.
- 3) Connect test cord #1 between the light source and the power meter. Avoid placing bends in the cord that are less than 4" in diameter.
 - 4) The meter reading is the Reference Power Measurement (Pref). If the power meter has a Relative Power Measurement Mode, enter the Pref value into the meter. If it does not have this mode, then hand-write the Pref for future reference.
 - 5) Disconnect test cord #1 from the power meter. Do not disconnect test cord #1 from the light source.
 - 6) Connect test cord #2 between the power meter and test cord #1, using an appropriate adapter between the test cords. Test cord #2, the singlemode cord, shall include a high order mode filter. This can be accomplished by twice wrapping the cord around a 1.2" diameter (30mm) mandrel.
 - 7) The meter reading is the Power Measurement (Psum). If the power meter is in Relative Power Measurement Mode, the meter reading represents the CPR. If the meter does not have this mode, perform the following calculation to determine the CPR:
 - a) If Psum and Pref are in the same logarithmic units (dBm, dBu, etc.):

$$\text{CPR (dB)} = (\text{Psum} - \text{Pref})$$
 - b) If Psum and Pref are in watts: $\text{CPR (dB)} = [10 \times \log_{10} (\text{Psum}/\text{Pref})]$

COUPLED POWER RATIO (CPR) TABLE					
	Cat-1 Overfilled	Cat-2	Cat-3	Cat-4	Cat-5 Underfilled
850nm source	20 - 24	16 – 19.9	11 – 15.9	7 – 10.9	0 – 5.9

- b. Test method: Perform the passive link insertion loss testing of multimode fibers according to the "Test Method B: One Jumper Reference," per OFSTP-14, for permanent links, and perform according to the "Test Method C: Three Jumper Reference," per OFSTP-14, for channel links.
 - 1) After setting up the test equipment, verifying the performance of the test cords and determining the light source's CPR, the insertion loss of the passive link segments can be measured.
 - 2) Connect test cord #1 between the light source and the power meter.
 - 3) The meter reading is the Reference Power Measurement (Pref). If the power meter has a Relative Power Measurement Mode, enter the Pref value into the meter. If it does not have this mode, then hand-write the Pref for future reference.
 - 4) Disconnect test cord #1 from the power meter. Do not disconnect test cord #1 from the light source.
 - 5) Connect test cord #1 to the passive link segment input.
 - 6) At the opposite end of the passive link segment, connect test cord #2 to the link segment input and the power meter.

- 7) The meter reading is the Power Measurement (Psum). If the power meter is in Relative Power Measurement Mode, the meter reading represents the insertion loss. If the meter does not have this mode, perform the following calculation to determine the insertion loss:
 - a) If Psum and Pref are in the same logarithmic units (dBm, dBu, etc.):
Link segment attenuation (dB) = (Psum - Pref)
 - b) If Psum and Pref are in watts: Link segment attenuation (dB) = $[10 \times \log_{10} (Psum/Pref)]$
- 8) Record Psum for inclusion into the record documents.
4. Singlemode passive link insertion loss testing procedure:
 - a. Determine the launch conditions:
 - 1) Use the launch conditions as described in FOTP-78.
 - 2) Employ a method to remove high-order propagating modes as described in FOTP-77.
 - b. Test method: Perform the passive link insertion loss testing of singlemode fibers according to the "Test Method A.1: One Jumper Reference," per OFSTP-7.
 - 1) After setting up the test equipment and verifying the performance of the test cords, the insertion loss of the passive link segments can be measured.
 - 2) Connect test cord #1 between the light source and the power meter.
 - 3) The meter reading is the Reference Power Measurement (Pref). If the power meter has a Relative Power Measurement Mode, enter the Pref value into the meter. If it does not have this mode, then hand-write the Pref for future reference and to be included in the Record Documents.
 - 4) Disconnect test cord #1 from the power meter. Do not disconnect test cord #1 from the light source.
 - 5) Connect test cord #1 to the passive link segment input.
 - 6) At the opposite end of the passive link segment, connect test cord #2 to the link segment input and the power meter.
 - 7) The meter reading is the Power Measurement (Psum). If the power meter is in Relative Power Measurement Mode, the meter reading represents the insertion loss. If the meter does not have this mode, perform the following calculation to determine the insertion loss:
 - a) If Psum and Pref are in the same logarithmic units (dBm, dBu, etc.): Link segment attenuation (dB) = (Psum - Pref)
 - b) If Psum and Pref are in watts: Link segment attenuation (dB) = $[10 \times \log_{10} (Psum/Pref)]$
 - 8) Record Psum for inclusion into the record documents.
5. Acceptable measurement values:
 - a. Remove and replace any cabling links failing to meet the criteria described in this Specification, at no cost to the Owner, with cables that prove to meet the minimum requirements.
 - b. The general insertion loss equation for any link segment is as follows:
 - 1) Insertion loss = cable loss + connection loss + splice loss + CPR adjustment.
 - 2) Note: A connection is defined as the joint made by two mating fibers terminated with remateable connectors.

- c. 50/125µm multimode attenuation coefficients:
- 1) Cable loss = Cable length (km) x (3.0dB/km @ 850nm) or (1.0dB/km @ 1300nm).
 - 2) Connection loss = (Connections x 0.14dB) + 0.24dB.
 - 3) Splice loss = Splice x 0.05dB.
 - 4) CPR adjustment = See Table below.

MULTIMODE LIGHT SOURCE CPR ADJUSTMENT TABLE					
	Cat-1	Cat-2	Cat-3	Cat-4	Cat-5
Links w/ LC connectors	+0.25	0.00	-0.10	-0.20	-0.30

- d. Singlemode attenuation coefficients:
- 1) OSP cable loss = Cable length (km) x (0.40dB/km @ 1310nm) or (0.30dB/km @1550nm).
 - 2) ISP cable loss = Cable length (km) x (0.650dB/km @ 1310nm) or (0.50dB/km @1550nm).
 - 3) Connection loss = (Connection x 0.24dB) + 0.24dB.
 - 4) Splice loss = Splices x 0.07dB.
 - 5) CPR adjustment = Not applicable for singlemode.

E. Twisted pair testing:

1. Test for UTP cabling as follows:

TESTS FOR FIBER OPTIC CABLING TABLE				
Subsystem	Type	Test	Configuration	Notes
Backbone	OSP	See Notes	-	Wire map & length
Backbone	ISP/Riser	See Notes	-	Wire map & length
Horizontal	CAT6A	Category 6A	Permanent Link	Per TIA/EIA-568-C.2

2. Precautions:
 - a. Adhere to the equipment manufacturer’s instructions during all testing.
 - b. Prior to any testing activity or any measurements taken, ensure the test equipment is at room temperature, approximately 70°F.
 - c. Fully charge power sources before each day’s testing activity.
3. Backbone twisted pair testing:
 - a. The installation will be accepted when testing has indicated availability of 100% terminated pairs.
 - b. Test continuity and wire map for all pairs.
 - c. Test length for 2% of pairs of each cable. Pairs shall be from different 25 pair binder groups.
4. Horizontal twisted pair testing:
 - a. Test equipment set-up:
 - 1) Set-up the tester to perform a full CAT6A test, as a Permanent Link configuration.

- 2) If the tester has the capability, set the cable type as product specific setting. If not, set as generic CAT6A cable.
 - 3) Set the tester to save the full test results (all test points, graphs, etc.).
 - 4) Save the test results with associated cable link identifier.
 - 5) Calibrate the test set per the manufacturer's instructions.
- b. Acceptable test results measurements:
- 1) Overall test results:
 - a) Links which report a Fail, Fail or Pass for any of the individual tests shall result in an overall link Fail. All individual test results must result in a Pass to achieve an overall Pass.
 - b) Any reconfiguration of link components required as a result of a test Fail, must be re-tested for conformance.
 - c) Remove and replace any cabling links failing to meet the criteria described in this Specification, at no cost to the Owner, with cables that prove to meet the minimum requirements.
 - 2) Wire map: Provide continuous pairs and terminate all of the cabling links correctly at both ends, no exceptions taken.
 - 3) Length: Ninety-four meters (308 feet) is the maximum acceptable electrical length measurements for any cabling link measured under a Permanent Link configuration, including test cords.
 - 4) Insertion loss: The acceptable insertion loss measurements for any horizontal cabling link is that which is no greater than that listed in TIA/EIA-568-B.2.
 - 5) Worst pair-to-pair near end crosstalk (NEXT) loss: The acceptable worst pair-to-pair NEXT loss for any horizontal cable is that which is no greater than that listed in TIA/EIA-568-B.2.
 - 6) Power sum NEXT loss: The acceptable power sum PS-NEXT loss for any horizontal cable is that which is no greater than that listed in TIA/EIA-568-B.2.
 - 7) Worst pair-to-pair ELFEXT and FEXT loss: The acceptable worst pair-to-pair ELFEXT and FEXT loss for any horizontal cable is that which is no greater than that listed in TIA/EIA-568-B.2.
 - 8) Power sum ELFEXT and FEXT loss: The acceptable PS-ELFEXT and PS-FEXT loss for any horizontal cable is that which is no greater than that listed in TIA/EIA-568-B.2.
 - 9) Return loss: The acceptable return loss measurements for any horizontal cabling link is that which is no greater than that listed in TIA/EIA-568-B.2.
 - 10) Propagation delay and delay skew: The acceptable propagation delay and delay skew measurements for any horizontal cabling link is that which is no greater than that listed in TIA/EIA-568-B.2.
- F. Record documents:
1. Permanently record all test results.
 2. Export test results' numerical values to a single Microsoft Excel spreadsheet.
 3. Submit test results in a format acceptable to the Owner, Owner's Representative and the Engineer before system acceptance.

