

# CONSTRUCTION DOCUMENTS

DSA Appl #: 01-121701  
DSA File #: 21-39

## **GLENWOOD ELEMENTARY SCHOOL HVAC, ELEC, TECH/LOW VOLTAGE UPGRADE**

25 W Castlewood Drive, San Rafael, ca 94901

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3584002-100

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San Rafael City Schools  
310 Nova Albion Way, San Rafael, CA 94903



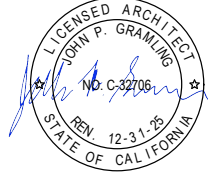
May 13, 2024

HMC Architects

**GLENWOOD ELEMENTARY SCHOOL - HVAC, ELEC, TECH/LOW  
VOLTAGE UPGRADE  
San Rafael City Schools  
San Rafael, California**

August 22, 2024

HMC #3584002-100



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HMC ARCHITECTS



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Hohbach-Lewin  
Structural Engineer



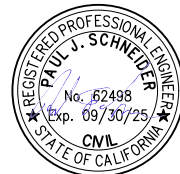
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LP Consulting Engineers  
Mechanical/Plumbing Engineers



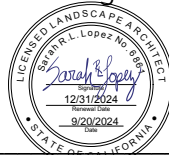
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LP Consulting Engineers  
Electrical Engineer



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Siegfried Engineering, Inc.  
Civil Engineer



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ANLA Associates  
Landscape Architect

SRCS GLENWOOD ELEMENTARY SCHOOL  
HVAC, ELEC, TECH/LOW VOLTAGE UPGRADE  
SAN RAFAEL, CALIFORNIA  
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13 MAY 2024

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HMC Architects  
3584002100

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NOT APPLICABLE

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**EXHIBIT D**

**GENERAL CONSTRUCTION PROVISIONS  
FOR THE FOLLOWING PROJECT:**

**GLENWOOD ELEMENTARY SCHOOL HVAC, ELEC,  
TECH/LOW VOLTAGE UPGRADE**

**BY AND BETWEEN**

**SAN RAFAEL CITY SCHOOLS**

**AND**

**[DEVELOPER]**

Dated as of \_\_\_\_\_, 20\_\_

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## **1. Contract Terms and Definitions**

### **1.1 Definitions**

Wherever used in the Contract Documents, the following terms shall have the meanings indicated, which shall be applicable to both the singular and plural thereof:

**1.1.1 Adverse Weather.** Shall be only weather that satisfies all of the following conditions: (1) unusually severe precipitation, sleet, snow, hail, or extreme temperature or air conditions in excess of the norm for the location and time of year it occurred based on the closest weather station data averaged over the past five years, (2) that is unanticipated and would cause unsafe work conditions and/or is unsuitable for scheduled work that should not be performed during inclement weather (i.e., exterior finishes), and (3) at the Project.

**1.1.2 Allowance(s):** The Allowance Item(s) identified in **Exhibit C** and included in the Guaranteed Maximum Price. Any unused portion of the Allowance will revert to the District documented by a deductive Change Order. Developer hereby authorizes the District to execute a unilateral deductive Change Order at or near the end of the Project for all or any portion of the Allowance not allocated.

**1.1.3 Allowance Expenditure Directive.** Written authorization for expenditure of an Allowance, if any. Developer shall not bill for or be due any portion of an Allowance unless the District has identified specific work, Developer has submitted a price for that work or the District has proposed a price for that work, the District has accepted the cost for that work, and the District has executed an Allowance Expenditure Directive incorporating that work.

**1.1.4 Approval, Approved, and/or Accepted.** Written authorization, unless stated otherwise.

**1.1.5 Architect (or "Design Professional in General Responsible Charge").** The individual, partnership, corporation, joint venture, or any combination thereof, named as Architect, who will have the rights and authority assigned to the Architect in the Contract Documents. The term Architect means the Design Professional in General Responsible Charge as defined in DSA PR 13-02 on this Project or the Architect's authorized representative.

**1.1.6 As-Builts.** Digitally prepared and reproducible drawings using the web-based ProCore application, or comparable, to be prepared on a monthly basis pursuant to the Contract Documents, that reflect changes made during the performance of the Work, recording differences between the original design of the Work and the Work as constructed since the preceding monthly submittal. See **Record Drawings**.

**1.1.7 Burdened.** The labor rate for Developer or any Subcontractor inclusive of any and all burden costs including, but not limited to, health and welfare pay, vacation and holiday pay, pension contributions, training rates, benefits of any kind, insurance of any kind, workers' compensation, liability insurance, truck expenses, supply expenses of any kind, payroll taxes, and any other taxes of any kind.

**1.1.8 Change Order.** A written order to Developer authorizing an addition to, deletion from, or revision in the Work, and/or authorizing an adjustment in the Guaranteed Maximum Price or Contract Time.

**1.1.9 Claim.** A Dispute that remains unresolved at the conclusion of all the applicable Dispute Resolution requirements provided herein.

**1.1.10 Completion.** The earliest of the date of acceptance by the District or the cessation of labor thereon for a continuous period of sixty (60) days.

**1.1.11 Construction Change Directive.** A written order prepared and issued by the District, the Construction Manager, and/or the Architect and signed by the District and the Architect, directing a change in the Work.

**1.1.12 Construction Manager.** The individual, partnership, corporation, joint venture, or any combination thereof, or its authorized representative, named as such by the District. If no Construction Manager is used on the Project that is the subject of this Contract, then all references to Construction Manager herein shall be read to refer to District.

**1.1.13 Construction Schedule.** The progress schedule of construction of the Project as provided by Developer and approved by District.

**1.1.14 Contingency.** The GMP proposal will contain, as part of the estimated cost of the Work, Project's Contingency, a sum mutually agreed upon, controlled by District, and monitored by District and Developer to cover costs that are properly reimbursable as a cost of the Work, but are not the basis for a Change Order. Project's Contingency will not be used for changes in scope or for any item that would be the basis for an increase in the GMP. Developer will provide District with a monthly accounting of charges against Project's Contingency, if applicable, with each application for payment. Any unused Project Contingency belongs to District.

**1.1.15 Contract.** The agreement between the District and Developer contained in the Contract Documents.

**1.1.16 Contract Documents.** The Contract Documents consist exclusively of the documents evidencing the agreement of the District and Developer. The Contract Documents consist of the following documents:

**1.1.16.1** Non-Collusion Declaration

**1.1.16.2** Iran Contracting Act Certification

**1.1.16.3** Site Lease

**1.1.16.4** Facilities Lease, including Exhibits A-G

**1.1.16.4.1** Iran Contracting Act Certification (if applicable)

**1.1.16.4.2** Federal Debarment Certification (if applicable)

**1.1.16.4.3** Federal Byrd Anti-Lobbying Certification (if applicable)

**1.1.16.4.4** Performance Bond

**1.1.16.4.5** Payment Bond (Developer's Labor & Material Bond)

**1.1.16.4.6** Workers' Compensation Certification

**1.1.16.4.7** Prevailing Wage Certification

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**1.1.16.4.13** Hazardous Materials Procedures and Requirements

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**1.1.16.4.17** Skilled and Trained Workforce Certification

**1.1.16.4.18** Project Labor Agreement (if applicable)

**1.1.16.4.19** Registered Subcontractors List

**1.1.16.4.20** Escrow Agreement for Security Deposits in Lieu of Retention (if used)

**1.1.16.4.21** Guarantee Form

**1.1.16.4.22** Agreement and Release of Any and All Claims

**1.1.16.5** All Plans, Technical Specifications, and Drawings, including the Division of the State Architect approved versions of the foregoing

**1.1.16.6** Any and all addenda to any of the above documents

**1.1.16.7** Any and all change orders or written modifications to the above documents if approved in writing by the District

**1.1.17 Contract Time.** The time period stated in the Facilities Lease for the completion of the Work.

**1.1.18 Daily Job Report(s).** Daily Project reports prepared by Developer's employee(s) who are present on Site, which shall include the information required herein.

**1.1.19 Day(s).** Unless otherwise designated, day(s) means calendar day(s).



**1.1.20 Department of Industrial Relations (or "DIR").** DIR is responsible, among other things, for labor compliance monitoring and enforcement of California prevailing wage laws and regulations for public works contracts.

**1.1.21 Design Professional in General Responsible Charge.** See definition of Architect above.

**1.1.22 Developer.** The person or persons identified in the Facilities Lease as contracting to perform the Work to be done under this Contract, or the legal representative of such a person or persons.

**1.1.23 Dispute.** A separate demand by Developer for a time extension, or payment of money or damages arising from Work done by or on behalf of Developer pursuant to the Contract and payment of which is not otherwise expressly provided for or Developer is not otherwise entitled to; or an amount of payment disputed by the District.

**1.1.24 District.** The public agency or the school district for which the Work is performed. The governing board of the District or its designees will act for the District in all matters pertaining to the Contract. The District may, at any time:

**1.1.24.1** Direct Developer to communicate with or provide notice to the Construction Manager or the Architect on matters for which the Contract Documents indicate Developer will communicate with or provide notice to the District; and/or

**1.1.24.2** Direct the Construction Manager or the Architect to communicate with or direct Developer on matters for which the Contract Documents indicate the District will communicate with or direct Developer.

**1.1.25 Drawings (or "Plans").** The graphic and pictorial portions of the Contract Documents showing the design, location, scope and dimensions of the Work, generally including plans, elevations, sections, details, schedules, sequence of operation, and diagrams.

**1.1.26 DSA.** Division of the State Architect.

**1.1.27 Force Account Directive.** A process that may be used when the District and Developer cannot agree on a price for a specific portion of work or before Developer prepares a price for a specific portion of work and whereby Developer performs the work as indicated herein on a time and materials basis.

**1.1.28 Guaranteed Maximum Price.** The total monies payable to Developer under the terms and conditions of the Contract Documents.

**1.1.29 Job Cost Reports.** Any and all reports or records detailing the costs associated with work performed on or related to the Project that Developer shall maintain for the Project. Specifically, Job Cost Reports shall contain, but are not limited by or to, the following information: a description of the work performed or to be performed on the Project; quantity, if applicable, of work performed (hours, square feet, cubic yards, pounds, etc.) for the Project; Project budget; costs for the Project to date; estimated costs to complete the Project; and expected costs at completion. The Job Cost Reports shall also

reflect all Contract cost codes, change orders, elements of non-conforming work, back charges, and additional services.

**1.1.30 Labor Commissioner's Office (or "Labor Commissioner").** Also known as the Division of Labor Standards Enforcement ("DLSE"): Division of the DIR responsible for adjudicating wage claims, investigating discrimination and public works complaints, and enforcing Labor Code statutes and Industrial Welfare Commission orders.

**1.1.31 Material Safety Data Sheets (or "MSDS").** A form with data regarding the properties for potentially harmful substances handled in the workplace.

**1.1.32 Municipal Separate Storm Sewer System (or "MS4").** A system of conveyances used to collect and/or convey storm water, including, without limitation, catch basins, curbs, gutters, ditches, man-made channels, and storm drains.

**1.1.33 Plans.** See "Drawings".

**1.1.34 Premises.** The real property on which the Site is located.

**1.1.35 Product(s).** New material, machinery, components, equipment, fixtures and systems forming the Work, including existing materials or components required and approved by the District for reuse.

**1.1.36 Product Data.** Illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by Developer to illustrate a material, product, or system for some portion of the Work.

**1.1.37 Program Manager.** The individual, partnership, corporation, joint venture, or any combination thereof, or its authorized representative, named as such by the District. If no Program Manager is designated for the Project that is the subject of the Contract Documents, then all references to Program Manager herein shall be read to refer to District.

**1.1.38 Project.** The planned undertaking as provided for in the Contract Documents.

**1.1.39 Project Inspector (or "Inspector").** The individual(s) retained by the District in accordance with title 24 of the California Code of Regulations to monitor and inspect the Project.

**1.1.40 Project Labor Agreement (or "PLA" or Project Stabilization Agreement or "PSA").** A prehire collective bargaining agreement in accordance with Public Contract Code section 2500 *et seq.* that establishes terms and conditions of employment for a specific construction project or projects and/or is an agreement described in Section 158(f) of Title 29 of the United States Code.

**1.1.41 Proposed Change Order (or "PCO").** A written request prepared by Developer requesting that the District, the Construction Manager and the Architect issue a Change Order based upon a proposed change to the Work, to the Guaranteed Maximum Price, and/or to the Contract Time.

**1.1.42 Provide.** Shall include “provide complete in place,” that is, “furnish and install,” and “provide complete and functioning as intended in place” unless specifically stated otherwise.

**1.1.43 Qualified SWPPP Practitioner (or “QSP”).** Certified personnel that attended a State Water Resources Control Board sponsored or approved training class and passed the qualifying exam.

**1.1.44 Record Drawings.** Unless otherwise defined in the Special Conditions, Reproducible drawings (or Plans) prepared pursuant to the requirements of the Contract Documents, that reflect all changes made during the performance of the Work, recording differences between the original design of the Work and the Work as constructed upon completion of the Project. See also **“As-Builts.”**

**1.1.45 Request for Information (or “RFI”).** A written request prepared by Developer requesting that the Architect provide additional information necessary to clarify or amplify an item in the Contract Documents that Developer believes is not clearly shown or called for in the Drawings or Specifications or other portions of the Contract Documents, or to address problems that have arisen under field conditions.

**1.1.46 Request for Substitution for Specified Item.** A request by Developer to substitute an equal or superior material, product, thing, or service for a specific material, product, thing, or service that has been designated in the Contract Documents by a specific brand or trade name.

**1.1.47 Safety Orders.** Written and/or verbal orders for construction issued by the California Division of Occupational Safety and Health (“Cal/OSHA”) or by the United States Occupational Safety and Health Administration (“OSHA”).

**1.1.48 Safety Plan.** Developer’s safety plan specifically adapted for the Project. Developer’s Safety Plan shall comply with all provisions regarding Project safety, including all applicable provisions in these Construction Provisions.

**1.1.49 Samples.** Physical examples that illustrate materials, products, equipment, finishes, colors, or workmanship and that, when approved in accordance with the Contract Documents, establish standards by which portions of the Work will be judged.

**1.1.50 Shop Drawings.** All drawings, prints, diagrams, illustrations, brochures, schedules, and other data that are prepared by Developer, a subcontractor, manufacturer, supplier, or distributor, that illustrate how specific portions of the Work shall be fabricated or installed.

**1.1.51 Site.** The Project site as shown on the Drawings.

**1.1.52 Specifications.** That portion of the Contract Documents, Division 1 through Division 49, and all technical sections, and addenda to all of these, if any, consisting of written descriptions and requirements of a technical nature of materials, equipment, construction methods and systems, standards, and workmanship.