4. Cable, fiber and pair identifiers of the test reports shall match the identifiers as labeled in the field, i.e. use the same ID on the cable/termination label as what appears on the test report.
5. Measurements shall carry a precision through one significant decimal place, minimum.
6. Use feet for the units for measurements shown on the print of the test measurements.
7. Print report such that fiber strands of a given cabling link have matching axis scales. The "X" and the "Y" axis shall be the same from report-to-report.
8. The trace of the printed test report shall show the launch cord.
9. For each fiber optic backbone cable test, report shall contain the following information:
 - a. Project name and address.
 - b. Test company's and Operator's name.
 - c. Date measurements were taken.
 - d. Test equipment type to include model and serial numbers.
 - e. Cable identification number, fiber/strand number and fiber type (i.e. multimode, singlemode, etc).
 - f. Measurement direction.
 - g. Set-up parameters (i.e. wavelength, pulse width, refractive index, event threshold, etc.)
 - h. OTDR trace.
 - i. Length of fiber.
 - j. Overall link loss.
 - k. Passive link insertion loss testing:
 - 1) Wavelength.
 - 2) Loss measurement.
10. For each cabling link, include either a schematic graphic or a brief narrative accurately describing the test set-up. The description shall include test/launch cord (with length), expected events (connectors, slices, etc.) with expected distances, etc. This information will eliminate many questions the Engineer will have while reviewing the reports.
11. For each twisted pair backbone and horizontal cable test, report shall contain the following information:
 - a. Project name and address.
 - b. Test company's and Operator's name.
 - c. Date measurements were taken.
 - d. Test equipment type to include model and serial numbers.
 - e. Cable identification number and pair number.
 - f. Measurement results.

3.5 INSPECTION AND ADJUSTMENTS

- A. Contractor shall inspect all installed Work in conjunction with the General Contractor and develop a "punchlist" for all items needing correction. Provide punchlist to the Engineer prior to their final walk of Project.
- B. Punchlist work and the required remediation shall be performed prior to system final acceptance.
- C. Replace or repair work completed by others that was defaced or destroyed during the installation of the telecommunication cabling system by this contractor.

- D. Make changes to adjust the system to optimum operation for final use. Contractor is responsible for making changes to the system such that any defects in workmanship are correct and all cables and the associated termination hardware passes the minimum test requirements.

3.6 CLEANING

- A. Remove all unused, excess and left over products, to include debris, spills, and installation equipment.
- B. Leave finished work and adjacent surfaces in neat, clean conditions with no evidence of damage.
- C. Legally dispose of debris.
- D. Clean installed products in accordance with manufacturer's instructions prior to final punchlist.

3.7 TRAINING

- A. Refer to Specification Section 260800: Electrical Commissioning.
- B. At the completion of all Work, a period of not less than 16 hours shall be allocated by the Contractor for instruction and training for the Owner Representative. The Cabling Contractor will need to describe how the cable from each coverplate is separated between different patch panels, how cross-connects are made and other basic cable plant management skills.
- C. Contractor shall schedule training with a minimum of 7 days advance notice.

END OF SECTION

SECTION 26 76 13

SCHOOL COMMUNICATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Intercom/public address system.
 - 2. Telephone system.
 - 3. Integration with master clock system.
 - 4. Uninterruptible power supply "UPS".
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Underwriters Laboratories, Inc. (UL):
 - UL 13; Power-Limited Circuit Cables.
 - UL 50; Enclosures for Electrical Equipment.
 - UL 813; Commercial Audio Equipment.

1.3 SYSTEM REQUIREMENTS

- A. Furnish all labor, project management, materials, tools, equipment and resources necessary for the installation of a new Intercom System as shown on the plans and as herein specified.
- B. It is the intent of these specifications and the accompanying plans that the Contractor furnishes and installs a system complete in every respect and ready to operate. All miscellaneous items and accessories required for such installation, whether or not each such item or accessory is shown on the plans or mentioned in these specifications, shall be furnished and installed.
- C. Furnish additional items not mentioned herein to meet requirements as specified without claim for additional payments. Items, may include hardware, rack panels, termination blocks etc., and other devices that are required for installation.
- D. It shall be the responsibility of the contractor to examine the plans and specifications carefully before submitting his bid. Any questions or discrepancies discovered shall be brought to the attention of the Architect/Engineer, prior to bid, and resolved by way of addendum.

- E. The Intercom System shall include intercom, audio paging, text-to-speech, and program distribution functions for distribution of schedules, emergency tones and messages via Intercom System speakers.
- F. The system shall be connected at the head-end, to the Owner's phone system, to allow integration of the two systems. It is the contractor's responsibility to coordinate with the Owner to insure compatibility of intercom and phone system prior to any procurement of intercom system components. Provide all necessary interconnecting equipment. Coordinate with Owner to determine exact configuration of their phone system.
- G. This contractor is responsible for the tie-in and testing of the phone/intercom system tie-ins to allow paging by any phone, and answering of the assigned phones to call switch call-ins and main entry door switch activation.
- H. The system shall interface with the Master Clock system and support a minimum of eight (8) time signal groups. The system may provide an integrated Master Clock provided the clock system fully complies with Specification Section 267616: Clock System
- I. Furnish and install all necessary equipment, including but not limited to back boxes, specialty boxes, speakers, wall plates, supports and enclosures.
- J. Furnish and install all necessary structured cabling as needed from speakers and other IP equipment to IDF's or MDF, and provide for all network connectivity (i.e. fiber patch cables, Cat5e or Cat6 cable, etc.) for distribution of the intercom system.
- K. Furnish all programming of the system (initial and final) and audio level adjustments (initial and final).
- L. All materials, equipment and apparatus provided shall be new and of the latest design or model offered for sale by the manufacturer.
- M. An uninterruptible power supply 'UPS' shall be provided for the school communication system and sized to allow 100% battery operation for a period of 30 minutes.

1.4 RELATED WORK

- A. It shall be the responsibility of this Contractor to coordinate the installation of equipment with the other contractors on site, the Architect, and the Owner.

1.5 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Documentation on the network requirements that are needed for proper installation and distribution.
 - 2. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.

3. Describe system operation, equipment and dimensions and indicate features of each component and cross referenced with a Component Block Relationship Diagram.
4. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
5. Shop Drawings to include:
 - a. Plot plans and building floor plans, showing location of and conduit routing to all devices.
 - b. Point-to-point wiring diagrams in block or riser format showing all components, conduit and wire types and sizes with cable legend.
 - c. Provide 1/4" scale plan of equipment layout in main equipment room (MDF).
 - d. Include elevations of equipment rack(s).
6. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
7. Submit Manufacturer's installation instructions.
8. Complete Bill of Materials listing all components.
9. Warranty.

- B. Installer's qualifications: Furnish satisfactory proof of required experience specified herein for system installer.

1.6 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
1. A detailed explanation of the operation of the system.
 2. Instructions for routine maintenance.
 3. Pictorial parts list and part numbers.
 4. Schematic wiring diagrams.
 5. Telephone numbers for the authorized parts and service distributor.
 6. Final testing reports.

1.7 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.
- C. Installer's qualifications: Firms with a minimum of 5 years of successful installation experience with projects utilizing school communication systems similar to that of this Project.
- D. The system shall be approved for direct interconnection to the utility services under part 68 of FCC rules and regulations. Those systems that are not FCC approved or utilize an intermediary device for connection, will not be considered. Provide FCC registration number of system being proposed in equipment submittal.

- E. Underwriter's Laboratories under UL Standard 1459 shall list the communication system supplied. A copy of the UL listing card for the proposed system shall be included with the Contractor's submittal.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: School communication system components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipping shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.9 WARRANTY

- A. Units and components offered under this Section shall be covered by a 1 year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

1.10 SYSTEM START-UP

- A. Upon completion of installation, a factory trained dealer service representative shall perform initial start-up of the school communication system. Sufficient time shall be allowed to properly check the system out and perform required minor adjustments before the Engineer's witnessed test shall begin.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The intercom equipment specified herein is that of Valcom Engineered Solutions IP6000 Series. The equipment of this manufacturer constitutes the quality of design and construction, operational characteristics, appearance standards, space requirements and field service staffing levels required to comply with the requirements of the specification.
- B. Other manufacturers systems and suppliers may be acceptable, but shall meet or exceed the specifications of the Valcom IP 6000 product. The contractor shall submit all product data for review to the Architect/Engineer.

2.2 SYSTEM DESCRIPTION

- A. Components of the IP Intercom System shall provide a complete system IP Based solution for a fully functioning Intercom System (IC) and Public Address System (PAS) for the project. System shall include software from a single manufacturer for complete control and monitoring of the system for a fully supported system. System shall be IP based and operate over a separate school Local Area Network (LAN) and Wide Area Network (WAN).
- B. Contractor shall provide all system programming for configuration and interfaces.
- C. System shall be capable of being configured and controlled remotely via Owner provided connectivity (e.g. via a smart phone, VPN, etc.).
- D. System shall include General Purpose Input and Output (GPIO) trigger points for interfacing to other systems including Emergency and Security Systems, to provide event driven configuration scenarios for the system.
- E. Each classroom shall be a “zone” on the system capable of individual intercom use or as part of a “zone group” or “all call” during Public Address System use. Classroom end device shall be a PoE device attached to the school network.
- F. Common areas, including but not limited to, Corridors, Commons (cafeteria), Multi-Purpose, Media Center, Mechanical Rooms, and Restrooms, shall be provided with PAS coverage from the system for general and emergency announcements.
- G. System shall provide multicast or hybrid unicast/multicast for configuration of LAN and WAN with standard Ethernet protocols. No exceptions.
- H. System shall interface with any telephone system utilizing either SIP, FXS or FXO Port type integration thus allowing the school(s) to upgrade or replace their telephone system without suffering a requirement to replace, or lose any feature of, their internal communications (intercom) system.
- I. System shall provide opening tones and messages for announcements to speakers.
- J. System shall be CAP (common alert protocol) compliant, capable of incorporating automatic weather and amber alerts as directed by the Owner’s Representative. No exceptions.
- K. All common area loudspeakers shall operate on a 24Vdc distributed system. The loudspeakers shall be grouped in modular zones allowing maximum flexibility for paging area assignment.
- L. Server, Software and Operating System shall be provided and connected to a separate Owner LAN. Provide all necessary hardware for support of system software.

2.3 SYSTEM OPERATION

- A. The following functional capabilities are required for the Intercom notification system:
 - 1. System operation shall allow administrator to define user privileges, define loudspeaker zones, pre-recorded messages, bell schedules, bell designations, event logs, background music streams, system configuration and end point status.