**1.1.53 State.** The State of California.

**1.1.54 Storm Water Pollution Prevention Plan (or "SWPPP").** A document which identifies sources and activities at a particular facility that may contribute pollutants to storm water and contains specific control measures and time frames to prevent or treat such pollutants.

**1.1.55 Subcontractor.** A contractor and/or supplier who is under contract with Developer or with any other subcontractor, regardless of tier, to perform a portion of the Work of the Project.

**1.1.56 Submittal Schedule.** The schedule of submittals as provided by Developer and approved by District.

**1.1.57 Surety.** The person, firm, or corporation that executes as surety Developer's Performance Bond and Payment Bond, and must be a California admitted surety insurer as defined in the Code of Civil Procedure section 995.120.

**1.1.58 Work.** All labor, materials, equipment, components, appliances, supervision, coordination, and services required by, or reasonably inferred from, the Contract Documents, that are necessary for the construction and completion of the Project.

## **1.2 Laws Concerning the Contract Documents; Venue**

The Contract is subject to all provisions of the Constitution and laws of California and the United States governing, controlling, or affecting District, or the property, funds, operations, or powers of District, and such provisions are by this reference made a part hereof. Any provision required by law to be included in this Contract shall be deemed to be inserted.

To the fullest extent permitted by California law, the county in which the District administration office is located shall be the venue for any action or proceeding that may be brought or arise out of, in connection with or by reason of this Contract.

## **1.3 No Oral Agreements**

No oral agreement or conversation with any officer, agent, or employee of District, either before or after execution of Contract Documents, shall affect or modify any of the terms or obligations contained in any of the documents comprising the Contract Documents.

## **1.4 No Assignment**

Except as specifically permitted in the Facilities Lease, Developer shall not assign the Contract Documents or any part thereof including, without limitation, any services or money to become due hereunder without the prior written consent of the District. Assignment without District's prior written consent shall be null and void. Any assignment of money due or to become due under the Contract Documents shall be subject to a prior lien for services rendered or material supplied for performance of Work called for under the Contract Documents in favor of all persons, firms, or corporations rendering services or supplying material to the extent that claims are filed pursuant to the Civil Code, Code of Civil Procedure, Government Code, Labor Code, and/or Public Contract Code, and shall also be subject to deductions for liquidated damages or withholding of payments as determined by District in accordance with the Contract Documents. Developer shall not assign or transfer in

any manner to a Subcontractor or supplier the right to prosecute or maintain an action against the District.

## **1.5 Notice and Service Thereof**

**1.5.1** Any notice from one party to the other or otherwise under the Contract Documents shall be in writing and shall be dated and signed by the party giving notice or by a duly authorized representative of that party. Notice shall not be effective for any purpose whatsoever unless served in one of the following manners:

**1.5.1.1** If notice is given by personal delivery thereof, it shall be considered delivered on the day of delivery.

**1.5.1.2** If notice is given by overnight delivery service, it shall be considered delivered one (1) day after date deposited, as indicated by the delivery service.

**1.5.1.3** If notice is given by depositing same in United States mail, enclosed in a sealed envelope, it shall be considered delivered five (5) days after date deposited, as indicated by the postmarked date.

**1.5.1.4** If notice is given by registered or certified mail with postage prepaid, return receipt requested, it shall be considered delivered on the day the notice is signed for.

## **1.6 No Waiver**

The failure of District in any one or more instances to insist upon strict performance of any of the terms of the Contract Documents or to exercise any option herein conferred shall not be construed as a waiver or relinquishment to any extent of the right to assert or rely upon any such terms or option on any future occasion. No action or failure to act by the District, Architect, or Construction Manager shall constitute a waiver of any right or duty afforded the District under the Contract Documents, nor shall any action or failure to act constitute an approval of or acquiescence on any breach thereunder, except as may be specifically agreed in writing.

## **1.7 Substitutions For Specified Items**

Developer shall not substitute different items for any items identified in the Contract Documents without prior written approval of the District, unless otherwise provided in the Contract Documents.

## **1.8 Materials and Work**

**1.8.1** Except as otherwise specifically stated in the Contract Documents, Developer shall provide and pay for all materials, labor, tools, equipment, transportation, supervision, temporary constructions of every nature, and all other services, management, and facilities of every nature whatsoever necessary to execute and complete the Work, in a good and workmanlike manner, within the Contract Time.

**1.8.2** Unless otherwise specified, all materials shall be new and of the best quality of their respective kinds and grades as noted or specified, and workmanship shall be of high quality, and Developer shall use all diligence to

inform itself fully as to the required manufacturer's instructions and to comply therewith.

**1.8.3** Materials shall be furnished in ample quantities and at such times as to ensure uninterrupted progress of Work and shall be stored properly and protected from the elements, theft, vandalism, or other loss or damage as required.

**1.8.4** For all materials and equipment specified or indicated in the Drawings and Specifications, Developer shall provide all labor, materials, equipment, and services necessary for complete assemblies and complete working systems, functioning as intended. Incidental items not indicated on Drawings, nor mentioned in the Specifications, that can legitimately and reasonably be inferred to belong to the Work described, or be necessary in good practice to provide a complete assembly or system, shall be furnished as though itemized here in every detail. In all instances, material and equipment shall be installed in strict accordance with each manufacturer's most recent published recommendations and specifications.

**1.8.5** Developer shall, after award of the Project by District and after relevant submittals have been reviewed, place orders for materials and/or equipment as specified so that delivery of same may be made without delays to the Work. Developer shall, upon five (5) days' demand from District, present documentary evidence showing that orders have been placed.

**1.8.6** In the event of Developer's neglect in complying or failure to comply with the above instructions, District reserves the right, but has no obligation, to place orders for such materials and/or equipment as the District may deem advisable so that the Work may be completed by the date specified in the Facilities Lease, and all expenses incidental to the procuring of said materials and/or equipment shall be paid for by Developer or deducted from payment(s) to Developer.

**1.8.7** Developer warrants good title to all material, supplies, and equipment installed or incorporated in Work and agrees upon completion of all Work to deliver the Site to District, together with all improvements and appurtenances constructed or placed thereon by it, and free from any claims, liens, or charges. Developer further agrees that neither it nor any person, firm, or corporation furnishing any materials or labor for any work covered by the Contract Documents shall have any right to lien any portion of the Premises or any improvement or appurtenance thereon, except that Developer may install metering devices or other equipment of utility companies or of political subdivision, title to which is commonly retained by utility company or political subdivision. In the event of installation of any such metering device or equipment, Developer shall advise District as to owner thereof.

**1.8.8** Nothing contained in this Article, however, shall defeat or impair the rights of persons furnishing materials or labor under any bond given by Developer for their protection or any rights under any law permitting such protection or any rights under any law permitting such persons to look to funds due Developer in hands of District (e.g., Stop Payment Notices), and this provision shall be inserted in all subcontracts and material contracts and notice of its provisions shall be given to all persons furnishing material for Work when no formal contract is entered into for such material.

**1.8.9** Title to new materials and/or equipment for the Work of the Contract Documents and attendant liability for its protection and safety shall remain with Developer until incorporated in the Work of the Contract Documents and accepted by District. No part of any materials and/or equipment shall be removed from its place of storage except for immediate installation in the Work of the Contract Documents. Should the District, in its discretion, allow Developer to store materials and/or equipment for the Work off-site, Developer will store said materials and/or equipment at a bonded warehouse and with appropriate insurance coverage at no cost to District. Developer shall keep an accurate inventory of all materials and/or equipment in a manner satisfactory to District or its authorized representative and shall, at the District's request, forward it to the District.

**1.8.10 [Reserved]**

**2. [Reserved]**

**3. Architect**

**3.1** The Architect shall represent the District during the Project and will observe the progress and quality of the Work on behalf of the District. Architect shall have the authority to act on behalf of District to the extent expressly provided in the Contract Documents and to the extent determined by District. Architect shall have authority to reject materials, workmanship, and/or the Work whenever rejection may be necessary, in Architect's reasonable opinion, to ensure the proper execution of the Contract Documents.

**3.2** Architect shall, with the District and on behalf of the District, determine the amount, quality, acceptability, and fitness of all parts of the Work, and interpret the Specifications, Drawings, and shall, with the District, interpret all other Contract Documents.

**3.3** Architect shall have all authority and responsibility established by law, including title 24 of the California Code of Regulations.

**3.4** Developer shall provide District and the Construction Manager with a copy of all written communication between Developer and Architect at the same time as that communication is made to Architect, including, without limitation, all RFIs, correspondence, submittals, claims, change order requests and/or proposed change orders.

**4. Construction Manager**

**4.1** If a Construction Manager is used on this Project ("Construction Manager" or "CM"), the Construction Manager will provide administration of the Contract Documents on the District's behalf. After execution of the Contract Documents, all correspondence and/or instructions from Developer and/or District shall be forwarded through the Construction Manager. The Construction Manager will not be responsible for and will not have control or charge of construction means, methods, techniques, sequences, or procedures or for safety precautions in connection with the Work, which shall all remain Developer's responsibility.

**4.2** The Construction Manager, however, will have authority to reject materials and/or workmanship not conforming to the Contract Documents, as determined by the District, the Architect, and/or the Project Inspector. The Construction Manager shall

also have the authority to require special inspection or testing of any portion of the Work, whether it has been fabricated, installed, or fully completed. Any decision made by the Construction Manager in good faith, shall not give rise to any duty or responsibility of the Construction Manager to: Developer, any Subcontractor, or their agents, employees, or other persons performing any of the Work. The Construction Manager shall have free access to any or all parts of Work at any time.

**4.3** If the District does not use a Construction Manager on this Project, all references within the Contract Documents to Construction Manager or CM shall be read as District.

## **5. Inspector, Inspections, and Tests**

### **5.1 Project Inspector**

**5.1.1** One or more Project Inspector(s), including special Project Inspector(s), as required, will be assigned to the Work by District, in accordance with requirements of title 24, part 1, of the California Code of Regulations, to enforce the building code and monitor compliance with Plans and Specifications for the Project previously approved by the DSA. Duties of Project Inspector(s) are specifically defined in section 4-342 of said part 1 of title 24.

**5.1.2** No Work shall be carried on except with the knowledge and under the inspection of the Project Inspector(s). The Project Inspector(s) shall have free access to any or all parts of Work at any time. Developer shall furnish Project Inspector(s) reasonable opportunities for obtaining such information as may be necessary to keep Project Inspector(s) fully informed respecting progress and manner of work and character of materials, including, but not limited to, submission of form DSA 156 (or the most current version applicable at the time the Work is performed) to the Project Inspector at least 48 hours in advance of the commencement and completion of construction of each and every aspect of the Work. Forms are available on the DSA's website at: <http://www.dgs.ca.gov/dsa/Forms.aspx>. Inspection of Work shall not relieve Developer from an obligation to fulfill the Contract Documents. Project Inspector(s) and the DSA are authorized to suspend work whenever Developer and/or its Subcontractor(s) are not complying with the Contract Documents. Any work stoppage by the Project Inspector(s) and/or DSA shall be without liability to the District. Developer shall instruct its Subcontractors and employees accordingly.

**5.1.3** If Developer and/or any Subcontractor requests that the Project Inspector(s) perform any inspection off-Site, this shall only be done if it is allowable pursuant to applicable regulations and DSA approval, if the Project Inspector(s) agree to do so, and at the expense of Developer.

### **5.2 Tests and Inspections**

**5.2.1** Tests and Inspections shall comply with title 24, part 1, California Code of Regulations, group 1, article 5, section 4-335, and with the provisions of the Specifications.

**5.2.2** The District will select an independent testing laboratory to conduct the tests. Selection of the materials required to be tested shall be by the laboratory or the District's representative and not by Developer. Developer shall notify the



District's representative a sufficient time in advance of its readiness for required observation or inspection. This notice shall be provided, at a minimum, forty-eight (48) hours prior to the inspection of the material that needs to be tested and, at a minimum, seventy-two (72) hours prior to any special or off-site inspection.

**5.2.3** Developer shall notify the District's representative a sufficient time in advance of the manufacture of material to be supplied under the Contract Documents that must by terms of the Contract Documents be tested so that the District may arrange for the testing of same at the source of supply. This notice shall be provided, at a minimum, seventy-two (72) hours prior to the manufacture of the material that needs to be tested.

**5.2.4** Any material shipped by Developer from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from said representative that such testing and inspection will not be required, shall not be incorporated into and/or onto the Project.

**5.2.5** The District will select the testing laboratory and pay for the costs for all tests and inspections, except those inspections performed at Developer's request and expense. Developer shall reimburse the District for any and all laboratory costs or other testing costs for any materials found to be not in compliance with the Contract Documents. At the District's discretion, District may elect to deduct laboratory or other testing costs for noncompliant materials from the Guaranteed Maximum Price, and such deduction shall not constitute a withholding.

### **5.3 Costs for After Hours and/or Off Site Inspections**

If Developer performs Work outside the Inspector's regular working hours, costs of any inspections required outside regular working hours shall be borne by Developer and may be invoiced to Developer by the District or the District may deduct those expenses from the next Tenant Improvement Payment.

## **6. Developer**

Developer shall construct and complete, in a good and workmanlike manner, the Work for the Guaranteed Maximum Price including any adjustment(s) to the Guaranteed Maximum Price pursuant to provisions herein regarding changes to the Guaranteed Maximum Price. Except as otherwise noted, Developer shall provide and pay for all labor, materials, equipment, permits (excluding DSA), fees, licenses, facilities, transportation, taxes, bonds and insurance, and services necessary for the proper execution and completion of the Work, except as indicated herein.

### **6.1 Status of Developer**

**6.1.1** Developer represents and warrants that Developer is an independent do or business entity that is: (i) free from the control and direction of the District in connection with the performance of the Services, (ii) performing Services that are outside the usual course of the District's business, and (iii) customarily engaged in an independently established trade, occupation, or business of the same nature as that involved in the Services performed, District being interested only in the results obtained. Developer understands and agrees that it and all of its employees and its Subcontractors shall not be considered

officers, employees, agents, partner, or joint venture of the District, and are not entitled to benefits of any kind or nature normally provided employees of the District and/or to which District's employees are normally entitled, including, but not limited to, State Unemployment Compensation or Worker's Compensation. Developer shall assume full responsibility for payment of all federal, state, and local taxes or contributions, including unemployment insurance, social security, and income taxes with respect to Consultant's employees. Developer is and shall at all times be deemed be wholly responsible for the manner in which it, its agents, and its Subcontractors perform the services required of it by the Contract Documents. Nothing herein contained shall be construed as creating the relationship of employer and employee, or principal and agent, between the District, or any of the District's employees or agents, and Developer or any of Developer's Subcontractors, agents or employees. District shall be permitted to monitor Developer's activities to determine compliance with the terms of the Contract Documents.