2. Automatically sound a tone or play a pre-page WAV file 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. The privacy tone must repeat every 15 (fifteen) seconds. (System must allow option of defeating this tone via software programming by law enforcement in case of school emergency situations.)
3. Distribution of emergency announcement(s) from any authorized telephone to all areas furnished with a loudspeaker. Emergency announcements shall have the highest system priority.
4. Distribution of general announcements from any administrative telephone, staff telephone, or classroom telephone. The system shall be capable of providing all-call, group call, and multiple group calls. Classroom speakers shall be software assignable to an unlimited amount of paging groups. No exceptions.
5. Provide the ability to define and archive unlimited amount of time schedules. Each schedule shall be capable of controlling an unlimited amount of events. An event is defined as but not limited to, pre-defined audio wav files, relay controls, streaming music, etc. System shall be capable of uploading and storing wav files, text-to-speech and recording on the fly. System shall allow for an unlimited amount of audio sources that are programmable to play over an unlimited amount of audio groups. The system shall be capable of supplying an unlimited amount of relays for building control. Each scheduled audio event shall be distributable to an unlimited amount of audio groups. The system shall feature the ability to automatically initiate up to an unlimited amount of schedules per day, based upon the day of the week or calendar dates up to 5 years in advance. Schedule administration, modification and creation functions must be available through a browser based system. Systems that do not allow the school to manage their own schedules with browser based software and do not offer calendar based scheduling up to 5 years in advance or require separate page and time groups shall not be acceptable.
6. Provides 1 to 11 digits numbering plan, thus allowing the classroom speaker and the classroom telephone to be the same architectural number.
7. Call buttons (Model # V-2972PK) shall be placed in each classroom and talkback area and will trigger caller ID information to main office.
8. System shall be capable of placing intercoms call on hold in order to perform other administrative functions.
9. The system shall offer a test room mask to minimize audio distributions during tests. Emergency audio shall not be encumbered by this test room mask.
10. Programmable features shall be stored in non-volatile memory and shall not be lost due to power failures.
11. 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.
12. System must allow facilities to announce 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.
13. System functionality must include the capability to manually distribute an unlimited amount of chained events via browser based device, pushbuttons, contact closure, or dial up tones from any administrative telephone. These events shall be customizable with

- respect to volume levels, cadence, priority, type and duration. Browser access and dial up events must only be accessible by authorized users.
14. The system must be capable of providing an unlimited amount of ports to be connected to the telephone system via SIP, FXS or FXO Port integration from the intercom system. These ports shall provide built-in Enhanced Caller Line Identification which will visually announce the name of the teacher or location, the architectural classroom number.
 15. The system shall have the ability to control all system relays. Relays shall be controlled through any computer on the LAN/WAN, DTMF controlled, automatically cycle at a programmed time of day, follow time schedule events. All relays must be software programmable with the flexibility to change as required.
 16. The system shall provide an unlimited amount of user administration and system operation access. The audio program material shall be controlled and distributed by way of a browser based device such as a computer allowing simple and easy changes. Systems that require manual operated switch-banks or cumbersome DTMF telephone codes for distribution shall not be acceptable.
 17. The system shall have the ability to store a minimum of 25000 seconds of WAV files and shall not be lost due to power outage. No exceptions.
 18. The WAV files shall be activated via any computer on the LAN/WAN, Telephone and/or Telephone system, and/or pushbuttons.
 19. 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.
 20. The WAV files shall also have the ability to be broadcast into an unlimited number of audio groups.
 21. 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.
 22. 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.

2.4 NETWORK REQUIREMENTS FOR MANAGED VOIP PRODUCTS

- A. Hardware Requirements
 1. 10/100 Ethernet
- B. Bandwidth Requirements
 1. 86 kbps per active One Way Page
 2. 172 kbps per active Two Way Call
- C. TCP Requirements
 1. Port 21 for FTP
 2. Port 22 for SSH
 3. Port 23 for Telnet
 4. Port 80 for Web based access
- D. UDP Requirements

1. 7 Bi-directional Ports: 4097, 4098, 4099, 4120, 4121, 4122, 4197, 123 (for NTP)
2. The addition of Multicast-to-Unicast gateways (VEUTM) will require additional ports

E. Multicast Requirements

1. A correctly configured multicast (IGMPv2 or IGMPv3) enabled network is essential
2. 4 multicast addresses: 239.1.1.2, 239.1.1.3, 239.1.1.4 and 239.1.1.5 are the defaults
3. SIP Ports: The default SIP TCP & UDP port number is 5060. Port 20,000 is the default UDP port used for the RTP media stream.

F. Power Requirements

1. Power requirements for IP speakers or VE80XX Talkback Gateways: 802.3af PoE compatible switches or equivalent inline power injector.
2. Power requirements for IP LED signs and IP Emergency Call Towers: 802.3at High Power PoE compatible switches or equivalent inline power injector
3. Power requirements for VE602X IP server: Supply Included
4. Power requirements for other managed VoIP products: 802.3af PoE compatible switches, equivalent inline power injector or VIP-324D VoIP Device Power Supplies

G. Other requirements:

1. A VLAN dedicated to the Valcom VoIP system or shared with IP telephony endpoints is strongly recommended. It should be a manually configured port based VLAN as Valcom devices do not signal the switch to select between voice and data VLANs. If associated Valcom IP endpoints are installed in more than one VLAN, then properly configured multicast routing between those VLANs is required.
2. It is required that the Contractor/Integrator installing the intercom system have a working knowledge of the hosting network's design and the expertise and access rights to manage its settings, OR, that they have immediate access to the individual or individuals who do. Advance notice required from customer for any change management policies or configuration changes. All necessary network approvals must be required in advance of system installation.
3. Power requirements vary among device models and whether they are active or idle. For planning purposes, assume full Class 3 power for each device; actual power used may be less. In addition, PoE power management features may need to be set to static or high priority. This pre-allocates power to the endpoint, even when power requirement is at a minimum. This guarantees that when the endpoint requires more power, it will be available. Networks vary in complexity, security parameters and general configuration. It is required that the parties installing the intercom system have a working knowledge of the hosting network's design and the expertise and access rights to manage its settings, or, that they have immediate access to the individual, or individuals who do. Change management policies may require advance notice and approval for any network configuration changes required. Acquire necessary approvals in advance of the installation.

2.5 INTERCOM SYSTEM CONTROL UNIT

- A. Shall be a CAP Compliant Applications Server, part #VE6021. The server shall provide automated emergency messaging, event scheduling and clock control capability. It allows distribution of WAV formatted audio out to 25 simultaneous groups of speakers. The simple

browser based interface facilitates easily accessible manipulation of custom audio files for use as class change tones or emergency notification alerts. The VE6021 features text-to-speech conversion and provides on demand access of pre-loaded audio files via web browser or contact closure. Schedules may be automated based upon day of the week, calendar date up to one year in advance, or may be manually controlled.

2.6 SYSTEM EQUIPMENT

- A. Speakers: System speakers shall be capable of utilizing standard Cat 6 infrastructure for installation from the MDF or IDF's as applicable, to the classroom and/or zone, thus allowing for only one type of wiring infrastructure within the school
- B. IP Speaker (for classrooms and other necessary talkback locations) – shall provide two-way communication with hands free talkback ability. All new classroom IP Speakers shall be connected via PoE (802.3af). Speaker qualities:
 - 1. IP Clock/Speaker Combo part # VE4031A-A with analog face clock.
 - a. Back boxes are required for combo models listed. Recessed back box model for both VE4031A-A is # VB-R19. Surface mount back box for the same models is # VB-S20.
 - b. IP Clock/Speaker combo must require only one (1) network drop (RJ45) per unit to handle both speaker and clock inclusive. In talkback areas where clock not needed or required, 2'x2' IP Lay-In Ceiling Speaker part #VE4022A (no additional back box needed), IP Wall Speaker part # VE4030A (no back box needed), or flush mount IP wall speaker part # VE4028A with back box # VB-R12 may be used. (VB-S11 back box for wall areas requiring surface mounting.)
 - 2. Allow volume level to be electronically adjusted via software.
 - 3. Provide call switch input via screw terminal connections.
 - 4. Provide internal RJ45 connection.
 - 5. Include all mounting hardware and any necessary back boxes.
- C. IP Speakers for Hard Lid Ceilings (for “common” area one-way paging areas such as bathrooms). 8” IP Speaker(s) shall be flush (recessed) mounted unless otherwise indicated on plans. Use IP speaker part # VE120A. Use V-9916M bridge/back box.
 - 1. Speaker must be PoE
 - 2. Allow volume level to be electronically adjusted via software.
 - 3. Provide call switch input via screw terminal connections.
 - 4. Provide internal RJ45 connection.
 - 5. Include all mounting hardware and any necessary bridges/back boxes.
- D. Exterior Common Area Paging Loudspeaker Horns – Surface mounted one-way analog horn speaker with integral amplifier and volume control. Install with necessary brackets and vandal resistant enclosures where requested and connected with Cat6 cable. Speaker qualities:
 - 1. Speaker assembly, part #V-1080-GY. Use V-9805 vandal resistant enclosure for flush mounting. (If surface mount vandal resistant enclosure needed for any area, use V-9809.)
 - 2. Speaker 3.5”.
 - 3. Impedance greater than 600 Ohms nominal.
 - 4. Signal Level: -10dBm line level
 - 5. Output rating: 108dB at 4’-0”

6. Signal noise ratio: -70dB
 7. Frequency response: 400Hz to 10kHz
 8. Power requirements: 200mA at 24Vdc
 9. Voice Coil: 0.75" diameter, 45 Ohm
 10. Dispersion angle: 120 degrees horizontal, 90 degrees vertical
 11. Constructed with filled polypropylene, gray, surface bracket fabricated with 16 AWG CRS and finished with weather resistant E-Coat.
 12. All Hardware shall be stainless steel.
 13. Operating temperature: -4 to 131 degrees F
 14. Operating humidity: 0 to 85% non-condensing
 15. Provide all mounting hardware.
- E. Dual Networked Page Zone Extender – enables voice access to two common area zones of one-way paging over an IP based LAN/WAN. Zone expander shall feature:
1. Dual zone extender, part #VE8002AR
 2. 2 audio outputs
 3. 2 audio inputs
 4. 2 Form A relay contacts
 5. 2 contact closure inputs.
 6. RJ-45 for network connection
 7. Front panel activity LED
 8. Aux audio input via RCA jack
 9. Contact closure or VOX operation of audio input
 10. Page with music output, music mutes during page
 11. Output control contact closure provided during paging output.
 12. 2.5mm jack for dc power
 13. PoE 802.3af compliant
 14. Easy windows based set-up
 15. Power requirements: 325mA at 24Vdc
 16. Shall be rack mountable
- F. Dual Networked Station Port: Provides interface to telephone systems (via trunk port or FXO port/module) to be connected to a managed IP-based LAN/WAN. Station Port shall feature:
1. Dual networked station port, part #VE8012AR (Quad port VE8014AR also available)
 2. 2 RJ-11 telephone connections.
 3. 2 relays with Form C contacts.
 4. Generates caller ID signals
 5. Front Panel and network activity LEDs.
 6. 2 REN
 7. 2.5mm jack for dc power
 8. Easy windows based set-up
 9. Input impedance: 600 Ohms
 10. Output impedance: 600 Ohms
 11. Protocols: DHCP, IGMP v3, UDP, TCP, HTTP, Telnet, FTP
 12. Relay current: 1A at 24Vdc
 13. Voice Algorithm: G.711 (64kbits/s) (ulaw), Echo suppression
 14. 802.3af Compliant
 15. Shall be rack mountable

- G. PoE Switches. Switches shall be rack mountable to meet district standard as noted below:
 - 1. POE switches to be switch managed, rack mounted.
 - 2. Number as required to power speakers and other intercom components.
 - 3. Coordinate exact network connectivity requirements with school district IT personnel prior to ordering.
 - 4. Alternates are not acceptable.
- H. Power Supplies: Provide as required for all system components and all rack locations. Power supplies shall be nominal 115V, 60Hz input, 24Vdc output.
- I. UPS units: Provide as required to support all system components in order to maintain intercom system functionality during power outages.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of school communication system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

- A. Supplying Contractor shall coordinate all necessary service requests with the local utility and act as the agent for the Owner.
- B. Coordinate with Owner for quantity of incoming lines required.
- C. Coordinate with serving Telephone Company the installation and wiring of RJ31X blocks. These are required for fire alarm signaling, for security signaling and for campus energy management system.

3.3 INSTALLATION

- A. General:
 - 1. Install school communication system in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
 - 2. Provide all cable, equipment, miscellaneous parts and accessories to make a complete and fully operational system as described herein.
 - 3. Equipment shall be installed and wired in accordance with accepted engineering and installation practices. Only the highest degree of workmanship will be accepted. All Work is subject to the Owner/Engineer's approval. Work that does not meet approval shall be rectified to their satisfaction at the sole expense of the Contractor.
- B. Wiring:
 - 1. The contractor shall provide and install all cabling, clips, hangers, j-hooks, etc. as required. This infrastructure is not shown on the plans.

2. Wiring shall be in accordance with the Manufacturer's specifications. Wiring shall meet all local and state codes. All wiring shall be tested per category 6 standards.
3. All wiring shall be listed for the intended purpose. The cabling shall be Cat5e or Cat6 for all connections from the IDF or MDF to the classroom and or zone origination point. All IP speakers shall be homerun connected to each local IDF that serves that area, or MDF as noted on plans. There shall be no additional cabling required from the IDF to the MDF as this is accomplished through the shared fiber network devices and infrastructure. All interior wiring shall be in accordance with new construction guidelines suggested by the Manufacturer, including the speaker and the call-in switch.

3.4 TESTING

- A. Upon completion of the installation, all systems must be completely tested by the respective manufacturer's representative, and all necessary modifications and/or adjustments must be made to assure compliance with this specification. Testing shall be performed in the presence of the Owner's representative at a time mutually agreed upon by the Contractor and Owner's representative.
- B. Testing shall include functionality of interface between the Intercom systems and Owners phone system, and shall not be conducted until phone system is operational and able to be tested in this manner.

3.5 PROGRAMMING

- A. All programming of system shall be done by Contractor at the direction of the Owner. Allow for sufficient time to program entire system.
- B. Upon completion of programming, training and acceptance of system, provide the Owner with a computer disk containing all specific system programming.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's field service: Contractor shall arrange and pay for the services of a factory-authorized service representative to supervise the initial start-up, pretesting and adjustment of the school communication system. Objectives shall be to:
 1. Assure school communication system installation conforms with specified requirements and operates within specified tolerances.
 2. Field test and inspect to ensure operation is in accordance with Manufacturer's recommendations and Specifications.
 3. Prepare final test report including results, observations, failures, adjustments and remedies.
 4. Verify settings and make final adjustments.
- B. At least three weeks prior to any testing, notify the Engineer so that arrangements can be made for witnessing tests, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.
- C. Pretesting:

1. Upon completing system installation, adjust the system and perform complete pretesting to determine conformance with the requirements of the Contract Documents. Correct any deficiencies observed in the pretesting. Replace all malfunctioning or damaged items and retest until satisfactory results are achieved.
 2. Continuity tests of circuits.
- D. Visual and mechanical inspection:
1. Inspect for physical damage, defects alignment and fit.
 2. Perform mechanical operational tests in accordance with Manufacturer's instructions.
 3. Compare nameplate information and connections to Contract Documents.
 4. Check tightness of all connections.
 5. Check that all covers, barriers and doors are secure.
- E. Electrical tests: Perform an operational test to verify conformance of system performance and conditions to Contract Document within Manufacturer's tolerances.
- F. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation, the Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and Engineer's hourly rate.
- G. Contractor shall replace at no cost to the Owner all devices which are found defective or do not operate within factory specified tolerances.
- H. Contractor shall submit the testing final report to the Engineer for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observations, deficiencies and remedies. Include a copy of the test report in the Owner's operation and maintenance manuals.
- 3.7 TRAINING
- A. Factory authorized service representative shall conduct a two 4 hour training seminars for Owner's representative upon completion and acceptance of system. Instructions shall include safe operation, maintenance and testing of equipment.
- B. Contractor shall schedule training with a minimum of 7 days advance notice.

END OF SECTION

SECTION 27 51 26

ASSISTIVE LISTENING SYSTEM (ALS)

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A Provide a permanently installed Assistive Listening System for the building 1 gymnasium room 116 and stage 117 as indicated on the Drawings and specified herein. The assistive listening system transmitter shall be installed in the AV cabinet and shall be connected to the room AV system. The interconnection of the two systems shall not void any warranties.
- B Provide portable Assistive Listening Systems in building 1 Meeting Room 111 as indicated on the Drawings and specified herein.
- C Provide portable Assistive Listening Systems in building 3A and 3B Meeting Rooms A301 and B301 as indicated on the Drawings and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A Due to the nature of the project, this section may relate directly to, or requires coordination with all sections of the Contract Documents. Special attention should be given to:
 - 1. Division 26 - Electrical Specifications
 - 2. Section 27 00 10 - Basic Communications Requirements
 - 3. Section 27 41 00 - Audio Video System

1.3 QUALITY ASSURANCE:

- A All materials shall comply with applicable standards of the Underwriters Laboratories Inc.
- B Provide assisted listening system components from the same manufacturer.
- C Manufacturer qualifications: Firms regularly engaged in the manufacturing of Assistive Listening System of the type(s) specified for this Project and whose products have been in satisfactory use in similar service for not less than 5 years.
- D All products shall comply with applicable standards of the Underwriters Laboratories Inc., and conform to applicable U.S. Federal Communications Commission (FCC) requirements.

1.4 CONTRACTOR SUBMITTALS:

- A Shop drawings and catalog data submittals shall be made in accordance with Section, "Contractor Submittals." Submit sufficient information to indicate the scope and quality of the Assistive Listening System.
 - 1. Block diagram showing system relationships of major components and quantities and interconnecting cable requirements.
 - 2. Plans showing equipment location and conductor requirements.
 - 3. Equipment outlet devices, and special mounting details.
 - 4. Wiring diagrams showing terminal identification for field-installed wiring.

5. Catalog literature with component specifications.

1.5 DESCRIPTION:

- A Work under this section includes all equipment, labor, and materials necessary to furnish and install a complete assistive listening system conforming to the requirements of the 2016 California Building Code (CBC) Section 11B-219 and Section 11B-706.
- B The assistive listening system shall be a Frequency Modulated Radio Transmission system using the 216-217 MHz range assigned by the FCC exclusively for low power assistive listening systems. Systems using the older 72-76 MHz range are not acceptable.
- C The number of receivers provided shall be equal or greater than 4-percent of the total seating capacity. 25-percent of the receivers required to be provided, but no fewer than two, shall be hearing aid compatible in accordance with the requirements of the 2016 California Building Code (CBC) Section 11B-706.3.
 - 1. Provide ALS system with fixed transmitter in all classrooms with amplified Audio-Visual systems. Contractor shall integrate that ALS into the owner provided AV system. Confirm locations with Architectural and Electrical Plans.
 - 2. Provide portable ALS system for conference rooms. Confirm locations with Architectural and Electrical Plans.
- D The permanently installed system shall be a fixed, rack mounted transmitter and connected to the sound system. The ALS system shall be complete consisting of transmitter, portable receivers, antenna and earphones.

1.6 WARRANTY:

- A The assistive listening system transmitter and receiver units furnished under this Section shall be warranted to be free from defects in workmanship and material under normal use and conditions for a period of two (2) years. Accessories such as headphones, earphones, neckloops, and cords shall be warranted to be free from defects in workmanship and material for a period of 90 days; batteries are excluded. Warranty periods shall begin upon acceptance of the assistive listening system by the Owner's Representative.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Williams Sound
 - 2. Listen Technologies
- B All equipment shall be the standard catalogued products of a single manufacturer.
- C Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 GENERAL:

- A Fixed Transmitter
 - 1. The stationary FM transmitter shall be capable of broadcasting on 57 channels.