**6.1.2** As required by law, Developer and all Subcontractors shall be properly licensed and regulated by the Contractors State License Board, 9821 Business Park Drive, Sacramento, California 95827 (Post Office Box 26000, Sacramento, California 95826), <http://www.cslb.ca.gov>.

**6.1.3** As required by law, Developer and all Subcontractors shall be properly registered as public works contractors by the Department of Industrial Relations at <https://efiling.dir.ca.gov/PWCR/ActionServlet?action=displayPWCRRegistrationForm> or current URL.

**6.1.4** Developer represents that Developer and all Subcontractors shall not be presently debarred, suspended, proposed for disbarment, declared ineligible or excluded pursuant to either Labor Code section 1777.1 or Labor Code section 1777.7.

**6.1.5 [Reserved]**

**6.1.6** Developer represents that it has no existing interest and will not acquire any interest, direct or indirect, which could conflict in any manner or degree with the performance of Work required under this Contract and that no person having any such interest shall be employed by Developer.

**6.1.7 [Reserved]**

**6.1.8** If Developer intends to make any change in the name or legal nature of the Developer's entity, Developer must first notify the District in writing prior to making any contemplated change. The District shall determine in writing if Developer's intended change is permissible while performing this Contract.

## **6.2 Project Inspection Card(s)**

Developer shall verify that forms DSA 152 (or most current version applicable at the time the Work is performed) are issued for the Project prior to the commencement of construction.

## **6.3 Developer's Supervision**

**6.3.1** During progress of the Work, Developer shall keep on the Premises, and at all other locations where any Work related to the Contract is being

performed, an experienced and competent project manager and construction superintendent who are employees of Developer, to whom the District does not object and whom shall be fluent in English, written and verbal.

**6.3.2** The project manager and construction superintendent shall both speak fluent English and the predominant language of Developer's employees.

**6.3.3** Developer acknowledges the quality and qualifications of the Key Personnel were important factors in District's selection of Developer for the Project. Developer and District agree that the personal services of the Key Personnel are a material term of the Contract Documents. Developer and District agree further that the substitution or removal or change in role or level of effort of such Key Personnel would result in damages to the District, the measure of which would be impractical or extremely difficult to fix. In lieu such damages, District and Developer have agreed to liquidated damages as described below:

**6.3.3.1** Before commencing the Work herein, Developer shall give written notice to District of Developer's Key Personnel.

**6.3.3.2** Key Personnel shall be the same as those individuals identified in Developer's response to the District's RFQ/P.

**6.3.3.3** For any substitution of any Key Personnel individual before the end of the individual's Project commitment period provided in Developer's Key Personnel staffing schedule, District may assess once, and Developer shall accept, liquidated damages in the amount of six (6) times the gross monthly salary for each substituted Key Personnel.

**6.3.4** Developer's Key Personnel shall not be changed except with prior written notice to, and approval by, District.

**6.3.5** If any of Developer's Key Personnel prove to be unsatisfactory to Developer, or to District, any of the District's employees, agents, the Construction Manager, or the Architect, the unsatisfactory Key Personnel shall be replaced. However, Developer shall immediately notify District in writing before any change occurs, but no less than two (2) business days prior. Any replacement of Key Personnel shall be made promptly and must be satisfactory to the District. Developer's Key Personnel shall each represent Developer, and all directions given to Key Personnel shall be as binding as if given to Developer.

**6.3.6** Developer shall give efficient supervision to Work, using its best skill and attention. Developer shall carefully study and compare all Contract Documents, Drawings, Specifications, and other instructions and shall at once report to District, Construction Manager, and Architect any error, inconsistency, or omission that Developer or its employees and Subcontractors may discover, in writing, with a copy to District's Project Inspector(s). Developer shall have responsibility for discovery of errors, inconsistencies, or omissions.

**6.3.7** All contractors doing work on the Project will provide their workers with identification badges. These badges will be worn by all members of the contractor's staff who are working in a District facility.

**6.3.7.1** Badges must be filled out in full and contain the following information:

**6.3.7.1.1** Name of contractor

**6.3.7.1.2** Name of employee

**6.3.7.1.3** Contractor's address and phone number

**6.3.7.2** Badges are to be worn when Developer or his/her employees are on site and must be visible at all times. Contractors must inform their employees that they are required to allow District employees, the Architect, the Construction Manager, the Program Manager, or the Project Inspector to review the information on the badges upon request.

**6.3.7.3** Continued failure to display identification badges as required by this policy may result in the individual being removed from the Project or assessment of fines against the contractor.

#### **6.4 Duty to Provide Fit Workers**

**6.4.1** Developer and Subcontractor(s) shall at all times enforce strict discipline and good order among their employees and shall not employ any unfit person or anyone not skilled in work assigned to that person. It shall be the responsibility of Developer to ensure compliance with this requirement. District may require Developer to permanently remove unfit persons from Project Site.

**6.4.2** Any person in the employ of Developer or Subcontractor(s) whom District may deem incompetent or unfit shall be excluded from working on the Project and shall not again be employed on the Project except with the prior written consent of District.

**6.4.3** Developer shall furnish labor that can work in harmony with all other elements of labor employed or to be employed in the Work.

**6.4.4 Fingerprinting.** Developer shall comply with the provisions of Education Code section 45125.2 regarding the submission of employee fingerprints to the California Department of Justice and the completion of criminal background investigations of its employees, Subcontractor(s), and Subcontractors' employees. Developer shall not permit any employee to have any contact with District pupils until such time as Developer has verified in writing to the governing board of the District, (A) that such employee has not been convicted of a violent or serious felony, as defined in Education Code section 45122.1 and/or (B) that the prohibition does not apply to an employee as provided by Education Code section 45125.1(e)(2) or (3). Developer shall fully complete and perform all tasks required pursuant to the Criminal Background Investigation/ Fingerprinting Certification.

#### **6.5 Field Office**

**6.5.1** Developer shall provide on the Site a temporary office.

#### **6.6 Purchase of Materials and Equipment**

Developer is required to order, obtain, and store materials and equipment sufficiently in advance of its Work at no additional cost or advance payment from District to assure that there will be no delays.

## **6.7 Documents on Work**

**6.7.1** Developer shall at all times keep on the Site, or at another location as the District may authorize in writing, one legible copy of all Contract Documents, including Addenda and Change Orders, and Titles 19 and 24 of the California Code of Regulations, the specified edition(s) of the Uniform Building Code, all approved Drawings, Plans, Schedules, and Specifications, and all codes and documents referred to in the Specifications, and made part thereof. These documents shall be kept in good order and available to District, Construction Manager, Architect, Architect's representatives, the Project Inspector(s), and all authorities having jurisdiction. Developer shall be acquainted with and comply with the provisions of these titles as they relate to this Project. (See particularly the duties of Contractor, Title 24, Part 1, California Code of Regulations, Section 4-343.) Developer shall also be acquainted with and comply with all California Code of Regulations provisions relating to conditions on this Project, particularly Titles 8 and 17. Developer shall coordinate with Architect and Construction Manager and shall submit its verified report(s) according to the requirements of Title 24.

### **6.7.2 Daily Job Reports**

**6.7.2.1** Developer shall maintain, at a minimum, at least one (1) set of Daily Job Reports on the Project. These must be prepared by Developer's employee(s) who are present on Site, and must include, at a minimum, the following information:

**6.7.2.1.1** A brief description of all Work performed on that day.

**6.7.2.1.2** A summary of all other pertinent events and/or occurrences on that day.

**6.7.2.1.3** The weather conditions on that day.

**6.7.2.1.4** A list of all Subcontractor(s) working on that day, including DIR registration numbers, Subcontractor employees working, and hours of work.

**6.7.2.1.5** A list of each Developer employee working on that day and the total hours worked for each employee.

**6.7.2.1.6** A complete list of all equipment on Site that day, whether in use or not.

**6.7.2.1.7** A complete list of all materials, supplies, and equipment delivered on that day, and verification that all materials, supplies, and equipment comply with the Contract Documents and are properly stored.

**6.7.2.1.8** A complete list of all inspections and tests performed on that day.

**6.7.2.1.9** Daily verification the Project is properly secured from the public and unauthorized entry.

**6.7.2.2** Each day Developer shall provide a copy of the previous day's Daily Job Report to the District or the District's Construction Manager.

## **6.8 Preservation of Records**

Developer shall maintain, and District shall have the right to inspect, Developer's financial records for the Project, including, without limitation, Job Cost Reports for the Project in compliance with the criteria set forth herein. The District shall have the right to examine and audit all Daily Job Reports or other Project records of Developer's project manager(s), project superintendent(s), and/or project foreperson(s), all certified payroll records and/or related documents including, without limitation, Job Cost Reports, payroll, payment, timekeeping and tracking documents; and as it pertains to change orders, all books, estimates, records, contracts, documents, cost data, subcontract job cost reports, and other data of Developer, any Subcontractor, and/or supplier, including computations and projections related to estimating, negotiating, pricing, or performing the Work or modification, in order to evaluate the accuracy, completeness, and currency of the cost, manpower, coordination, supervision, or pricing data at no additional cost to the District. These documents may be duplicative and/or be in addition to any documents held in escrow by the District. Developer shall make available at its office at all reasonable times the materials described in this paragraph for the examination, audit, or reproduction until three (3) years after final payment under this Facilities Lease. Notwithstanding the provisions above, Developer shall provide any records requested by any governmental agency, if available, after the time set forth above.

## **6.9 Integration of Work**

**6.9.1** Developer shall do all cutting, fitting, patching, and preparation of Work as required to make its several parts come together properly, to fit it to receive or be received by work of other contractors, and to coordinate tolerances to various pieces of work, showing upon, or reasonably implied by, the Drawings and Specifications for the completed structure, and shall conform them as District and/or Architect may direct.

**6.9.2** Developer shall make its own layout of lines and elevations and shall be responsible for the accuracy of both Developer's and Subcontractors' work resulting therefrom.

**6.9.3** Developer and all Subcontractors shall take all field dimensions required in performance of the Work, and shall verify all dimensions and conditions on the Site. All dimensions affecting proper fabrication and installation of all Work must be verified prior to fabrication by taking field measurements of the true conditions. If there are any discrepancies between dimensions in drawings and existing conditions which will affect the Work, Developer shall bring such discrepancies to the attention of the District and Architect for adjustment before proceeding with the Work. In doing so, it is recognized that Developer is not acting in the capacity of a licensed design professional, and that Developer's examination is made in good faith to facilitate construction and does not create an affirmative responsibility of a design professional to detect errors, omissions or inconsistencies in the Contract Documents or to ascertain compliance with applicable laws, building codes or regulations. However, nothing in this provision shall abrogate Developer's responsibilities for discovering and reporting any error, inconsistency, or omission pursuant to the Contract within Developer's standard of care including, without limitation, any applicable laws,

ordinance, rules, or regulations. Following receipt of written notice from Developer, the District and/or Architect shall inform Developer what action, if any, Developer shall take with regard to such discrepancies.

**6.9.4** All costs caused by noncompliant, defective, or delayed Work shall be borne by Developer, inclusive of repair work. Schedule delays resulting from unauthorized work shall be Developer's responsibility.

**6.9.5** Developer shall not endanger any work performed by it or anyone else by cutting, excavating, or otherwise altering work and shall not cut or alter work of any other contractor except with consent of District.

## **6.10 Notifications**

**6.10.1** Developer shall notify the Architect and Project Inspector, in writing, of the commencement of construction of each and every aspect of the Work at least 48 hours in advance by submitting form DSA 156 (or the most current version applicable at the time the Work is performed) to the Project Inspector. Forms are available on the DSA's website at: <http://www.dgs.ca.gov/dsa/Forms.aspx>.

**6.10.2** Developer shall notify the Architect and Project Inspector, in writing, of the completion of construction of each and every aspect of the Work at least 48 hours in advance by submitting form DSA 156 (or the most current version applicable at the time the Work is performed) to the Project Inspector.

## **6.11 Obtaining of Permits, Licenses and Registrations**

**6.11.1** Developer shall secure and pay for any permits (except DSA), licenses, registrations, approvals, and certificates necessary for prosecution of Work, including but not limited to those listed in the Special Conditions, **Exhibit D-1**, if any, before the date of the commencement of the Work or before the permits, licenses, registrations, approvals and certificates are legally required to continue the Work without interruption. Developer shall obtain and pay, only when legally required, for all licenses, approvals, registrations, permits, inspections, and inspection certificates required to be obtained from or issued by any authority having jurisdiction over any part of the Work included in the Contract Documents. All final permits, licenses, registrations, approvals and certificates shall be delivered to District before demand is made for final payment. The costs associated with said permits, licenses, registrations, approvals and certificates shall be direct reimbursement items and are not subject to any markup.

### **6.11.2 General Permit For Storm Water Discharges Associated With Construction and Land Disturbance Activities.**

**6.11.2.1** Developer acknowledges that all California school districts are obligated to develop and implement the following requirements for the discharge of storm water to surface waters from its construction and land disturbance activities pursuant to the Clean Water Act and Porter Cologne Water Quality Act. District has determined that the construction of this Project requires enrollment in the Construction Storm Water Permit. District has filed certain submittals referred to as Permit

Registration Documents ("PRDS") with the Regional Water Control Board ("Storm Water Pollution Prevention Plan" or "SWPPP").

**6.11.2.2** Developer shall comply with any District SWPPP that is approved by the District and applicable to the Project, at no additional cost to the District. Developer shall pay any fees and any penalties that may imposed by a regulatory agency for its non-compliance with the SWPPP during the course of Work.

**6.11.2.3** Developer shall provide a Qualified Storm Water Practitioner ("QSP") at no additional cost to the District, who shall be onsite and implement and monitor any and all SWPPP requirements applicable to the Project, including but not limited to:

**6.11.2.3.1** All required visual observations, sampling, analysis, reporting and record keeping, including any Numeric Action Levels ("NALs"), if applicable;

**6.11.2.3.2** Rain Event Action Plan ("REAP") at least forty eight (48) hours prior to any forecasted rain event requiring implementation of the REAP, including any erosion and sediment control measures needed to protect all exposed portions of the site, if applicable;

**6.11.2.3.3** Active Treatment System ("ATS"), if applicable; and

**6.11.2.3.4** Best management practices ("BMPs").

## **6.12 Royalties and Patents**

**6.12.1** Developer shall obtain and pay, when legally required, all royalties and license fees necessary for prosecution of Work before the earlier of the date of the commencement of the Work or the date the license is legally required to continue the Work without interruption. Developer shall defend suits or claims of infringement of patent, copyright, or other rights and shall hold the District, Construction Manager and the Architect harmless and indemnify them from loss on account thereof except when a particular design, process, or make or model of product is required by the Contract Documents. However, if Developer has reason to believe that the required design, process, or product is an infringement of a patent or copyright, Developer shall indemnify and defend the District, Construction Manager and Architect against any loss or damage.

**6.12.2** The review by the District, Construction Manager or Architect of any method of construction, invention, appliance, process, article, device, or material of any kind shall be only as to its adequacy for the Work and shall not constitute approve use by Developer in violation of any patent or other rights of any person or entity.

## **6.13 Work to Comply With Applicable Laws and Regulations**

**6.13.1** Developer shall give all notices and comply with the following specific laws, ordinances, rules, and regulations and all other applicable laws, ordinances, rules, and regulations bearing on conduct of Work as indicated and specified, including but not limited to the appropriate statutes and administrative code sections. If Developer observes that Drawings and



Specifications are at variance with any applicable laws, ordinances, rules and regulations, or should Developer become aware of the development of conditions not covered by Contract Documents that may result in finished Work being at variance therewith, Developer shall promptly notify District in writing and any changes deemed necessary by District shall be made as provided in this **Exhibit D** for changes in Work.

**6.13.1.1** National Electrical Safety Code, U. S. Department of Commerce

**6.13.1.2** National Board of Fire Underwriters' Regulations

**6.13.1.3** International Building Code, latest addition, and the California Code of Regulations, title 24, and other amendments

**6.13.1.4** Manual of Accident Prevention in Construction, latest edition, published by A.G.C. of America

**6.13.1.5** Industrial Accident Commission's Safety Orders, State of California

**6.13.1.6** Regulations of the State Fire Marshall (title 19, California Code of Regulations) and Pertinent Local Fire Safety Codes

**6.13.1.7** Americans with Disabilities Act

**6.13.1.8** Education Code of the State of California

**6.13.1.9** Government Code of the State of California

**6.13.1.10** Labor Code of the State of California, division 2, part 7, Public Works and Public Agencies

**6.13.1.11** Public Contract Code of the State of California

**6.13.1.12** California Art Preservation Act

**6.13.1.13** U. S. Copyright Act

**6.13.1.14** U. S. Visual Artists Rights Act

**6.13.2** Developer shall comply with all applicable mitigation measures, if any, adopted by any public agency or local utility with respect to this Project pursuant to the California Environmental Quality Act (Public Resources Code section 21000 et seq.).

**6.13.3** If Developer performs any Work that it knew, or through exercise of reasonable care should have known, to be contrary to any applicable laws, ordinance, rules, or regulations, Developer shall bear all costs arising therefrom and arising from the correction of said Work.

**6.13.4** Where Specifications or Drawings state that materials, processes, or procedures must be approved by the DSA, State Fire Marshall, or other body or agency, Developer shall use its best efforts to satisfy the requirements of such bodies or agencies applicable at the time the Work is performed, and as determined by those bodies or agencies.

#### **6.13.5 [Reserved]**

### **6.14 Safety/Protection of Persons and Property**

**6.14.1** Developer will be solely and completely responsible for conditions of the Site, including safety of all persons and property during performance of the Work. This requirement will apply continuously and not be limited to normal working hours.

**6.14.2** Developer to provide safe access for staff and students at any time, and to provide barricades, sound walls, signage, fencing, and other reasonably necessary protective measures, as necessary, to protect staff and students during construction.

**6.14.3** The wearing of hard hats will be mandatory at all times for all personnel on Site. Developer shall supply sufficient hard hats to properly equip all employees and visitors.

**6.14.4** Any construction review of Developer's performance is not intended to include review of the adequacy of Developer's safety measures in, on, or near the Site.

**6.14.5** Implementation and maintenance of safety programs shall be the sole responsibility of Developer.

**6.14.6** Developer shall furnish to the District a copy of Developer's safety plan within the time frame indicated in the Contract Documents and specifically adapted for the Project.

**6.14.7** Developer shall be responsible for all damages to persons or property that occur as a result of its fault or negligence in connection with the prosecution of the Contract Documents and shall take all necessary measures and be responsible for the proper care and completion and final acceptance by District. All Work shall be solely at Developer's risk.

**6.14.8** Developer shall take, and require Subcontractors to take, all necessary precautions for safety of workers on the Project and shall comply with all applicable federal, state, local, and other safety laws, standards, orders, rules, regulations, and building codes to prevent accidents or injury to persons on, about, or adjacent to premises where Work is being performed and to provide a safe and healthful place of employment. Developer shall furnish, erect, and properly maintain at all times, all necessary safety devices, safeguards, construction canopies, signs, nets, barriers, lights, and watchmen for protection of workers and the public and shall post danger signs warning against hazards created by such features in the course of construction.

**6.14.9** Hazards Control –Developer shall store volatile wastes in approved covered metal containers and remove them from the Site daily. Developer shall prevent accumulation of wastes that create hazardous conditions. Developer shall provide adequate ventilation during use of volatile or noxious substances.

**6.14.10** Developer shall designate a responsible member of its organization on the Project, whose duty shall be to post information regarding protection and obligations of workers and other notices required under occupational safety and health laws, to comply with reporting and other occupational safety

requirements, and to protect the life, safety, and health of workers. Name and position of person so designated shall be reported to District by Developer.

**6.14.11** Developer shall correct any violations of safety laws, rules, orders, standards, or regulations. Upon the issuance of a citation or notice of violation by the Division of Occupational Safety and Health, Developer shall correct such violation promptly.

**6.14.12** Developer shall comply with any District storm water requirements that are approved by the District and applicable to the Project, at no additional cost to the District.

**6.14.13** In an emergency affecting safety of life or of work or of adjoining property, Developer, without special instruction or authorization, shall act, at its discretion, to prevent such threatened loss or injury. Any compensation claimed by Developer on account of emergency work shall be determined by agreement.

**6.14.14** All salvage materials will become the property of Developer and shall be removed from the Site unless otherwise called for in the Contract Documents. However, the District reserves the right to designate certain items of value that shall be turned over to the District unless otherwise directed by District.

**6.14.15** All connections to public utilities and/or existing on-site services, including, without limitation, internet, phone, and data connections, shall be made and maintained in such a manner as to not interfere with the continuing use of same by the District during the entire progress of the Work.

**6.14.16** Developer shall provide such heat, covering, and enclosures as are necessary to protect all Work, materials, equipment, appliances, and tools against damage by weather conditions, such as extreme heat, cold, rain, snow, dry winds, flooding, or dampness.

**6.14.17** Developer shall protect and preserve the Work from all damage or accident, providing any temporary roofs, window and door coverings, boxings, or other construction as required by the Architect. Developer shall be responsible for existing structures, walks, roads, trees, landscaping, and/or improvements in working areas; and shall provide adequate protection therefor. If temporary removal is necessary of any of the above items, or damage occurs due to the Work, Developer shall replace same at his expense with same kind, quality, and size of Work or item damaged. This shall include any adjoining property of the District and others.

**6.14.18** Developer shall take adequate precautions to protect existing roads, sidewalks, curbs, pavements, utilities, adjoining property, and structures (including, without limitation, protection from settlement or loss of lateral support), and to avoid damage thereto, and repair any damage thereto caused by construction operations.

**6.14.19** Developer shall confine apparatus, the storage of materials, and the operations of workers to limits indicated by law, ordinances, permits, or directions of Architect, and shall not interfere with the Work or unreasonably encumber Premises or overload any structure with materials. Developer shall

enforce all instructions of District and Architect regarding signs, advertising, fires, and smoking, and require that all workers comply with all regulations while on Project Site.

**6.14.20** Developer, Developer's employees, Subcontractors, Subcontractors' employees, or any person associated with the Work shall conduct themselves in a manner appropriate for a school site. No verbal or physical contact with neighbors, students, and faculty, profanity, or inappropriate attire or behavior will be permitted. Developer is also responsible for ensuring workers refrain from wearing inappropriate clothing and/or logos on the Project. District may require Developer to temporarily or permanently remove non-complying persons from Project Site.

**6.14.21** Developer shall take care to prevent disturbing or covering any survey markers, monuments, or other devices marking property boundaries or corners. If such markers are disturbed, Developer shall have a civil engineer, registered as a professional engineer in California, replace them at no cost to District.

**6.14.22** In the event that Developer enters into any agreement with owners of any adjacent property to enter upon the adjacent property for the purpose of performing the Work, Developer shall fully indemnify, defend, and hold harmless each person, entity, firm, or agency that owns or has any interest in adjacent property. The form and content of the agreement of indemnification shall be approved by the District prior to the commencement of any Work on or about the adjacent property. Developer shall also indemnify the District as provided in the indemnification provision herein. These provisions shall be in addition to any other requirements of the owners of the adjacent property.

#### **6.15 General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities ("Construction Storm Water Permit")**

**6.15.1** Developer acknowledges that all California school districts are obligated to develop and implement the following requirements for the discharge of storm water to surface waters from its construction and land disturbance activities pursuant to the Clean Water Act and Porter Cologne Water Quality Act. District has determined that the construction of this Project requires enrollment in the Construction Storm Water Permit. District has filed certain submittals referred to as Permit Registration Documents (PRDS) with the Regional Water Control Board (Storm Water Pollution Prevention Plan or "SWPPP").

**6.15.2** Developer shall comply with any District SWPPP that are approved by the District and applicable to the Project at no additional cost to the District. Developer shall pay any fees and any penalties that may be imposed by a regulatory agency for its non-compliance with the SWPPP during the course of Work.

**6.15.3** Developer shall provide a Qualified SWPPP Practitioner (QSP) at no additional cost to the District, who shall be onsite and implement and monitor any and all SWPPP requirements applicable to the Project, including but not limited to:

**6.15.3.1** All required visual observations, sampling, analysis, reporting and record keeping, including any Numeric Action Levels (NALs), if applicable;

**6.15.3.2** Rain Event Action Plan (REAP) at least forty eight (48) hours prior to any forecasted rain event requiring implementation of the REAP, including any erosion and sediment control measures needed to protect all exposed portions of the site, if applicable;

**6.15.3.3** Active Treatment System (ATS), if applicable; and

**6.15.3.4** Best management practices (BMPs).

## **6.16 Working Evenings and Weekends**

Developer may be required to work increased hours, evenings, and/or weekends at no additional cost to the District. Developer shall give the District forty-eight (48) hours' notice prior to performing any evening and/or weekend work. Developer shall perform all evening and/or weekend work in compliance with all applicable rules, regulations, laws, and local ordinances including, without limitation, all noise and light limitations. Developer shall reimburse the District for any increased or additional Inspector charges as a result of Developer's increased hours, or evening and/or weekend work.

## **6.17 Cleaning Up**

**6.17.1** Developer shall provide all services, labor, materials, and equipment necessary for protecting and securing the Work, all school occupants, furnishings, equipment, and building structure from damage until its completion and final acceptance by District. Dust barriers shall be provided to isolate dust and dirt from construction operations. At completion of the Work and portions thereof, Developer shall clean to the original state any areas beyond the Work area that become dust laden as a result of the Work. Developer must erect the necessary warning signs and barricades to ensure the safety of all school occupants. Developer at all times must maintain good housekeeping practices to reduce the risk of fire damage and must make a fire extinguisher, fire blanket, and/or fire watch, as applicable, available at each location where cutting, braising, soldering, and/or welding is being performed or where there is an increased risk of fire.

**6.17.2** Developer at all times shall keep Premises, including property immediately adjacent thereto, free from debris such as waste, rubbish (including personal rubbish of workers, e.g., food wrappers, etc.), and excess materials and equipment caused by the Work. Developer shall not leave debris under, in, or about the Premises (or surrounding property or neighborhood), but shall promptly remove same from the Premises on a daily basis. If Developer fails to clean up, District may do so and the cost thereof shall be charged to Developer. If the Contract calls for Work on an existing facility, Developer shall also perform specific clean-up on or about the Premises upon request by the District as it deems necessary for continued operations. Developer shall comply with all related provisions of the Specifications.

**6.17.3** If the Construction Manager, Architect, or District observes the accumulation of trash and debris, the District will give Developer a 24-hour written notice to mitigate the condition.

**6.17.4** Should Developer fail to perform the required clean-up, or should the clean-up be deemed unsatisfactory by the District, the District may, at its sole discretion, then perform the clean-up. All cost associated with the clean-up work (including all travel, payroll burden, and costs for supervision) will be deducted from the Guaranteed Maximum Price.

#### **6.18 No Relief from Obligations Based on Review by Other Persons**

**6.18.1** Developer shall not be relieved of obligations to perform the Work in accordance with the Contract Documents by act or omission of the District, Architect, Construction Manager, Project Inspector, or DSA or other entities having jurisdiction including, but not limited to, administration of the Contract, review of submittals, or by tests, observation, inspection, or permit /interconnection approvals.

### **7. Subcontractors**

**7.1** Developer shall provide the District with information for all of Developer's Subcontracts and Subcontractors as indicated in Developer's Submittals and Schedules Section herein.

**7.2** No contractual relationship exists between the District and any Subcontractor, supplier, or sub-subcontractor by reason of the Contract Documents.

**7.3** Developer agrees to bind every Subcontractor by terms of the Contract Documents as far as those terms that are applicable to Subcontractor's work including, without limitation, all labor, wage & hour, apprentice and related provisions and requirements. If Developer subcontracts any part of the Work called for by the Contract Documents, Developer shall be as fully responsible to District for acts and omissions of any Subcontractor and of persons either directly or indirectly employed by any Subcontractor, including Subcontractor caused Project delays, as it is for acts and omissions of persons directly employed by Developer. The divisions or sections of the Specifications and/or the arrangements of the drawings are not intended to control Developer in dividing the Work among Subcontractors or limit the work performed by any trade.

**7.4** District's consent to, or approval of, or failure to object to, any Subcontractor under the Contract Documents shall not in any way relieve Developer of any obligations under the Contract Documents and no such consent shall be deemed to waive any provisions of the Contract Documents.

**7.5** Developer is directed to familiarize itself with sections 1720 through 1861 of the Labor Code of the State of California, as regards the payment of prevailing wages and related issues, and to comply with all applicable requirements therein including, without limitation, section 1775 and Developer's and Subcontractors' obligations and liability for violations of prevailing wage law and other applicable laws.

**7.6** Developer shall be responsible for the coordination of the trades, Subcontractors, sub-subcontractors, and material or equipment suppliers working on the Project.

**7.6.1** Developer is responsible for ensuring that first-tier Subcontractors holding C-4, C-7, C-10, C-16, C-20, C-34, C-36, C-38, C-42, C-43, and/or C-46 licenses, are prequalified by the District to work on the Project pursuant to Public Contract Code section 20111.6.