2. The transmitter shall have a SNR of 80 dB or greater.
 3. The output power shall be adjustable to quarter, half or full.
 4. Channel tuning shall be capable of being locked.
 5. The device shall broadcast on both wide and narrow band channels.
 6. The device shall have an audio frequency response of 50 Hz to 15k Hz, ± 3 dB at 72 MHz, or of 50 Hz to 10k Hz, ± 3 dB at 72 MHz.
 7. It shall have two mixing audio inputs. The device shall have the following:
 - a. Audio device shall have an audio processor that is capable of automatic gain control and limiting.
 8. Model Number:
 - a. Williams T45
 - b. Listen LT-800-072-01
 9. Provide with Rack Mount Kit:
 - a. Williams RPK 005
 - b. Listen LA-326
- B Portable Transmitter**
1. The transmitter shall be a wide-band body-pack transmitter and shall operate on 17 selectable frequencies between 72MHz and 76MHz.
 2. It shall operate for up to 30 hrs with two AA Alkaline batteries and be housed in a black plastic enclosure with an aluminum faceplate.
 3. It shall have battery recharge ability utilizing drop-in chargers.
 4. The transmitter shall have a 3.5 mm microphone jack and a 2.5 mm auxiliary audio input jack. The microphone cord will serve as the transmitting antenna.
 5. The transmitter shall have three buttons on the front to access channel select, master and aux gain, compression on/off, channel lock and screen adjustments. There shall be an OLED screen on the front of the T46 displaying current operating status and menu information.
 6. The Transmitter shall have the ability to operate in dual channel mode whereby the user can switch between two different transmitting channel presets, each with its own set-up parameters (channel, master volume, aux volume).
 7. There shall be a power switch which also serves as a microphone mute control on the top bezel of the transmitter.
 8. The Transmitter shall have wide band FM modulation at 75 KHz peak with a frequency response of 180 Hz to 13 KHz.
 9. The transmitter shall be equipped with an omni-directional conference microphone
 10. Model Number:

- a. Williams PPA T46
 - 1) Microphone: MIC 049
- b. Listen LT-700-072
 - 1) Microphone: LA-277

C Portable Receiver

1. The FM receiver shall be capable of receiving on 57 wide band channels with a SNR of 80dB or greater.
 - a. The device shall be able to be locked on a single channel.
 - b. The receiver shall be capable of seeking channels.
 - c. The device shall have an adjustable squelch.
 - d. The device shall have an audio frequency response of 50 Hz to 15 KHz, ± 3 dB.
 - e. The device will incorporate a stereo headset jack that allows the user to plug in either a mono or stereo headset.
 - f. The device shall incorporate an LCD display that indicates channel, battery level, low battery, battery charging, and RF signal strength.
 - g. The receiver shall be able to function in both DX and Local mode.
 - h. The unit shall operate off of 2 AA batteries. The receiver shall incorporate automatic battery charging circuitry for recharging of NiMH batteries.
 - i. Model Number:
 - 1) Williams R38
 - 2) Listen LR-400-072
2. The FM receivers shall be recharged using a charging carrying case for up to 8 units.
 - a. Model Number:
 - 1) Williams CHG 3512 PRO
 - 2) Listen LA-324
3. The FM receivers shall each be equipped with Ear Speakers.
 - a. Model Number:
 - 1) Williams EAR 022
 - 2) Listen LA-164
4. The system shall include a neck loop that wirelessly connects to hearing aids equipped with a "T" coil.
 - a. Model Number:
 - 1) Williams NKL 001
 - 2) Listen LA-166

5. Receivers shall be equipped with NiMH rechargeable batteries.
 - a. Model Number:
 - 1) Williams BAT 026-2
 - 2) The Listen LA-362
- D Remote antenna shall be required for the transmission of the audio from the transmitter to the receiver. The antenna shall be able to transmit signals at 72 Mhz.
 1. The antenna shall be wall mounted to a BNC wall plate.
 - a. Model Number:
 - 1) Williams ANT 028
 - 2) Listen LA-123
 - b. Provide RG58 coax cable with BNC connectors, length as required.
- E Provide sound reinforcement wall plaques per ADA requirements to indicate equipment available for the hearing impaired. Provide a plaque in space.
 1. Verify location with general contractor prior to installation. Use the “international symbol of access for the hearing impaired”.
 2. Model Number:
 - a. Willaims IDP 008
 - b. Listen Technologies LA-304 ADA Access/Compliance signage kit.

PART 3 - EXECUTION

3.1 INSTALLATION

- A The contractor shall supply all equipment required to provide a complete and functional assistive listening system.
- B The assisted listening system shall be an integral part of the sound reinforcement system for the required spaces.

3.2 TESTS AND ADJUSTMENTS

- A Under completion of the installation of all equipment and when same is in full operating condition, the contractor shall perform the initial completion tests and adjustments specified hereinafter. The Contractor is responsible to provide all necessary instruments, equipment, material, and labor necessary to complete the tests.

3.3 TRAINING:

- A Prior to establishing a training schedule, contractor will verify operational status of system with owners representative.
- B Owner personnel will be trained in the operation of the Assistive Listening System.

C Training will be conducted no less than two times, four hours each. An initial familiarization and a follow up for detailed questions.

3.4 **WARRANTY**

A The manufacturer shall guarantee the system and components to be free from defects of material and workmanship for a period of two years from the date of final acceptance by the owner.

END OF SECTION

SECTION 31 10 00 SITE CLEARING

GENERAL

1.01 SUMMARY

A. Contractor shall:

1. Protect existing trees, shrubs, and grass to remain.
2. Remove existing trees, buildings, ramps, shrubs, groundcovers, plants, and grass.
3. Clear and grub as required for a complete installation.
4. Strip and stockpile topsoil.
5. Remove above grade site improvements. Remove below grade site improvements as noted.
6. Relocate underground utilities and structures to remain in service.
7. Disconnect, cap or seal, and abandon site utilities in place.
8. Provide temporary erosion and sedimentation control measures.

B. Related Sections include the following:

1. Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities.
2. Section "Execution Requirements" for verifying utility locations and for recording field measurements.
3. Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.

1.02 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.

1.03 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.

1.04 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings, according to Division 1 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.05 QUALITY ASSURANCE

- A. Pre-construction Conference: Conduct conference at Project site to comply with requirements in Section "Project Management and Coordination."

1.06 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. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by Architect.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 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.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Follow the Erosion and Sediment Control plan that describes project 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. At project completion remove temporary erosion and sedimentation controls. Restore and stabilize areas disturbed during removal.
- D. See section 01 57 13 for further instructions.

3.03 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.
 - 1. Cover exposed roots with burlap and water regularly.

2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 4. Backfill with soil as soon 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.

3.04 UTILITIES

- A. Disconnect and seal or cap.
1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
1. Arrange with utility companies to shut off indicated utilities.
- C. 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 two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Architect's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.

3.05 CLEARING AND GRUBBING

- A. Remove top 6" of ground surface, obstructions, 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 dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Depressions shall be cleaned of all loose or disturbed materials and dish-shaped (with sideslope at 3(h):1(v) or flatter) to permit access for compaction equipment. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.06 SITE IMPROVEMENTS

A. Remove existing above- 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. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.07 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.

END OF SECTION

SECTION 31 20 00 EARTH MOVING

PART 1 GENERAL

1.01 SUMMARY

A. Contractor Shall:

1. Prepare subgrades for slabs-on-grade and pavements.
2. Excavate and backfill for field and surrounding areas.
3. Provide rock capillary break for slabs-on-grade.
4. Provide base course for asphalt paving.
5. Provide subsurface drainage backfill for walls and trenches.
6. Excavate and backfill for utility trenches.

1.02 RELATED SECTIONS AND DOCUMENTS INCLUDE THE FOLLOWING

- A. Section 31 "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, and removal of above- and below-grade improvements and utilities.
- B. Section 31 "Excavation Support and Protection" for shoring, and bracing of excavations.
- C. Section 1 "ECP-SWPPP" for additional information on Erosion and Sediment Controls and Storm Water Pollution Prevention Plan.

1.03 DEFINITIONS

- A. Backfill: Soil material or lean concrete used to fill an excavation.
 1. Trench Backfill: Backfill placed over pipe bedding to fill the trench.
- B. Aggregate Base: Granular material placed between the subgrade and hot-mix asphalt paving.
- C. Pipe Bedding: Material supporting, surrounding, and extending to 6 inches above the top of the pipe as shown on the Plans.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

- E. Rock Capillary Break: Clean crushed rock layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
- G. Engineered Fill: Compacted soil materials used to raise existing grades or to backfill excavations.
- 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: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill.
- J. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.04 SUBMITTALS

- A. Product Data: For the following:
 - 1. Geotextile.
 - 2. Lean concrete, including design mixture.
- B. Samples:
 - 1. None
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for the following with requirements indicated:

Material	Test	Test Method
Engineered Fill:	Compaction Curve	ASTM D1557
	Atterberg Limits	ASTM D4318
Structural Fill:	Compaction Curve	ASTM D1557
	Atterberg Limits	ASTM D4318
Pipe Bedding:	Compaction Curve	ASTM D1557
	Sand Equivalent	CTM 217
Trench Backfill:	Compaction Curve	ASTM D1557
	Sand Equivalent	CTM 217

- D. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.05 QUALITY ASSURANCE

- A. Agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in the Section for Project Management and Coordination.

1.06 PROJECT CONDITIONS

- A. The Contractor is presumed to have visited the site and familiarized himself with existing site conditions. The Contractor shall not be relieved of liability under the contract for any loss sustained as a result of any variance between conditions indicated by plans and the actual conditions encountered during the course of the work.
- B. The Contractor shall, upon becoming aware of surface and/or subsurface conditions differing from those disclosed by the contract documents, promptly notify the Owner as to the nature and extent of the differing conditions, first verbally to permit verification of the conditions and then in writing. No claim by the Contractor for any conditions differing from those anticipated in the plans and specifications will be allowed unless the Contractor has so notified the Owner's representative verbally and in writing, as required above, of such changed conditions.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Architect not less than seven days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- D. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Aggregate Base: Aggregate base shall conform to the requirements of the State Standard Specifications for Class 2 aggregate base, 3/4-inch maximum size (Caltrans).
- C. Engineered Fill: Requirements for engineered fill, as well as applicable test procedures to verify material suitability are provided in the table below.

D.

ENGINEERED FILL REQUIREMENTS			
Fill Requirement		Test Procedures	
		ASTM¹	Caltrans²
Gradation			
Sieve Size	Percent Passing		
3 inch	100	C 136	202
¾-inch	50-100	C 136	202
No. 4	25-100	C 136	202
No. 40	5-100	C 136	---
No. 50	5-100	---	202
No. 200	0-70	C 136	202
Plasticity			
Liquid Limit	Plasticity Index		
<30	<10	D 4318	204
Organic Content			
Less than 3%		D2974	---
Expansion Potential			
Less than 20	---	---	---
Maximum Dry Density AT OR			
More than 105 pcf	---	D1557	---
¹ AMERICAN SOCIETY FOR TESTING AND MATERIALS STANDARDS (LATEST EDITION)			
² State of California, Department of Transportation, Standard Test Methods (latest edition)			

E. Pipe Bedding: Imported clean sand or well graded sand gravel mix, maximum size of ¾-inch, free from all organic matter and debris; minimum sand equivalent of 30. In areas with pipe slope greater than 2 percent use a silt-sand-gravel mixture with gradation corresponding to that for Caltrans Class 2 aggregate base – ¾-inch maximum size.

- F. Rock Capillary Break: Narrowly graded mixture of with 100 percent passing a 1-inch sieve and zero percent passing a No. 4 sieve.
- G. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- H. Trench Backfill: Caltrans Class 2 aggregate base ¾-inch maximum size or backfill per pipe manufacturers specifications.

2.02 GEOTEXTILES

- A. Subsurface Drainage Geotextile: A woven fabric with an equivalent opening size (EOS), U.S. Standard Sieve, of between 40 and 70, a permeability of at least 0.02 centimeters per second, a minimum flow rate of 50 gallons per minute per square foot of fabric, and a minimum puncture strength of 50 pounds.

2.03 LEAN CONCRETE

- A. Lean concrete used in deepened foundation excavations should have a minimum unconfined compressive strength of 1,000 pounds per square inch after a 28-day curing period.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Section 31 "Site Clearing".
- C. Protect and maintain erosion and sedimentation controls, which are specified in Section 31 "Site Clearing," during earthwork operations.

3.02 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 by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.03 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.04 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.05 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions 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: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.07 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 1. Clearance: 6 inches each side of pipe or conduit.

- C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course.

3.08 SUBGRADE INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect or Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with a loaded 10-wheel, tandem-axle water truck with a rear axle load of not less than 8 tons.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.09 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 1,000 PSI, may be used when approved by Architect.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.10 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.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact pipe bedding on trench bottoms as shown on the Plans. Shape bedding to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section "Cast-in-Place Concrete."
- D. Place and compact remainder of pipe bedding material to a height of 6 inches over the utility pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- E. Backfill voids with trench backfill material while removing shoring and bracing.
- F. Place and compact trench backfill material to final subgrade elevation.
- G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SURFACE PREPARATION FOR FILL PLACEMENT

- A. After site stripping and any required grubbing and/or over excavation, areas to receive fill shall be scarified to a depth of 8 inches, uniformly moisture conditioned to at or above optimum moisture content and compacted to at least 90 percent of the material's

maximum dry density as determined by ASTM Test Method D1557. Scarification and compaction may not be required within earthwork cut areas consisting of undisturbed bedrock and if approved by the project Geotechnical Engineer during construction.

If soft or yielding soils are encountered during scarification and compaction, they shall be removed by over excavation to expose firmer soils. The horizontal and vertical extent of the over excavation shall be determined in the field by the project Geotechnical Engineer. Bench sloped surfaces steeper than 1 vertical to 6 horizontal so fill material will be placed on a level surface; benches shall be at least six feet wide and the rise between successive benches shall not exceed two feet.

3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to at or above the optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that is too wet to compact to specified dry unit weight or that is unstable under the earthwork or proofrolling equipment.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 8 inches of existing subgrade and each layer of backfill or fill soil material to at least 90 percent.
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material to at least 90 percent.
 - 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material to at least 85 percent.
 - 4. For utility trenches, compact each layer of bedding and backfill material to at least 90 percent.

3.16 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 Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch.
 - 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 AGGREGATE BASE

- A. Place aggregate on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place aggregate base as follows:
 - 1. Shape aggregate base to required crown elevations and cross-slope grades.
 - 2. Place aggregate base 6 inches or less in compacted thickness in a single layer.
 - 3. Place aggregate base 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.
 - 4. Compact aggregate base at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
- C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.18 ROCK CAPILLARY BREAK

- 1. Place per structural engineering and architectural requirements under building slabs.

3.19 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

- B. Allow 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 complies 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 Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 1557, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
 - 3. Trench Backfill: At each compacted initial and final trench backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

- A. Adequate protection measures shall be provided to protect workmen and passers-by at the site. Streets and adjacent property shall be fully protected throughout the operations.
- B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal work hours.
- C. Any construction review of the contractor's performance conducted by the Architect or the Soil Engineer is not intended to include review of the adequacy of the Contractor's safety measures in, on or near the construction site
- D. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- E. 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 Architect; reshape and recompact.

- F. 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.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Soil spoils to be located at southwest corner of property at location to be determined by Owner
- B. Waste materials and garbage to be hauled off and disposed of properly

END OF SECTION

SECTION 31 50 00 EXCAVATION SUPPORT AND PROTECTION

Part 1 General

1.01 SUMMARY

A. The Contractor shall provide temporary excavation support and protection systems.

1.02 RELATED SECTIONS INCLUDE THE FOLLOWING:

- A. Section "Temporary Facilities and Controls" for temporary utilities and support facilities.
- B. Section "Earth Moving" for excavating and backfilling and for existing utilities.

1.03 PERFORMANCE REQUIREMENTS

- A. Furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
 - 1. Provide professional engineering services needed to assume engineering responsibility, including preparation of Shop Drawings and a comprehensive engineering analysis by a qualified professional engineer.
 - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 3. Install excavation support and protection systems without damaging existing buildings, pavements, and other improvements adjacent to excavation.

1.04 SUBMITTALS

- A. Shop Drawings for Information: Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems.
 - 1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Qualification Data: For Installer and professional engineer.
- C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage

caused by the absence of, the installation of, or the performance of excavation support and protection systems.1.05 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by the Project Manager and then only after arranging to provide temporary utility services according to requirements indicated.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.
- C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.
- D. Wood Lagging: Lumber, mixed hardwood.
- E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.
- F. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
 - 1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having

jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

- C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces is not impeded.
- D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
- E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.02 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
 - 1. Repair or replace, as approved by the Project Manager, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION

SECTION 32 12 13 CONCRETE PAVING

PART 1 GENERAL

1.01 SUMMARY

- A. Furnish and install exterior cement concrete pavement systems including form work, reinforcement steel, mesh, curing compounds and accessories as required for a complete installation. The systems specified include:

1. Driveways and roadways.
2. Curbs and gutters.
3. Walkways.
4. Plazas.

1.02 RELATED SECTIONS INCLUDE THE FOLLOWING:

- A. Section "Earthwork" for subgrade preparation, grading, and subbase course.
- B. Section "Cast-in-Place Concrete" for general building applications of concrete.

1.03 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.04 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Provide 2' x 2' sample panel of all concrete finishes and colors indicated in the drawings. Approved samples to be kept at the jobsite to serve as a prerequisite for all finishes until final acceptance.

1.05 QUALITY ASSURANCE

- A. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
- B. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.06 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.01 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 - 1. Use flexible or curved forms for curves with a radius 100 feet or less.
- B. 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.

2.02 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- C. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.
- D. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.
- E. 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, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.03 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
 - 1. Portland Cement: ASTM C 150, Type II
- B. Normal-Weight Aggregates: ASTM C 33, Class 4M coarse aggregate, uniformly graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: 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/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.

2.04 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, 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. Evaporation retarder in paragraph below temporarily reduces moisture loss from concrete surfaces awaiting finishing in hot, dry, and windy conditions. Evaporation retarders are neither curing compounds nor chemical surface retarders used to delay concrete setting.

2.05 RELATED MATERIALS

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

2.06 PAVEMENT MARKINGS

- A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes.
 - 1. Color: As indicated.
- B. Glass Beads: AASHTO M 247, Type 1.

2.07 WHEEL STOPS

- A. Wheel Stops: Precast, air-entrained concrete, 2500-PSI minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
 - 1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.08 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 2500 PSI.
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
 - 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: 3-1/2 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.09 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
 - 1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with a loaded 10-wheel tandem-axle water truck with not less than 8 tons on the rear axles.
 - 3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Section "Earthmoving."
- C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.02 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.04 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. 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.

3.05 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edgings 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 pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
 - 2. Provide tie bars at sides of pavement strips where indicated.
 - 3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 4. 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.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, buildings, walks, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Control Joints: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a **1/4-inch** radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groove marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 3/16-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 3. Doweled Contraction 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
 4. Spacing: Sidewalks: control joints shall be placed not more than 4 feet on center both ways. Outdoor slabs: Control joints shall not be spaced more than 8 feet on center both ways.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a **3/8-inch** radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.06 CONCRETE PLACEMENT

- A. Inspection: Before placing 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. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase 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.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site.
- F. Do not add water to fresh concrete after testing.
- G. 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.
- H. 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.

- I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
 - 1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.
- J. Screed pavement surfaces with a straightedge and strike off.
- K. 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.
- L. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
- M. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.
 - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.
- N. 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.
- O. 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 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 unless otherwise specified and approved in mix designs.

- P. 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 subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.07 FLOAT FINISHING

- 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.
- C. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.08 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.
- C. Evaporation Retarder: Apply evaporation retarder to 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.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moist 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.

1. 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. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
2. 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.

3.09 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, unlevelled straightedge not to exceed 1/4 inch.
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
8. Joint Spacing: 3 inches.
9. Control Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.10 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.

- D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

- 1. Spread glass beads uniformly into wet pavement markings at a rate of 6 lb/gal..

3.11 Not used

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 prepare test reports.
- B. Strength of each concrete mix will be satisfactory if average of any 3 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.
- C. 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.
- D. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.13 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide asphalt pavement, including aggregate base course and materials as required for complete finished paving system.
- B. Related Sections:
 - 1. Section 31 20 00: Earth Moving

1.2 REFERENCES

- A. Standard Specifications: The Standard Specifications of the State of California, Business and Transportation Agency, Department of Transportation, current edition.
- B. The Asphalt Institute: Asphalt Paving Manual, Manual Series No. 8 (MS-8).

1.3 PROJECT CONDITIONS

- A. Do not install pavement during inclement weather or when air temperature is below that recommended by Standard Specifications or The Asphalt Institute (AI) MS-8.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Conform to applicable requirements of Standard Specifications for type of asphaltic pavement indicated, and requirements of AI MS-8; where conflicts occur, follow Standard Specifications.
- B. Aggregate Base: Class 2, 3/4" maximum size; sound, angular crushed stone, crushed gravel or crushed slag, sand, stone, or slag screenings.
- C. Surface Course Aggregate: Crushed stone, crushed gravel, crushed slag, and sharp-edged natural sand.
- D. Mineral Filler: Rock or slag dust, hydraulic cement, or inert material complying with Standard Specifications and AASHTO M17/ASTM D242.
- E. Asphalt Cement: Comply with Standard Specifications for type of paving indicated, but no less than AR 4000, Type B aggregate, and AASHTO M226/ASTM D3381; minimum Viscosity Grade AC-20, AR-80.