**7.6.2** Developer is responsible for ensuring that all Subcontractors are properly registered as public works contractors by the Department of Industrial Relations.

**7.7** Developer is solely responsible for settling any differences between Developer and its Subcontractor(s) or between Subcontractors.

**7.8** Developer must include in all of its subcontracts the assignment provisions indicated in the Termination section of these Construction Provisions.

## **8. Other Contracts/Contractors**

**8.1** District reserves the right to let other contracts, and/or to perform work with its own forces, in connection with the Project. Developer shall afford other contractors reasonable opportunity for introduction and storage of their materials and execution of their work and shall properly coordinate and connect Developer's Work with the work of other contractors.

**8.2** Developer shall protect the work of any other contractor that Developer encounters while working on the Project.

**8.3** If any part of Developer's Work depends for proper execution or results upon work of District or any other contractor, Developer shall visually inspect, and with reasonable effort, physically inspect all accessible portions of District's or any other contractor's work and, before proceeding with its Work, promptly report to the District in writing any defects in District's or any other contractor's work that render Developer's Work unsuitable for proper execution and results. Developer shall be held accountable for damages to District for District's or any other contractor's work that Developer failed to inspect or should have inspected. Developer's failure to inspect and report shall constitute Developer's acceptance of all District's or any other contractor's work as fit and proper for reception of Developer's Work, except as to defects that may develop in District's or any other contractor's work after execution of Developer's Work and not caused by execution of Developer's Work.

**8.4** To ensure proper execution of its subsequent Work, Developer shall measure and inspect Work already in place and shall at once report to the District in writing any discrepancy between that executed Work and the Contract Documents.

**8.5** Developer shall ascertain to its own satisfaction the scope of the Project and nature of District's or any other contracts that have been or may be awarded by District in prosecution of the Project to the end that Developer may perform under the Contract in light of the other contracts, if any.

**8.6** Nothing herein contained shall be interpreted as granting to Developer exclusive occupancy of the Site, the Premises, or of the Project. Developer shall not cause any unnecessary hindrance or delay to the use and/or operation(s) of the Premises and/or to District or any other contractor working on the Project. If simultaneous execution of any contract or Premises operation is likely to cause interference with performance of Developer's obligations under the Contract Documents, Developer shall coordinate with those contractor(s), person(s), and/or entity(s) and shall notify the District of the resolution.

## **9. Drawings and Specifications**

**9.1** A complete list of all Drawings that form a part of the Contract Documents are to be found as an index on the Drawings themselves, and/or may be provided to Developer and/or in the Table of Contents.

**9.2** Materials or Work described in words that so applied have a well-known technical or trade meaning shall be deemed to refer to recognized standards, unless noted otherwise.

**9.3** Trade Name or Trade Term

It is not the intention of the Contract Documents to go into detailed descriptions of any materials and/or methods commonly known to the trade under "trade name" or "trade term." The mere mention or notation of "trade name" or "trade term" shall be considered a sufficient notice to Developer that it will be required to complete the work so named, complete, finished, and operable, with all its appurtenances, according to the best practices of the trade.

**9.4** The naming of any material and/or equipment shall mean furnishing and installing of same, including all incidental and accessory items thereto and/or labor therefor, as per best practices of the trade(s) involved, unless specifically noted otherwise.

**9.5** Contract Documents are complementary, and what is called for by one shall be binding as if called for by all. As such, Drawings and Specifications are intended to be fully cooperative and to agree. However, if Developer observes that Drawings and Specifications are in conflict with the Contract Documents, Developer shall promptly notify District and Architect in writing, and any necessary changes shall be made as provided in the Contract Documents.

**9.6** Figured dimensions shall be followed in preference to scaled dimensions, and Developer shall make all additional measurements necessary for the work and shall be responsible for their accuracy. Before ordering any material or doing any work, each Developer shall verify all measurements at the building and shall be responsible for the correctness of same.

**9.7** Should any question arise concerning the intent or meaning of the Contract Documents, including the Plans and Specifications, the question shall be submitted to the District for interpretation. If a conflict exists in the Contract Documents, these Construction Provisions shall control over the Facilities Lease, which shall control over the Site Lease, which shall control over Division 1 Documents, which shall control over Division 2 through Division 49 documents, which shall control over figured dimensions, which shall control over large-scale drawings, which shall control over small-scale drawings. In no case shall a document calling for lower quality and/or quantity of material or workmanship control. However, in the case of discrepancy or ambiguity solely between and among the Drawings and Specifications, the discrepancy or ambiguity shall be resolved in favor of the interpretation that will provide District with the functionally complete and operable Project described in the Drawings and Specifications.

**9.8** Drawings and Specifications are intended to comply with all laws, ordinances, rules, and regulations of constituted authorities having jurisdiction, and where referred



to in the Contract Documents, the laws, ordinances, rules, and regulations shall be considered as a part of the Contract Documents within the limits specified.

**9.9** As required by Section 4-317(c), Part 1, Title 24, CCR: "Should any existing conditions such as deterioration or non-complying construction be discovered which is not covered by the DSA-approved documents wherein the finished work will not comply with Title 24, California Code of Regulations, a construction change document, or a separate set of plans and specifications, detailing and specifying the required repair work shall be submitted to and approved by DSA before proceeding with the repair work."

#### **9.10 Ownership of Drawings**

All copies of Plans, Drawings, Designs, Specifications, and copies of other incidental architectural and engineering work, or copies of other Contract Documents furnished by District, are the property of District. They are not to be used by Developer in other work and, with the exception of signed sets of Contract Documents, are to be returned to District on request at completion of Work, or may be used by District as it may require without any additional costs to District. Neither Developer nor any Subcontractor, or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications, and other documents prepared by the Architect. District hereby grants Developer, Subcontractors, sub-subcontractors, and material or equipment suppliers a limited license to use applicable portions of the Drawings prepared for the Project in the execution of their Work under the Contract Documents.

### **10. Developer's Submittals and Schedules**

Developer's submittals shall comply with the provisions and requirements of the Specifications including, without limitation Submittals.

#### **10.1 Schedule of Work, Schedule of Submittals, and Schedule of Values.**

**10.1.1** Developer shall comply with the construction schedule attached to the Facilities Lease as **Exhibit F** ("Construction Schedule"). [To be attached when available.]

**10.1.2** Developer must provide all schedules both in hard copy and electronically, in a native format (e.g. Microsoft Project or Primavera) approved in advance by the District.

**10.1.3** The District will review the schedules submitted and Developer shall make changes and corrections in the schedules as requested by the District and resubmit the schedules until approved by the District.

**10.1.4** The District shall have the right at any time to discuss with Developer revisions to the schedule of values if, in the District's sole opinion, the schedule of values does not accurately reflect the value of the Work performed.

**10.1.5** All schedules must be approved by the District before Developer can rely on them as a basis for payment.

**10.1.6** Within TEN (10) calendar days after the date of the Notice to Proceed with Construction (unless otherwise specified in the Specifications), Developer shall prepare and submit to the District for review, in a form supported by sufficient data to substantiate its accuracy as the District may require:

#### **10.1.6.1 Preliminary Schedule**

A preliminary schedule of construction indicating the starting and completion dates of the various stages of the Work, including any information and following any form as may be specified in the Specifications. Once approved by District, this shall become the Construction Schedule. This schedule shall include and identify all tasks that are on the Project's critical path with a specific determination of the start and completion of each critical path task as well as all Contract milestones and each milestone's completion date(s) as may be required by the District.

**10.1.6.1.1** The District is not required to approve a preliminary schedule of construction with early completion, i.e., one that shows early completion dates for the Work and/or milestones. Developer shall not be entitled to extra compensation if the District approves a Construction Schedule with an early completion date and Developer completes the Project beyond the date shown in the schedule but within the Contract Time. A Construction Schedule showing the Work completed in less than the Contract Time, the time between the early completion date and the end of the Contract Time shall be Float.

#### **10.1.6.2 Preliminary Schedule of Values**

A preliminary schedule of values for all of the Work, which must include quantities and prices of items aggregating the Guaranteed Maximum Price and must subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Unless the Special Conditions contain different limits, this preliminary schedule of values shall include, at a minimum, the following information and the following structure:

**10.1.6.2.1** Divided into at least the following categories:

**10.1.6.2.1.1** Overhead and profit

**10.1.6.2.1.2** Supervision

**10.1.6.2.1.3** General conditions

**10.1.6.2.1.4** Layout

**10.1.6.2.1.5** Mobilization

**10.1.6.2.1.6** Submittals

**10.1.6.2.1.7** Bonds and insurance

**10.1.6.2.1.8** Close-out/Certification documentation

**10.1.6.2.1.9** Demolition

**10.1.6.2.1.10** Installation

**10.1.6.2.1.11** Rough-in

**10.1.6.2.1.12** Finishes

**10.1.6.2.1.13** Testing

**10.1.6.2.1.14** Punch list and District acceptance

**10.1.6.2.2** And also divided by each of the following areas:

**10.1.6.2.2.1** Site work

**10.1.6.2.2.2** By each phase and/or building, as applicable

**10.1.6.2.2.3** By each floor

**10.1.6.2.3** The preliminary schedule of values shall not provide for values any greater than the following percentages of the Contract value:

**10.1.6.2.3.1** Mobilization and layout combined to equal not more than 1%.

**10.1.6.2.3.2** Submittals, samples and shop drawings combined to equal not more than 3%.

**10.1.6.2.3.3** Bonds and insurance combined to equal not more than 2%.

**10.1.6.2.3.4** Closeout documentation shall have a value in the preliminary schedule of not less than 3%.

**10.1.6.2.4** Notwithstanding any provision of the Contract Documents to the contrary, payment of Developer's overhead, supervision, general conditions costs, and profit, as reflected in the Cost Breakdown, shall be paid based on percentage complete, with the disbursement of Progress Payments and the Final Payment.

**10.1.6.2.5** Developer shall certify that the preliminary schedule of values as submitted to the District is accurate and reflects the costs as developed in preparing Developer's bid. For example, without limiting the foregoing, Developer shall not "front-load" the preliminary schedule of values with dollar amounts greater than the value of activities performed early in the Project.

**10.1.6.2.6** The preliminary schedule of values shall be subject to the District's review and approval of the form and content thereof. In the event that the District objects to any portion of the preliminary schedule of values, the District shall notify Developer, in writing, of the District's objection(s) to the preliminary schedule of values. Within five (5) calendar days of the date of the District's written objection(s), Developer shall submit a revised preliminary schedule of values to the District for

review and approval. The foregoing procedure for the preparation, review and approval of the preliminary schedule of values shall continue until the District has approved the entirety of the preliminary schedule of values.

**10.1.6.2.7** Once the preliminary schedule of values is approved by the District, this shall become the Schedule of Values. The Schedule of Values shall not be thereafter modified or amended by Developer without the prior consent and approval of the District, which may be granted or withheld in the sole discretion of the District.

#### **10.1.6.3 Schedule of Values**

The Developer shall provide for District review and approval prior to commencement of the Work a schedule of values for all of the Work, which includes quantities and prices of items aggregating the Guaranteed Maximum Price and subdivided into component parts as per specifications. The Schedule of Values shall not be modified or amended by the Developer without the prior consent and approval of the District, which may be granted or withheld in the sole discretion of the District. The District shall have the right at any time to revise the schedule of values if, in the District's sole opinion, the schedule of values does not accurately reflect the value of the Work performed.

#### **10.1.6.4 Preliminary Schedule of Submittals**

A preliminary schedule of submittals, including Shop Drawings, Product Data, and Samples submittals. Once approved by District, this shall become the Submittal Schedule. All submittals may be reviewed by District in ProCore and shall be forwarded to the Architect by the date indicated on the approved Submittal Schedule, unless an earlier date is necessary to maintain the Construction Schedule, in which case those submittals shall be forwarded to the District so as not to delay the Construction Schedule. Upon request by the District, Developer shall provide an electronic copy of all submittals to the District. All submittals shall be submitted no later than ninety (90) days after the Notice to Proceed with Construction.

#### **10.1.6.5 Safety Plan**

Developer's Safety Plan specifically adapted for the Project shall comply with the following requirements:

**10.1.6.5.1** All applicable requirements of California Division of Occupational Safety and Health ("Cal/OSHA") and/or of the United States Occupational Safety and Health Administration ("OSHA").

**10.1.6.5.2** All provisions regarding Project safety, including all applicable provisions in these Construction Provisions.

**10.1.6.5.3** Developer's Safety Plan shall be in English and in the language(s) of Developer's and its Subcontractors' employees.

#### **10.1.6.6 Complete Registered Subcontractor List**

The name, address, telephone number, facsimile number, California State Contractors License number, classification, DIR registration number, and monetary value of all Subcontracts of any tier for parties furnishing labor, material, or equipment for completion of the Project.

### **10.2 Monthly Progress Schedule(s)**

**10.2.1** Developer shall provide Monthly Progress Schedule(s) to the District. A Monthly Progress Schedule shall update the approved Construction Schedule or the last Monthly Progress Schedule, showing all work completed and to be completed as well as updating the Registered Subcontractors List. The monthly Progress Schedule shall be sent as noted below and, if also requested by District, within the timeframe requested by the District and shall be in a format acceptable to the District and contain a written narrative of the progress of work that month and any changes, delays, or events that may affect the work. The process for District approval of the Monthly Progress Schedule shall be the same as the process for approval of the Construction Schedule.

**10.2.2** Developer shall submit Monthly Progress Schedule(s) with all payment applications.

**10.2.3** Developer must provide all schedules both in hard copy and electronically in a native format (e.g., Microsoft Project or Primavera), approved in advance by District.

**10.2.4** District will review the schedules submitted and Developer shall make changes and corrections in the schedules as requested by the District and resubmit the schedules until approved by the District.

**10.2.5** District shall have the right at any time to discuss with Developer revisions to the schedule of values if, in the District's sole opinion, the schedule of values does not accurately reflect the value of the Work performed.

**10.2.6** All schedules must be approved by the District before Developer can rely on them as a basis for payment. District shall use best efforts to approve all submittals and schedules on or before fourteen (14) days after presentation of the same from Developer, providing there are no extenuating circumstances, and no such approval shall be unreasonably withheld by District.

### **10.3 Material Safety Data Sheets (MSDS)**

Developer is required to ensure Material Safety Data Sheets are available in a readily accessible place at the Site for any material requiring a Material Safety Data Sheet per the federal "Hazard Communication" standard, or employees' "right to know" law. Developer is also required to ensure proper labeling on substances brought onto the job site and that any person working with the material or within the general area of the material is informed of the hazards of the substance and follows proper handling and protection procedures. Two additional copies of the Material Safety Data Sheets shall also be submitted directly to the District.