- F. Primer: AASHTO M82/ASTM D2027 MC 70; homogeneous medium curing liquid asphalt; of type recommended for asphaltic paving; of grade to suit job conditions.
- G. Tack Coat: Standard Specifications or AASHTO M140/ASTM D977 SS1h type asphalt emulsion diluted with water.
- H. Herbicide Treatments: Commercial chemical for weed control, registered by Environmental Protection Agency; granular, liquid or wettable powder form.
 - 1. Manufacturers: Use only products registered by EPA and acceptable to applicable authorities; verify acceptability of materials with applicable authorities.
 - a. Allied Chemical Corp.
 - b. Dow Chemical Co.
 - c. U.S. Borax and Chemical Corp.
 - d. Substitutions: Refer to Section 01 62 00.

2.2 MIXES

- A. Provide asphalt-aggregate mixture as recommended by Standard Specifications, Section 39, Type A; maintain thorough and uniform mixture.
- B. Bring asphalt cement and mineral constituents to required temperatures before mixing; ensure aggregates are sufficiently dry so as not to cause foaming in mixture.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Ensure buried work in paved areas has been completed, inspected, tested and approved prior to starting work.
- B. Ensure grading of sub-grade is to required elevations.

3.2 PREPARATION

- A. Where not previously excavated, thoroughly scarify pavement sub-grade to a minimum depth 12" and compact to 95% dry density.
 - 1. Prepare areas under track and field with lime treatment. Refer to geotechnical report.
 - 2. Prepare sub-grade to provide optimum moisture content.
 - a. Water and thoroughly mix sub-grade when deficiency exists.
 - b. When excess of moisture exists, rework and aerate sub-grade.

- B. Before final rolling shape entire section add additional sub-soil as required and compact sub-grade to provide grades, elevation and cross-section indicated.

- 1. Points of finished sub-grade surface shall be within 1" of elevations indicated.

3.3 INSTALLATION

- A. Aggregate Base Course:

- 1. Bring aggregate base course to required depths and profiles.
 - a. Extend minimum 6" beyond asphalt pavement width.
 - b. Place in layers not exceeding 5" in depth.
 - c. Compact each layer to 95% dry density unless otherwise indicated.
 - 2. Properly compact areas adjacent to curbs and areas not accessible to rollers with mechanical or hand tamping devices.
 - 3. Ensure aggregate base course materials are not contaminated with deleterious materials.
 - 4. Spread base course materials over prepared sub-base.
 - a. Depth: As indicated on Drawings.
 - b. Compaction: 95% dry density unless otherwise indicated.
 - 5. Ensure top surface of base course is true to lines and grades indicated, within 1/2" of elevations indicated.
 - 6. Add water during compaction to bring aggregate base course materials to optimum moisture content.
 - 7. When excess moisture exists, rework aggregate base course materials until optimum moisture content is obtained.

- B. Priming Prepared Aggregate Base Course: Ensure aggregate base course is dry and free of loose or foreign material before priming.

- 1. Apply primer over prepared aggregate base course at rate recommended by Standard Specifications and manufacturer's recommendations; ensure primer is at temperature recommended by manufacturer.
 - a. Use clean natural sand to blot excess primer.
 - 2. Prime surfaces of curbs in contact with asphalt pavement.
 - 3. Prevent asphalt adhesion to adjacent materials.

- C. Tack Coat: Apply liquid asphalt tack coat to vertical surfaces asphaltic concrete will be placed against; comply with Standard Specifications and manufacturer recommendations.
- D. Asphaltic Concrete Pavement: Place asphalt pavement within 24 hours of priming aggregate base course.
 - 1. Depths: As indicated on Drawings.
 - 2. Compaction: Compact asphalt paving with approved rolling equipment; start compaction as soon as pavement will bear equipment without checking or undue displacement.
 - a. Carry out compaction in three operations in pass sequence; ensure each pass of roller overlaps previous passes to ensure smooth surface free of roller marks.
 - b. Prevent pick-up of material on roller wheels.
 - c. Density: Minimum 95% density unless otherwise indicated.
 - 3. Perform hand tamping in areas not accessible to rolling equipment.
 - 4. Ensure joints made during paving operations are straight, clean, vertical and free of broken or loose material; prime vertical surfaces of joints to ensure tight bond.
 - 5. Ensure surface of completed asphalt pavement is true to lines, profiles, and elevations indicated.
 - 6. Ensure surface is free of depressions exceeding 1/4" when measured with a 10'-0" straight-edge.

3.4 PATCHING

- A. Remove and replace defective paving areas and paving areas mixed with foreign materials.
- B. Cut out areas and fill with fresh, hot asphaltic concrete; compact by rolling to maximum surface density and smoothness.

3.5 FIELD QUALITY CONTROL

- A. Site Tests and Inspection: Allow for testing and inspection of asphalt pavement mixes and testing of placed aggregate base course and asphalt pavement; refer to Division 1 testing laboratory services.
 - 1. Testing and inspection will be performed so as to minimize disruption to work.

2. Allow testing laboratory access to mixing plant for verification of weights or proportions, character of materials used and determination of temperatures used in preparation of paving mix.
3. When required, testing laboratory will perform laboratory tests of proposed asphalt pavement mixes to determine conformity with requirements.
4. Testing laboratory will perform one series of compaction tests for aggregate base course and for each asphalt pavement course.
5. Notify testing laboratory to perform density tests when aggregate base course or portion thereof has been placed and compacted in accordance with requirements,
 - a. Do not place asphalt pavement until results have been verified and base course installation approved.
6. If compaction tests indicate aggregate base course or asphalt paving do not meet specified requirements, remove defective work, replace and retest with no additional cost to Owner.

3.6 PROTECTION

- A. Do not allow vehicular traffic on newly paved areas until surface has cooled to atmospheric temperature and not less than 24 hours after completing asphaltic concrete work.

END OF SECTION

SECTION 33 11 13 WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Includes but not limited to:
 - 1. Water system piping, valves, fittings, and accessories.
 - 2. Connection of building domestic system to site-water distribution system.
 - 3. Fire water site distribution system
 - 4. Irrigation Lines

1.02 RELATED SECTIONS

- A. Section 31 20 00 Earth Moving

1.03 REFERENCES

- A. AWWA – American Water Works Association.

1.04 PROJECT RECORD DOCUMENTS

- A. Submit Record Drawings per Section 013300.
- B. Accurately record location of pipe runs, connections, valves, boxes, and meters.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.01 WATER SYSTEM PIPE MATERIAL

- A. 4-inch and larger PVC pipe shall be Class 150, SDR 18, conforming to AWWA C900.
- B. PVC pipe smaller than 4-inch in diameter shall be Schedule 40 thickness class conforming to ASTM 1785. Pipe joints shall be solvent weld. Fittings shall be Schedule 40 solvent weld type conforming to ASTM D2466.

2.02 PIPE FITTINGS

- A. All fittings for 4-inch and larger PVC pipe shall be either cast iron or ductile iron conforming to ANSI A21.10 (AWWA C110) and cement mortar lining and bituminous coated ANSI A21.4 (AWWA C104) and ANSI A21.6 or ANSI A21.51. As an option for mechanical or push on joint, fittings shall conform to AWWA C153. Buried fittings shall be wrapped in polyethylene film conforming to AWWA C105.

2.03 VALVES BOXES

- A. Provide for all valves placed underground. Boxes shall be traffic rated with cast iron ring and cover and concrete main body, Brooks Products, Inc., No. 1-RT, Christy G-5, Cook Concrete Products No. 10T12, or equal. Boxes shall be furnished with 8-inch PVC pipe extension sleeves. The lid shall be marked "WATER". The bottom of the valve box extensions shall be centered and cut to fit the valve and then sealed with polyurethane foam, mortar or other approved sealant to prevent soil migration into the box extension.

2.04 VALVES

- A. Gate Valves, 2 inches and larger: 125-pound, totally encapsulated disk, solid wedge resilient seat, non-rising stem, and open to left with O-ring seals. NRS valves with O-ring seals. Exposed valves shall have hand wheel operators. Buried valves shall have 2-inch square wrench nuts. American Flow Control or equal, and conform to AWWA C509. Valves shall be epoxy coated in conformance with AWWA C550.
- B. Extension Stems: Provide for all buried valves set deeper than 3 feet to the operating nut. Extension stems shall be a minimum of 1 ½ inches in diameter. Schedule 40 steel pipe, with a welded plate box at the bottom which fits over the valve operation nut, a set screw to secure the bottom box to the valve nut, have a 2-inch operating nut welded to the top of the stem, and extend to within 15 inches of the ground surface plus or minus 3 inches.

2.05 LOCATION WIRE

- A. Solid copper No. 12, soft drawn insulated wire, Type THHN, shall be used. Remove insulation at splices and inside valve boxes to allow for connecting a pipe finder.

2.06 FLANGED COUPLING ADAPTERS (FCA)

- A. Flanged coupling adapters (FCA) shall be suitable for piping to which they are attached. Flanged coupling adapters for 12-inch and smaller diameter pipe shall be cast or ductile iron. Larger sizes shall be steel. Steel couplings (FCA) shall be fusion epoxy lined and coated (8 mil minimum thickness). All couplings shall be furnished with low alloy steel bolts and nuts, except in exposed damp or submerged locations such as valve vaults, wet wells, water holding basins, in which case all bolts and nuts including flange bolts shall be Type 304 stainless steel, national coarse threads. FCAs shall be as manufactured by Smith Blair, Romac, or equal. Verify components with City of Orland prior to installation.

2.07 FIRE HYDRANTS

Hydrants shall meet the requirements of the local fire marshal. All parts and accessories purchased for fire hydrants shall be manufactured and warranted by the hydrant manufacturer. A lateral and gate valve conforming to these Specifications shall be provided from the main waterline to each hydrant as shown on the Plans.

2.08 SINGLE CHECK VALVE

- A. Iron body, bronze-mounted, swing check valves. Mueller No. A-2600, or equal.

2.09 REDUCED PRESSURE DETECTOR ASSEMBLY

- A. Reduced Pressure Detector Assembly shall be RPDA or approved equal acceptable to the local jurisdiction.
- B. All backflow device valve assemblies shall be lead free, tested and certified by an acceptable laboratory and approved for use by the California State Department of Drinking Water. All steel backflow devices shall be fusion bonded epoxy coated internally and externally, with the exception of stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavation base is ready to receive work, and excavations, dimensions, and elevations are as indicated on Drawings.
- B. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fill material.
- B. Remove large stones or other hard matter which could damage drainage tile or impede consistent backfilling or compaction.

3.03 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with manufacturer's instructions.
- B. Backfill trench in accordance with Section 31 20 00 Earth Moving

3.04 INSTALLATION – VALVES AND APPURTENANCES

- A. Install valves and appurtenances per manufacturer's recommendations.

3.05 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Section 01 General Requirements.
- B. Request inspection by PID & Owner prior to placing cover.

3.06 PROTECTION

- A. Protect finished installation under provisions of Section 01 General Requirements
- C. Protect pipe and filter aggregate cover from damage or displacement until backfilling operation is in progress.

3.07 WATER SYSTEM TESTING

- A. Upon completion of the installation of the water main and appurtenances, the contractor shall, pressure test all parts of the system. Each section of water main between line

valves shall be tested separately by closing the adjacent line valves and bringing the isolated section up to a test pressure that will cause the pressure at the highest point in the isolated section to be at least 50 pounds per square inch (PSI) and maintain at least that pressure for a minimum of one hour. At the end of the test period, the test pressure shall be at least equal to the starting test pressure in order to properly determine the leakage.

- B. Leakage shall not be in excess of 5 gallons per inch of diameter per 1,000 feet of pipe per 24 hours. Leakage shall be determined by pumping into the closed system from a barrel and maintaining the required pressure or by other means approved by the engineer. Where leakage is in excess of the specified rate, the amount of leakage shall be reduced by the Contractor to a quantity within the specified rate before the installation is accepted. In addition, the Contractor shall repair all visible leaks.
- D. Where interconnections are made between existing and the new system at other than existing isolation valves, the interconnection piping between the existing system and the first new isolation valve will not have to be pressure tested. However, when these interconnections are made and pressurized, any noticeable leaks shall be corrected.
- E. Where the new system interconnects to an existing system, at an existing system isolation valve, it will be the Contractor's option to either test against the existing isolation valve or to install a temporary thrust protected blind flange, cap, or plug, within 15 feet of the existing valve to test against.
- F. If the Contractor elects to test against the existing valve, the Contractor shall bear the full responsibility for leakage that may occur through the valve; and no additional lenience will be given for such potential leaks.
- G. If the second option is used, the final connections to the existing valve, after the pressure test is completed will not have to be tested but any noticeable leaks shall be corrected.

3.08 DISINFECTION OF COMPLETE WATERLINES

- A. Once the water system has been successfully hydrostatically tested, it shall be flushed of all dirt and debris. Following adequate flushing, the entire system shall be chlorinated. Chlorine shall be applied by one of the following methods.
 - 1. Liquid chloride gas-water mixture, fed chlorine gas, or calcium hypochlorite and water mixture.
 - 2. Chlorinating agent shall be applied at the beginning of the section adjacent to the feeder connection and shall be injected through a corporation cock, hydrant or other connection ensuring treatment of the entire line.
 - 3. Water shall be fed slowly into new line with chlorine applied in amounts to produce a residual of not less than 10 parts per million in all parts of the line for a period of not less than 24 hours.
- B. After chlorination, the water shall remain in the pipeline until the chlorine residual has dropped to below two-parts per million before it is flushed from the extremities of the system. All of the pipeline shall then be drained and refilled. The new pipeline shall then

be tested for bacteriological acceptability as determined by a minimum of four test samples for coli form bacteria taken by district representative from selected points in the pipeline shall be disinfected again.

- C. At connections to the existing system, where some sections of the piping cannot be reasonably disinfected in the normal procedure, all new pipe, fittings, etc., shall be sprayed or swabbed inside and out with a strong (one-to-five percent) chlorine solution prior to installation and installed in a sanitary manner so as not to contaminate the system. If the Contractor fails to take the proper precautions during connections to existing systems and allows dirt or dirty water to enter the existing piping, the Contractor shall flush and disinfect the existing water system as required.

END OF SECTION

SECTION 33 30 00 SANITARY SEWER

PART 1 - GENERAL

1.01 SUMMARY

- A. Contractor shall furnish and install gravity-flow, non-pressure sanitary sewer outside the building, with the following components, including all accessories for a complete installation:
 - 1. Sanitary sewer piping, fittings, and accessories.
 - 2. Precast concrete manholes.
 - 3. Cleanouts.

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.
- B. City of Chico Construction Standards and Specifications, current edition.

1.03 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.

1.04 REFERENCES

- A. ASTM D1785 - Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
- B. ASTM D3034 & D2321 - Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.

1.05 SUBMITTALS

- A. Shop Drawings: For the following:
 - 1. For Manholes: Include plans, elevations, sections, details, and frames and covers.
 - 2. Pipes and fittings

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic pipe and fittings in direct sunlight.

- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.

1.07 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Sewer 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 two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified on the plans.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified on the plans.

2.02 SANITARY SEWER PIPE MATERIALS

- A. All sanitary sewer materials shall conform to manufactures recommendations.
- B. Plastic Pipe: ASTM D1785, Schedule 40, polyvinyl chloride (PVC) material; Pipe joints shall be solvent weld conforming to ASTM D2466.

2.03 CLEANOUTS

- A. Cleanouts: As shown on the plans.

2.04 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

2.05 EXAMINATION

- A. Verify that excavation base is ready to receive work, and excavations, dimensions, and elevations are as indicated on Drawings.

- B. Beginning of installation means acceptance of existing conditions.

2.06 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer 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 beginning 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 manholes or cleanouts for changes in direction.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected.
- E. Install gravity-flow, nonpressure sewer piping according to the following:
 - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
 - 2. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 3. Installed gravity sewer pipe shall not deviate from the required line or grade more than 2 inches for line and 1/4" for grade. No variation is acceptable where it would result in a level or reverse sloping invert. Grade shall be measured at the pipe invert and the sewer shall have a smooth and uniform invert.
 - 4. Installed sewer pipe, after completion of backfill, shall not deviate from the vertical grade by more than 1 inch (plus or minus) and additionally, no sag in the piping shall be allowed which causes stagnant water to pond.

2.07 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from sanitary sewer pipe to cleanout at grade.
- B. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

2.08 CLEANING

- A. Clean ends and interior of piping of dirt and debris.

3.06 FIELD QUALITY CONTROL

- A. Failure to install joints properly shall be cause for rejection and replacement of piping system.
- B. Obtain Encroachment Permit from City of Chico, have all work inspected by City inspector prior to backfill. Conform to all City installation and inspection requirements.

- C. All portions of the pipeline shall be tested for straightness, roundness and leakage by the Contractor in accordance with the following specified procedures.
 - 1. All sewer pipelines shall be tested for leakage by utilizing a 2 hour pressure test of 50 psi. Any drop in pressure shall be cause for rejection.
 - 2. The Contractor shall have leakage measured in excess of the amounts specified herein, by locating the leaks, making permanent corrections by repairs or replacements to reduce the leakage to within allowable amounts, and retesting affected portions.
 - 3. Contractor to track system changes or modifications and forward a "redlined" set of plans to Engineer for a clean production of an "as-built" set.

END OF SECTION

SECTION 33 41 00 STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Contractor shall furnish and install gravity-flow, non-pressure storm drainage outside the building, with the following components, including all accessories for a complete installation:
 - 1. Storm drainage piping, fittings, and accessories.
 - 2. Catch basin, paved area drainage, field drainage, manhole access, site surface drainage, and miscellaneous concrete structures.
 - 3. Site drainage system for new track and field areas.

1.02 RELATED DOCUMENTS

- A. Section 31 20 00 Earth Moving

1.03 DEFINITIONS

- A. HDPE: High density polyethylene.
- B. PVC: Polyvinyl chloride plastic.

1.04 SUBMITTALS

- A. Shop Drawings: For the following:
 - 1. Area Drains: Include plans, elevations, sections, details, and frames and covers.
 - 2. Slot Drains: Include specifications sheets, material properties and inlet details.
 - 3. Storm Drainage pipe: Pipe materials and properties.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic pipe and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle area drains according to manufacturer's written rigging instructions.

1.06 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage 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 and Owner no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Owner's written permission.

1.07 Project Record Documents

- A. Submit record documents per Section 014100
- B. Accurately record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 STORM DRAIN PIPE MATERIALS

- A. Corrugated smooth interior wall polyethylene pipe (PE) with all necessary connection fittings conforming to ASTM F667
- B. Reinforced Concrete Pipe Joint Device: ANSI/ASTM C443, rubber compression gasket joint.
- C. Plastic Pipe: ANSI/ASTM D3034, SDR35 Type PSM, polyvinyl chloride (PVC) material; inside nominal diameter of 4, 6, 8, 10, 12, 15 & 18 inches bell and spigot style solvent sealed end joints.

2.03 AREA DRAINS

- A. As specified on the plans.

2.04 CLEANOUTS

- A. Cleanouts: As shown on the plans.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.02 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage 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 beginning 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 area drains for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing storm drain system is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected.
- E. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
 - 2. Install piping 18-inch and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
 - 3. Install piping with 24-inch minimum cover, unless otherwise indicated on plans.
 - 4. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

3.03 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from storm drain pipe to cleanout at grade.
- B. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.04 DRAIN INSTALLATION

- A. Install type of drains in locations indicated.
- B. Embed drains in 4-inch minimum depth of concrete around sides.
- C. Drains to have open bottom with drain rock unless otherwise noted on plans.
- D. Set drain frames and covers with tops flush with pavement surface.
- E. Protect drains with silt barriers until construction is complete

3.05 AREA DRAIN INSTALLATION

- A. General: Install area drains, complete with appurtenances and accessories indicated.
- B. Install area drains according to manufacturer's requirements.
- C. Drains to have solid bottom with sumps unless otherwise noted on plans.
- D. Set tops of frames and covers flush with finished surface of area drains that occur in pavements.
- E. Protect drains with silt barriers until construction is complete

3.06 CLEANING

- A. Clean interior of piping of dirt and debris often during construction and at end of project.

END OF SECTION