## **10.4 Submittals**

**10.4.1** Architect's favorable review shall neither be construed as a complete check nor relieve Developer, Subcontractor, manufacturer, fabricator, or supplier from responsibility for any deficiency that may exist or from any departures or deviations from the requirements of the Contract Documents unless Developer has, in writing, called Architect's attention to the deviations at the time of submission and the Architect has given specific written response. "Favorable review" shall mean merely that Architect has no objection to Developer using, upon Developer's own full responsibility, plan or method of Work proposed, or furnishing materials or equipment proposed.

## **11. Site Access, Conditions, And Requirements**

### **11.1 Site Investigation**

Developer has made a careful investigation of the Site and is familiar with the requirements of the Contract Documents and has accepted the readily observable, existing conditions of the Site.

### **11.2 Soils Investigation Report**

When a soils investigation report obtained from test holes at Site or for the Project is available, that report may be made available to Developer but shall not be a part of this Contract but shall not alleviate or excuse Developer's obligation to perform its own investigation. Any information obtained from that report or any information given on Drawings as to subsurface soil condition or to elevations of existing grades or elevations of underlying rock is approximate only, is not guaranteed, does not form a part of this Contract, and Developer may not rely thereon. Developer acknowledges that it has made a visual examination of the Site and has made whatever tests Developer deems appropriate to determine underground condition of soil. Although any such report is not a part of this Contract, recommendations from the report may be included in the Drawings, Specifications, or other Contract Documents. It is Developer's sole responsibility to thoroughly review all Contract Documents, Drawings, and Specifications.

### **11.3 Access to Work**

District and its representatives shall at all times have access to Work wherever it is in preparation or progress, including storage and fabrication. Developer shall provide safe and proper facilities for such access so that District's representatives may perform their functions. District shall provide Developer adequate advance notice for access to active construction zones such that Developer may provide for safety measures to District and representatives.

### **11.4 Layout and Field Engineering**

**11.4.1** All field engineering required for layout of this Work and establishing grades for earthwork operations shall be furnished by Developer at its expense. This Work shall be done by a qualified, California-registered civil engineer or licensed land surveyor approved in writing by District and Architect. Any required Record and/or As-Built Drawings of Site development shall be prepared by the approved civil engineer or licensed land surveyor.

**11.4.2** Developer shall be responsible for having ascertained pertinent local conditions such as location, accessibility, and general character of the Site and for having satisfied itself as to the conditions under which the Work is to be performed. District shall not be liable for any claim for allowances because of Developer's error or negligence in acquainting itself with the conditions at the Site.

**11.4.3** Developer shall protect and preserve established benchmarks and monuments and shall make no changes in locations without the prior written approval of District. Developer shall replace any benchmarks or monuments that are lost or destroyed subsequent to proper notification of District and with District's approval.

## **11.5 Utilities**

Utilities shall be provided as indicated in the Specifications.

## **11.6 Sanitary Facilities**

Sanitary facilities shall be provided as indicated in the Specifications.

## **11.7 Surveys**

Developer shall provide surveys done by a California-licensed civil engineer or licensed land surveyor to determine locations of construction, grading, and site work as required to perform the Work.

## **11.8 Regional Notification Center**

Developer, except in an emergency, shall contact the appropriate regional notification center at least two (2) days prior to commencing any excavation if the excavation will be conducted in an area or in a private easement that is known, or reasonably should be known, to contain subsurface installations other than the underground facilities owned or operated by the District, and obtain an inquiry identification number from that notification center. No excavation shall be commenced and/or carried out by Developer unless an inquiry identification number has been assigned to Developer or any Subcontractor and Developer has given the District the identification number. Any damages arising from Developer's failure to make appropriate notification shall be at the sole risk and expense of Developer. Any delays caused by failure to make appropriate notification shall be at the sole risk of Developer and shall not be considered for an extension of the Contract Time.

## **11.9 Existing Utility Lines**

**11.9.1** Pursuant to Government Code section 4215, District assumes the responsibility for removal, relocation, and protection of main or trunk utility lines and facilities located on the construction Site at the time of commencement of construction under the Contract Documents with respect to any such utility facilities that are not identified in the Plans and Specifications. Developer shall not be assessed for liquidated damages for delay in completion of the Project caused by failure of District or the owner of a utility to provide for removal or relocation of such utility facilities.

**11.9.2** Locations of existing utilities provided by District shall not be considered exact, but approximate within a reasonable margin and shall not

relieve Developer of its responsibilities to exercise reasonable care and to pay all costs of repair due to Developer's failure to do so. District shall compensate Developer for the costs of locating, repairing damage not due to the failure of Developer to exercise reasonable care, and removing or relocating such utility facilities not indicated in the Plans and Specifications with reasonable accuracy, and for equipment necessarily idle during such work.

**11.9.3** No provision herein shall be construed to preclude assessment against Developer for any other delays in completion of the Work. Nothing in this Article shall be deemed to require District to indicate the presence of existing service laterals, appurtenances, or other utility lines, within the exception of main or trunk utility lines. Whenever the presence of these utilities on the Site of the construction Project can be inferred from the presence of other visible facilities, such as buildings, meter junction boxes, on or adjacent to the Site of the construction.

**11.9.4** If Developer, while performing Work under this Contract, discovers utility facilities not identified by District in Contract Plans and Specifications, Developer shall immediately notify the District and the utility in writing. In the event Developer fails to immediately provide notice and subsequently causes damage to the utility facilities, the cost of repair for damage to above-mentioned visible facilities shall be borne by Developer.

#### **11.10 Notification**

Developer understands, acknowledges and agrees that the purpose for prompt notification to the District pursuant to these provisions is to allow the District to investigate the condition(s) so that the District shall have the opportunity to decide how the District desires to proceed as a result of the condition(s). Accordingly, failure of Developer to promptly notify the District in writing, pursuant to these provisions, shall constitute Developer's waiver of any claim for damages or delay incurred as a result of the condition(s).

#### **11.11 Hazardous Materials**

Developer shall comply with all provisions and requirements of the Contract Documents related to hazardous materials including, without limitation, Hazardous Materials Procedures and Requirements.

#### **11.12 No Signs**

Neither Developer nor any other person or entity shall display any signs not required by law or the Contract Documents at the Site, fences, trailers, offices, or elsewhere on the Site without specific prior written approval of the District.

### **12. Trenches**

#### **12.1 Trenches Greater Than Five Feet**

Pursuant to Labor Code section 6705, if the Guaranteed Maximum Price exceeds \$25,000 and involves the excavation of any trench or trenches five (5) feet or more in depth, Developer shall, in advance of excavation, promptly submit to the District and/or a registered civil or structural engineer employed by the District or Architect, a detailed plan showing the design of shoring for protection from the hazard of caving ground during the excavation of such trench or trenches.



## **12.2 Excavation Safety**

If such plan varies from the Shoring System Standards established by the Safety Orders, the plan shall be prepared by a registered civil or structural engineer, but in no case shall such plan be less effective than that required by the Safety Orders. No excavation of such trench or trenches shall be commenced until said plan has been accepted by the District or by the person to whom authority to accept has been delegated by the District.

## **12.3 No Tort Liability of District**

Pursuant to Labor Code section 6705, nothing in this Article shall impose tort liability upon the District or any of its employees.

## **12.4 No Excavation without Permits**

Developer shall not commence any excavation Work until it has secured all necessary permits including the required CalOSHA excavation/shoring permit. Any permits shall be prominently displayed on the Site prior to the commencement of any excavation.

## **12.5 Discovery of Hazardous Waste and/or Unusual Conditions**

**12.5.1** Pursuant to Public Contract Code section 7104, if the Work involves digging trenches or other excavations that extend deeper than four feet below the Surface, Developer shall promptly, and before the following conditions are disturbed, notify the District, in writing, of any:

**12.5.1.1** Material that Developer believes may be material that is hazardous waste, as defined in section 25117 of the Health and Safety Code, is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law.

**12.5.1.2** Subsurface or latent physical conditions at the Site differing from those indicated.

**12.5.1.3** Unknown physical conditions at the Project Site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents.

**12.5.2** The District shall promptly investigate the conditions, and if it finds that the conditions do materially so differ, or do involve hazardous waste, and cause a decrease or increase in Developer's cost of, or the time required for, performance of any part of the Work, shall issue a Change Order under the procedures described herein.

**12.5.3** In the event that a dispute arises between District and Developer whether the conditions materially differ or cause a decrease or increase in Developer's cost of, or time required for, performance of any part of the Work, Developer shall not be excused from any scheduled completion date provided for by the Contract Documents but shall proceed with all work to be performed under the Contract Documents. Developer shall retain any and all rights provided either by the Contract Documents or by law that pertain to the resolution of disputes and protests.

### **13. Insurance and Bonds**

#### **13.1 Developer's Insurance**

Developer shall comply with the insurance requirements as indicated in the Facilities Lease.

#### **13.2 Contract Security – Bonds**

**13.2.1** Developer shall furnish two surety bonds issued by a California admitted surety insurer as follows:

##### **13.2.1.1 Performance Bond**

A bond in an amount at least equal to one hundred percent (100%) of Guaranteed Maximum Price as security for faithful performance of the Contract Documents.

##### **13.2.1.2 Payment Bond**

A bond in an amount at least equal to one hundred percent (100%) of the Guaranteed Maximum Price as security for payment of persons performing labor and/or furnishing materials in connection with this Contract.

**13.2.2** Cost of bonds shall be included in the Guaranteed Maximum Price.

**13.2.3** All bonds related to this Project shall be in the forms set forth in these Contract Documents and shall comply with all requirements of the Contract Documents, including, without limitation, the bond forms.

### **14. Warranty/Guarantee/Indemnity**

#### **14.1 Warranty/Guarantee**

**14.1.1** Developer shall obtain and preserve for the benefit of the District, manufacturer's warranties on materials, fixtures, and equipment incorporated into the Work.

**14.1.2** In addition to guarantees and warranties required elsewhere, Developer shall, and hereby does guarantee and warrant all Work furnished on the job against all defects for a period of ONE (1) year after the later of the following dates, unless a longer period is provided for in the Contract Documents:

**14.1.2.1** The acceptance by the District's governing board of the Work, subject to these General Conditions, or

**14.1.2.2** The date that commissioning for the Project, if any, was completed.

**14.1.3** If any work is not in compliance with the Drawings and Specifications, Developer shall repair or replace any and all of that Work, together with any other Work that may be displaced in so doing, that may prove defective in workmanship and/or materials within a ONE (1) year period from date of

completion as defined above, unless a longer period is provided for in the Contract Documents, without expense whatsoever to District.

**14.1.4** In the event of failure of Developer and/or Surety to commence and pursue with diligence said replacements or repairs within ten (10) days after being notified in writing, Developer and Surety hereby acknowledge and agree that District is authorized to proceed to have defects repaired and made good at expense of Developer and/or Surety who hereby agree to pay costs and charges therefore immediately on demand.

**14.1.5** If any work is not in compliance with the Drawings and Specifications and if in the opinion of District said defective work creates a dangerous condition or requires immediate correction or attention to prevent further loss to District or to prevent interruption of District operations, District will attempt to give the notice required above. If Developer or Surety cannot be contacted or neither complies with District's request for correction within a reasonable time as determined by District, District may, notwithstanding the above provision, proceed to make any and all corrections and/or provide attentions the District believes are necessary. The costs of correction or attention shall be charged against Developer and Surety of the guarantees or warranties provided in this Article or elsewhere in this Contract.

**14.1.6** The above provisions do not in any way limit the guarantees or warranties on any items for which a longer guarantee or warranty is specified or on any items for which a manufacturer gives a guarantee or warranty for a longer period. Developer shall furnish to District all appropriate guarantee or warranty certificates as indicated in the Specifications or upon request by District.

**14.1.7** Nothing herein shall limit any other rights or remedies available to District.

## **14.2 Indemnity**

Developer shall indemnify the District as indicated in the Facilities Lease.

## **15. Time**

### **15.1 Notice to Proceed with Construction**

**15.1.1** District may issue a Notice to Proceed with Construction ("NTP 2") within ninety (90) days from the date of the Notice of Award after Guaranteed Maximum Price. Once Developer has received the Notice to Proceed with Construction, Developer shall complete the Work within the period of time indicated in the Contract Documents.

**15.1.2** In the event that the District desires to postpone issuing the Notice to Proceed with Construction beyond ninety (90) days from the date of the Notice of Award after Guaranteed Maximum Price, it is expressly understood that with reasonable notice to Developer, the District may postpone issuing the Notice to Proceed with Construction. It is further expressly understood by Developer that Developer shall not be entitled to any claim of additional compensation as a result of the postponement of the issuance of the Notice to Proceed with Construction.

**15.1.3** If Developer believes that a postponement of issuance of the Notice to Proceed with Construction will cause a hardship to Developer, Developer may terminate the Contract. Developer's termination due to a postponement shall be by written notice to District within ten (10) days after receipt by Developer of District's notice of postponement. It is further understood by Developer that in the event that Developer terminates the Contract as a result of postponement by the District, the District shall only be obligated to pay Developer for the Work that Developer had performed at the time of notification of postponement.

## **15.2 Computation of Time / Adverse Weather**

**15.2.1** Developer will only be allowed a time extension for Adverse Weather conditions if requested by Developer in compliance with the time extension request procedures herein and only if all of the following conditions are met:

**15.2.1.1** The weather conditions constitute Adverse Weather, as defined herein;

**15.2.1.2** Developer can verify that the Adverse Weather caused delays in excess of five (5) hours of the indicated labor required to complete the scheduled tasks of Work on the day affected by the Adverse Weather;

**15.2.1.3** Developer's crew is dismissed as a result of the Adverse Weather;

**15.2.1.4** Said delay adversely affect the critical path in the Construction Schedule; and

**15.2.1.5** Exceeds twelve (12) days of delay per year.

**15.2.2** If the aforementioned conditions are met, a non-compensable day-for-day extension will only be allowed for those days in excess of those indicated herein.

**15.2.3** Developer shall work seven (7) days per week, if necessary, irrespective of inclement weather, to maintain access and the Construction Schedule, and to protect the Work under construction from the effects of Adverse Weather, all at no further cost to the District.

**15.2.4** The Contract Time has been determined with consideration given to the average climate weather conditions prevailing in the County in which the Project is located.

## **15.3 Hours of Work**

### **15.3.1 Sufficient Forces**

Developer and Subcontractors shall continuously furnish sufficient and competent work forces with the required levels of familiarity with the Project and skill, training and experience to ensure the prosecution of the Work in accordance with the Construction Schedule.

### **15.3.2 Performance During Working Hours**

Work shall be performed during regular working hours as permitted by the appropriate governmental agency except that in the event of an emergency, or when required to complete the Work in accordance with job progress, Work may be performed outside of regular working hours with the advance written consent of the District and approval of any required governmental agencies.

### **15.3.3 No Work during State Testing**

Developer shall, at no additional cost to the District and at the District's request, coordinate its Work to not disturb District students including, without limitation, not performing any Work when students at the Site are taking State or Federally-required tests. The District or District's Representative will provide Developer with a schedule of test dates concurrent with the District's issuance of the Notice to Proceed with Construction, or as soon as test dates are made available to the District.

## **15.4 Progress and Completion**

### **15.4.1 Time of the Essence**

Time limits stated in the Contract Documents are of the essence to the Contract Documents. By executing the Facilities Lease, Developer confirms that the Contract Time is a reasonable period for performing the Work.

### **15.4.2 No Commencement Without Insurance or Bonds**

Developer shall not commence operations on the Project or elsewhere prior to the effective date of insurance and bonds. The date of commencement of the Work shall not be changed by the effective date of such insurance or bonds. If Developer commences Work without insurance and bonds, all Work is performed at Developer's peril and shall not be compensable until and unless Developer secures bonds and insurance pursuant to the terms of the Contract Documents and subject to District claim for damages.

## **15.5 Schedule**

Developer shall provide to District, Construction Manager, and Architect a schedule in conformance with the Contract Documents and as required in these Construction Provisions.

## **15.6 Expeditious Completion**

Developer shall proceed expeditiously with adequate forces and shall achieve Completion within the Contract Time.

## **16. Extensions of Time – Liquidated Damages, Excusable Delays**

### **16.1 Liquidated Damages**

Developer and District hereby agree that the exact amount of damages for failure to complete the Work within the time specified is extremely difficult or impossible to determine. If the Work is not completed within the time specified in the Contract Documents, it is understood that the District will suffer damage. It being impractical

and unfeasible to determine the amount of actual damage, it is agreed Developer shall pay to District as fixed and liquidated damages, and not as a penalty, the amount set forth in the Facilities Lease for each calendar day of delay in Completion. Developer and its Surety shall be liable for the amount thereof pursuant to Government Code section 53069.85.

## **16.2 Excusable Delay**

**16.2.1** Developer shall not be charged for liquidated damages because of any delays in completion of the Work which are not the fault of Developer or its Subcontractors, including without limitation acts of God as defined in Public Contract Code section 7105, acts of enemy, epidemics, and quarantine restrictions. Developer shall, within five (5) calendar days of beginning of any delay, including a Force Majeure event, notify District in writing of causes of delay including documentation and facts explaining the delay and the direct correlation between the cause and effect ("Notice of Delay"). If Developer fails to provide its written Notice of Delay within this timeframe, Developer waives, releases, and discharges any right to assert or claim any entitlement to an adjustment to the Guaranteed Maximum Price and/or the Contract Time based on circumstances giving rise to the asserted delay. District shall review the facts and extent of any delay and shall grant extension(s) of time for completing Work when, in its judgment, the findings of fact justify an extension. Extension(s) of time shall apply only to that portion of Work affected by delay and shall not apply to other portions of Work not so affected. An extension of time may only be granted if Developer has timely submitted the Construction Schedule as required herein.

**16.2.2** Developer's Notice of Delay and request for a time extension pursuant to subparagraph 16.2 is a condition precedent to Developer's submittal of and/or entitlement to a claim pursuant to Article 25 of these Construction Provisions. Developer shall notify the District pursuant to the claims provisions in these Construction Provisions of any anticipated delay and its cause. Following submission of a claim, the District may determine whether the delay is to be considered avoidable or unavoidable, how long it continues, and to what extent the prosecution and completion of the Work might be delayed thereby.

**16.2.3** In the event Developer requests an extension of Contract Time for unavoidable delay as set forth in subparagraph 16.2.1, such request shall be submitted in accordance with the provisions in the Contract Documents governing changes in Work, including without limitation, the time requirements set forth in subsection 17.5, below. When requesting time, requests must be submitted with full justification and documentation. If Developer fails to submit justification, it waives its right to a time extension at a later date. Such justification must be based on the official Construction Schedule as updated at the time of occurrence of the delay or execution of Work related to any changes to the Scope of Work. Any request for a time extension must include the following information as support, without limitation:

**16.2.3.1** The duration of the activity relating to the changes in the Work and the resources (manpower, equipment, material, etc.) required to perform the activities within the stated duration.

**16.2.3.2** Specific logical ties to the Contract Schedule for the proposed changes and/or delay showing the activity/activities in the Construction Schedule that are affected by the change and/or delay. In particular, Developer must show an actual impact to the schedule, after making a good faith effort to mitigate the delay by rescheduling the work, by providing an analysis of the schedule ("Time Impact Analysis"). Such Time Impact Analysis shall describe in detail the cause and effect of the delay and the impact on the critical dates in the Project schedule. (This information must be provided for any portion of any delay of seven (7) days or more.)

**16.2.3.3** A recovery schedule must be submitted within twenty (20) calendar days of written notification to the District of causes of delay.

**16.2.4** Developer must comply with requirements in subsection 16.2 for a Notice of Delay and supporting justification notwithstanding Developer contends the specific delay period is unknown and continuing. When submitting a Notice of Delay and supporting justification, Developer must provide an estimated delay duration to critical path activities at the time the Notice of Delay and supporting justification is required to be submitted. If Developer contends the delaying event(s) are continuing, Developer must update monthly the estimated delay period with supporting justification.

**16.2.5** Developer's failure to timely submit a written Notice of Delay and/or provide the justification required in subparagraph 16.2 shall constitute Developer's waiver of any right to later submit a Proposed Change Order or pursue a Claim on the circumstances giving rise to the request, or to later pursue any additional money or time extensions in any manner related to that issue, regardless of the merits. Developer will not have satisfied a condition precedent or exhausted administrative remedies required to show entitlement to a Contract Time adjustment. Developer acknowledges that these written notices and justification requirements are critically important to District's Work, Project management, and evaluating potential options and alternatives to implement mitigation efforts to reduce or eliminate additional Project costs and delays.

### **16.3 No Additional Compensation for Delays within Developer's Control**

**16.3.1** Developer is aware that governmental agencies and utilities, including, without limitation, the Division of the State Architect, the Department of General Services, gas companies, electrical utility companies, water districts, and other agencies may have to approve Developer-prepared drawings or approve a proposed installation. Accordingly, Developer has included in the Guaranteed Maximum Price, time for possible review of its drawings and for reasonable delays and damages that may be caused by such agencies, including without limitation delays due to California Environmental Quality Act ("CEQA") compliance. Thus, Developer is not entitled to make a claim for damages for delays arising from the review of Developer's drawings.

**16.3.2** Developer shall only be entitled to compensation for delay when all of the following conditions are met:

**16.3.2.1** The District is responsible for the delay;

**16.3.2.2** The delay is unreasonable under the circumstances involved;

**16.3.2.3** The delay was not within the contemplation of the District and Developer;

**16.3.2.4** The delay could not have been avoided or mitigated by reasonable diligence; and

**16.3.2.5** Developer timely complies with the claims procedure of the Contract Documents.

**16.3.3** Where a change in the Work extends the Contract Time, Developer may request and recover additional, actual direct costs, provided that Developer can demonstrate such additional costs are:

**16.3.3.1** Actually incurred performing the Work;

**16.3.3.2** Not compensated by the Markup allowed; and

**16.3.3.3** Directly result from the extended Contract Time.

**16.3.4** Developer shall comply with all required procedures, documentation and time requirements in the Contract Documents. Developer may not seek or recover such costs using formulas (e.g. Eichleay, labor factors).

## **16.4 Force Majeure**

"Force Majeure" means any event or circumstance unknown at the time of contracting that is beyond the parties' control and makes performance of the contract impractical or impossible. The Party seeking to have its performance obligation(s) excused must demonstrate that there was such an insuperable interference occurring without the party's intervention as could not have been prevented by the exercise of prudence, diligence, and care, by providing prompt notice to the other Party, including full particulars of such event, of its inability to perform its obligations due to such event, following commencement of the claiming Party's inability to so perform its obligations. To the extent satisfying these conditions, Force Majeure events include the following: acts of God, war, civil unrest, epidemic, fire, smoke, volcanic eruption, earthquake, strike, unusually severe weather, flood, or shortage of transportation facilities, lock out, or commandeering of materials, product, plant, or facilities by the government. Force Majeure shall not be based on a Party's financial inability to perform under this Agreement unless there exists extreme and unreasonable difficulty, expense, injury, or loss involved. A Force Majeure event does not include an act of negligence or intentional wrongdoing by a Party. Any Party claiming a Force Majeure event shall use reasonable diligence to remove the condition that prevents performance and shall not be entitled to suspend performance of its obligations in any greater scope or for any longer duration than is required by the Force Majeure event. Each Party shall use its best efforts to mitigate the effects of such Force Majeure event, remedy its inability to perform, and resume full performance of its obligations hereunder. No obligation that arose before the Force Majeure event that could and should have been fully performed before such Force Majeure event is excused as a result of such Force Majeure event.

## **16.5 Float or Slack in the Schedule**

Float or slack is the amount of time between the early start date and the late start date, or the early finish date and the late finish date, of any of the activities in the



schedule. Float or slack is not for the exclusive use of or benefit of either the District or Developer, but its use shall be determined solely by the District.

## **17. Changes in the Work**

### **17.1 No Changes without Prior Authorization**

**17.1.1** There shall be no change whatsoever in the Drawings, Specifications, or in the Work without an executed Change Order or a written Construction Change Directive authorized by the District as herein provided. District shall not be liable for the cost of any extra work or any substitutions, changes, additions, omissions, or deviations from the Drawings and Specifications unless the District's governing board has authorized the same and the cost thereof has been approved in writing by Change Order or Construction Change Directive in advance of the changed Work being performed. No extension of time for performance of the Work shall be allowed hereunder unless a request for such extension is made at the time changes in the Work are ordered, and such time duly adjusted and approved in writing in the Change Order or Construction Change Directive. The provisions of the Contract Documents shall apply to all such changes, additions, and omissions with the same effect as if originally embodied in the Drawings and Specifications.

**17.1.2** Developer shall perform immediately all work that has been authorized by a fully executed Change Order or Construction Change Directive. Developer shall be fully responsible for any and all delays and/or expenses caused by Developer's failure to expeditiously perform this Work.

**17.1.3** Should any Change Order result in an increase in the Guaranteed Maximum Price or extend the Contract Time, the cost of or length of extension in that Change Order shall be agreed to, in writing, by the District in advance of the work by Developer. In the event that Developer proceeds with any change in Work without a Change Order executed by the District or Construction Change Directive, Developer waives any claim of additional compensation or time for that additional work. Under no circumstances shall Developer be entitled to any claim of additional compensation or time not expressly requested by Developer in a Proposed Change Order or approved by District in an executed Change Order.

**17.1.4** A Change Order or Construction Change Directive will become effective when approved by the Board, notwithstanding that Developer has not signed it. A Change Order or Construction Change Directive will become effective without Developer's signature provided District indicates it as a "Unilateral Change Order". Any dispute as to the adjustment in the Guaranteed Maximum Price or Contract Time, if any, of the Unilateral Change Order shall be resolved pursuant to the Payment and Claims and Disputes provisions herein.

**17.1.5** Developer understands, acknowledges, and agrees that the reason for District authorization is so that District may have an opportunity to analyze the Work and decide whether the District shall proceed with the Change Order or alter the Project so that a change in Work becomes unnecessary.

## **17.2 Architect Authority**

The Architect will have authority to order minor changes in the Work not involving any adjustment in the Guaranteed Maximum Price, or an extension of the Contract Time, or a change that is inconsistent with the intent of the Contract Documents. These changes shall be effected by written Change Order, Construction Change Directive, or by Architect's response(s) to RFI(s), or by Architect's Supplemental Instructions ("ASI").

## **17.3 Change Orders**

**17.3.1** A Change Order is a written instrument prepared and issued by the District and/or the Architect and signed by the District (as authorized by the District's Board of Education), Developer, the Architect, and approved by the Project Inspector (if necessary) and DSA (if necessary), stating their agreement regarding all of the following:

**17.3.1.1** A description of a change in the Work.

**17.3.1.2** The amount of the adjustment in the Guaranteed Maximum Price, if any; and

**17.3.1.3** The extent of the adjustment in the Contract Time, if any.

## **17.4 Proposed Change Order**

### **17.4.1** Definition of Proposed Change Order

A Proposed Change Order ("PCO") is a written request prepared by the Developer requesting that the District and the Architect issue a Change Order based upon a proposed change to the Work, to the Guaranteed Maximum Price, and/or to the Contract Time.

### **17.4.2** Changes in Guaranteed Maximum Price

A PCO shall include breakdowns and backup documentation pursuant to the provisions herein and sufficient, in the District's judgment, to validate any change in Guaranteed Maximum Price. In no case shall Developer or any of its Subcontractors be permitted to reserve rights for additional compensation for Change Order Work.

### **17.4.3** Changes in Time

A PCO shall also include any changes in time required to complete the Project. Any additional time requested shall not be the number of days to make the proposed change, but must be based upon the impact to the critical path in the Construction Schedule as defined in the Contract Documents. Developer shall justify the proposed change in time by submittal of a schedule analysis that accurately shows the actual impact, if known, or the estimated impact if unknown, of the change on the critical path of the Construction Schedule ("Time Impact Analysis"). If Developer fails to request a time extension in a PCO, including the Time Impact Analysis, and/or fails to comply with these Construction Provisions including, without limitation, Articles 15, 16, or 17, then Developer is thereafter precluded from requesting, and waives any right to request, an adjustment to the Contract Time or Guaranteed Maximum Price

relating to the subject matter of the PCO. In no case shall Developer or any of its Subcontractors be permitted to reserve rights for additional time for Change Order Work. A PCO that leaves the amount of time requested blank, or states that such time requested is "to be determined," or otherwise not specifically identified, is not permitted and shall also constitute a waiver of any right to request additional time and/or claim a delay.

#### **17.4.4 Allowances**

If there is an Allowance, then Developer shall not bill for or be due any portion of an Allowance unless the District has identified specific work, Developer has submitted a price for that work or the District has proposed a price for that work, the District has accepted the cost for that work, and the District has executed an Allowance Expenditure Directive incorporating that work. Allowance Expenditure Directives shall be based on Developer's costs, without overhead and profit, for products, delivery, installation, labor, insurance, payroll, taxes, bonding and equipment rental will be included in Allowance Expenditure Directive authorizing expenditure of funds from the Allowance. No overhead and profit shall be added to the Allowance Expenditure Directive.

Any unused portion of the Allowance will revert to the District documented by a deductive Change Order. Developer authorizes the District to execute a unilateral deductive Change Order at or near the end of the Project for all or any portion of the Allowance not allocated.

#### **17.4.5 Unknown and / or Unforeseen Conditions**

Separate from what is provided in the Allowance, if requests an increase in Guaranteed Maximum Price and/or Contract Time that is based at least partially on Developer's assertion that Developer has encountered unknown and/or unforeseen condition(s) on the Project, then Developer shall base the PCO on provable information that, beyond a reasonable doubt and to the District's satisfaction, demonstrates that the unknown and/or unforeseen condition(s) were actually unknown and/or unforeseen and that the condition(s) were reasonably unknown and/or unforeseen. If not, the District shall deny the PCO as unsubstantiated, and the Developer shall complete the Project without any increase in Guaranteed Maximum Price and/or Contract Time based on that PCO.

#### **17.4.6 Time to Submit Proposed Change Order**

Developer shall submit its PCO, using the Proposed Change Order Form, within five (5) working days of the date Developer discovers, or reasonably should have discovered, the circumstances giving rise to the PCO, unless additional time to submit a PCO is granted in writing by the District. Time is of the essence in Developer's submission of PCOs so that the District can promptly investigate the basis for the PCO. Accordingly, if Developer fails to submit its PCO within this timeframe, Developer waives, releases, and discharges any right to assert or claim any entitlement to an adjustment of the Guaranteed Maximum Price and/or Contract Time based on circumstances giving rise to the PCO.

#### **17.4.7 Proposed Change Order Certification**

In submitting a PCO, Developer certifies and affirms that the cost and/or time request is submitted in good faith, that the cost and/or time request is accurate

and in accordance with the provisions of the Contract Documents, and Developer submits the cost and/or request for extension of time recognizing the significant civil penalties and treble damages which follow from making a false claim or presenting a false claim under Government Code section 12650 et seq.

It is expressly understood that the value of the extra Work or changes expressly includes any and all of Developer's costs and expenses, direct and indirect, resulting from additional time required on the Project or resulting from delay to the Project including, without limitation, cumulative impacts. Developer is not entitled to separately recover amounts for overhead or other indirect costs. Any costs, expenses, damages, or time extensions not included are deemed waived.

## 17.5 Format for Proposed Change Order

**17.5.1** The following format shall be used as applicable by the District and Developer (e.g. Change Orders, PCOs) to communicate proposed additions and/or deductions to the Contract, supported by attached documentation. Any spaces left blank will be deemed no change to cost or time.

	<b>WORK PERFORMED OTHER THAN BY DEVELOPER</b>	<b>ADD</b>	<b>DEDUCT</b>
(a)	<b>Material</b> (attach suppliers' invoice or itemized quantity and unit cost plus sales tax)		
(b)	<b>Add Labor</b> (attach itemized hours and rates, fully Burdened, and specify the hourly rate for each additional labor burden, for example, payroll taxes, fringe benefits, etc.)		
(c)	<b>Add Equipment</b> (attach suppliers' invoice)		
(d)	<b>Subtotal</b>		
(e)	<b>Add Overhead and Profit for any and all tiers of Subcontractors</b> , the total not to exceed ten percent (10%) of Item (d)		
(f)	<b>Subtotal</b>		
(g)	<b>Add General Conditions Cost</b> (if Time is Compensable) (attach supporting documentation)		
(h)	<b>Subtotal</b>		
(i)	<b>Add Overhead and Profit for Developer</b> , not to exceed _____ percent (____%) of Item (h)		
(j)	<b>Subtotal</b>		
(k)	<b>Add Bond and Insurance</b> , not to exceed _____ percent (____%) of Item (j)		
(l)	<b>TOTAL</b>		
(m)	<b>Time</b> (zero unless indicated; "TBD" not permitted)	<b>_____ Calendar Days</b>	

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	<b>WORK PERFORMED BY DEVELOPER</b>	<b>ADD</b>	<b>DEDUCT</b>
(a)	<b>Material</b> (attach itemized quantity and unit cost plus sales tax)		
(b)	<b>Add Labor</b> (attach itemized hours and rates, fully Burdened, and specify the hourly rate for each additional labor burden, for example, payroll taxes, fringe benefits, etc.)		
(c)	<b>Add Equipment</b> (attach suppliers' invoice)		
(d)	<b>Add General Conditions Cost</b> (if Time is Compensable) (attach supporting documentation)		
(e)	<b>Subtotal</b>		
(f)	<b>Add Overhead and Profit for Developer</b> , not to exceed _____ percent (____ %) of Item (e)		
(g)	<b>Subtotal</b>		
(h)	<b>Add Bond and Insurance</b> , not to exceed _____ percent (____ %) of Item (g)		
(i)	<b>TOTAL</b>		
(j)	<b>Time</b> (zero unless indicated; "TBD" not permitted)		<b>Calendar Days</b>

### 17.5.2 Mandatory Use of Forms

Developer shall only submit PCOs by completing the Proposed Change Order Form. Developer acknowledges and agrees that use of this specific and consistent format is essential to District's evaluation of PCOs. Accordingly, Developer waives, releases, and discharges any right to assert or claim any entitlement to an adjustment of the Guaranteed Maximum Price and/or Time for any purported PCO that does not comply with the Proposed Change Order Form.

### 17.5.3 Labor

Developer shall be compensated for the costs of labor actually and directly utilized in the performance of the Work. Such labor costs shall be the actual cost, use of any formulas (e.g. labor factors) is not allowed, not to exceed prevailing wage rates in the locality of the Site and shall be in the labor classification(s) necessary for the performance of the Work, fully Burdened. Labor costs shall exclude costs incurred by the Developer in preparing estimate(s) of the costs of the change in the Work, in the maintenance of records relating to the costs of the change in the Work, coordination and assembly of materials and information relating to the change in the Work or performance thereof, or the supervision and other overhead and general conditions costs associated with the change in the Work or performance thereof, including but not limited to the cost for the job superintendent. If applicable, District will pay Developer the reasonable costs for room and board, supported with appropriate backup documentation, without markup for profit or overhead as provided by U.S. General Services Administration per diem rates for California lodging, meals and incidentals, <https://www.gsa.gov/travel/plan-book/per-diem-rates/per-diem-rates-lookup>.

#### **17.5.4 Materials**

Developer shall be compensated for the costs of materials necessarily and actually used or consumed in connection with the performance of the change in the Work. Costs of materials may include reasonable costs of transportation from a source closest to the Site of the Work and delivery to the Site. If discounts by material suppliers are available for materials necessarily used in the performance of the change in the Work, they shall be credited to the District. If materials necessarily used in the performance of the change in the Work are obtained from a supplier or source owned in whole or in part by Developer, compensation therefor shall not exceed the current wholesale price for such materials. If, in the reasonable opinion of the District, the costs asserted by Developer for materials in connection with any change in the Work are excessive, or if Developer fails to provide satisfactory evidence of the actual costs of such materials from its supplier or vendor of the same, the costs of such materials and the District's obligation to pay for the same shall be limited to the then lowest wholesale price at which similar materials are available in the quantities required to perform the change in the Work. The District may elect to furnish materials for the change in the Work, in which event Developer shall not be compensated for the costs of furnishing such materials or any mark-up thereon.

#### **17.5.5 Equipment**

As a precondition to the District's duty to pay for Equipment rental or loading and transportation, Developer shall provide satisfactory evidence of the actual costs of Equipment from the supplier, vendor or rental agency of same. Developer shall be compensated for the actual cost of the necessary and direct use of Equipment in the performance of the change in the Work. Use of Equipment in the performance of the change in the Work shall be compensated in increments of fifteen (15) minutes. Rental time for Equipment moved by its own power shall include time required to move the Equipment to the site of the Work from the nearest available rental source of the same. If Equipment is not moved to the Site by its own power, Developer will be compensated for the loading and transportation costs in lieu of rental time. The foregoing notwithstanding, neither moving time or loading and transportation time shall be allowed if the Equipment is used for performance of any portion of the Work other than the change in the Work. Unless prior approval in writing is obtained by Developer from the Architect, the Project Inspector, the Construction Manager and the District, no costs or compensation shall be allowed for time while Construction Equipment is inoperative, idle or on standby, for any reason. Developer shall not be entitled to an allowance or any other compensation for Equipment or tools used in the performance of a change in the Work where the Equipment or tools have a replacement value of \$500.00 or less. Equipment costs claimed by Developer in connection with the performance of any Work shall not exceed rental rates established by distributors or construction equipment rental agencies in the locality of the Site; any costs asserted which exceed such rental rates shall not be allowed or paid. Unless otherwise specifically approved in writing by the Architect, the Project Inspector, Construction Manager and the District, the allowable rate for the use of Equipment in connection with the Work shall constitute full compensation to Developer for the cost of rental, fuel, power, oil, lubrication, supplies, necessary attachments, repairs or maintenance of any kind, depreciation, storage,

insurance, labor (exclusive of labor costs of the Equipment operator), and any and all other costs incurred by Developer incidental to the use of the Equipment.

**17.5.6 General Conditions Cost.**

The phrase "General Conditions Cost" shall mean, other than expressly limited or excluded herein, the costs of Developer during the construction phase, including but not limited to: payroll costs for project manager for Work conducted at the Site, payroll costs for the superintendent and full-time general foremen, workers not included as direct labor costs engaged in support functions (e.g., loading/unloading, clean-up), costs of offices and temporary facilities including office materials, office supplies, office equipment, minor expenses, utilities, fuel, sanitary facilities and telephone services at the Site, costs of consultants not in the direct employ of Developer or Subcontractors, and fees for permits and licenses.

**17.5.7 Overhead and Profit.**

The phrase "Overhead and Profit" shall include field and office supervisors and assistants, watchperson, use of small tools, consumable, insurance other than construction bonds and insurance required herein, and general conditions, field and home office expenses.

**17.6 Change Order Certification**

**17.6.1** All Change Orders and PCOs must include the following certification by Developer, either in the form specifically or incorporated by this reference:

The undersigned Developer approves the foregoing as to the changes, if any, and to the Guaranteed Maximum Price specified for each item and as to the extension of time allowed, if any, for completion of the entire Work as stated herein, and agrees to furnish all labor, materials, and service, and perform all work necessary to complete any additional work specified for the consideration stated herein. Submission of sums which have no basis in fact or which Developer knows are false are at the sole risk of Developer and may be a violation of the False Claims Act set forth under Government Code section 12650 et seq. and U.S. Criminal Code, 18 U.S.C. § 1001. It is understood that the changes herein to the Contract Documents shall only be effective when approved by the governing board of the District.

It is expressly understood that the value of the extra Work or changes expressly includes any and all of Developer's costs and expenses, both direct and indirect, resulting from additional time required on the Project or resulting from delay to the Project, including, without limitation, cumulative impacts. Developer is not entitled to separately recover amounts for overhead or other indirect costs. Any costs, expenses, damages, or time extensions not included are deemed waived.

**17.6.2** Accord and Satisfaction: Developer's execution of any Change Order shall constitute a full accord and satisfaction, and release, of all Developer (and if applicable, Subcontractor) claims for additional time, money or other relief arising from or relating to the subject matter of the change including, without

limitation, impacts of all types, cumulative impacts, inefficiency, overtime, delay and any other type of claim.

**17.6.3 Mandatory Use of Forms:** Developer shall only submit Change Orders by completing the Change Order Form. Developer acknowledges and agrees that use of this specific and consistent format is essential to District's processing of Change Orders. Accordingly, Developer waives, releases, and discharges any right to assert or claim any entitlement to an adjustment of the Guaranteed Maximum Price and/or Time for any change that does not comply with the Change Order Form.

## **17.7 Determination of Change Order Cost**

**17.7.1** The amount of the increase or decrease in the Guaranteed Maximum Price from a Change Order, if any, shall be determined in one or more of the following ways as applicable to a specific situation and at the District's discretion:

**17.7.1.1** District acceptance of a COR or PCO.

**17.7.1.2** By amounts contained in Developer's schedule of values, if applicable.

**17.7.1.3** By agreement between District and Developer.

## **17.8 Deductive Change Orders**

All deductive Change Order(s) must be prepared pursuant to the provisions herein. Where a portion of the Work is deleted from the Contract, the reasonable value of the deleted work less the value of any new work performed shall be considered the appropriate deduction. The value submitted on the Schedule of Values shall be used to calculate the credit amount unless the bid documentation is being held in escrow as part of the Contract Documents. Unit Prices, if any, may be used in District's discretion in calculating reasonable value. If Developer offers a proposed amount for a deductive Change Order(s) for work performed, Developer shall include a credit for total profit and overhead less proof of expended costs related to the deleted work with the Change Order(s). If Subcontractor work is involved, Subcontractors shall also include a credit for total profit and overhead less proof of expended costs related to the deleted work with the Change Order(s). Any deviation from this provision shall not be allowed.

## **17.9 Addition or Deletion of Alternate Bid Item(s)**

If Developer's Proposal includes proposal(s) for Alternate Bid Item(s), during Developer's performance of the Work, the District may elect to add or delete any such Alternate Bid Item(s) if not included in the Contract at the time the Guaranteed Maximum Price is agreed upon. If the District elects to add or delete Alternate Bid Item(s) after Contract award, the cost or credit for such Alternate Bid Item(s) shall be as set forth in the Proposal unless the parties agree to a different price and the Contract Time shall be adjusted by the number of days allocated in the Contract Documents. If days are not allocated in the Contract Documents, the Contract Time shall be equitably adjusted.



### **17.10 Discounts, Rebates, and Refunds**

For purposes of determining the cost, if any, of any change, addition, or omission to the Work hereunder, all trade discounts, rebates, refunds, and all returns from the sale of surplus materials and equipment shall accrue and be credited to Developer, Developer shall make provisions so that such discounts, rebates, refunds, and returns may be secured, and the amount thereof shall be allowed as a reduction of Developer's cost in determining the actual cost of construction for purposes of any change, addition, or omission in the Work as provided herein.

### **17.11 Construction Change Directives**

**17.11.1** A Construction Change Directive is a written order prepared and issued by the District, the Construction Manager, and/or the Architect and signed by the District and the Architect, directing a change in the Work. The District may, as provided by law, by Construction Change Directive and without invalidating the Contract, order changes in the Work consisting of additions, deletions, or other revisions. The adjustment to the Guaranteed Maximum Price or Contract Time, if any, is subject to the provision of this section regarding Changes in the Work. If all or a portion of the Project is being funded by funds requiring approval by the State Allocation Board ("SAB"), these revisions may be subject to compensation once approval of same is received and funded by the SAB, and funds are released by the Office of Public School Construction ("OPSC"). Any dispute as to the adjustment of the Guaranteed Maximum Price, if any, of the Construction Change Directive or timing of payment shall be resolved pursuant to the Payment and Claims and Disputes provisions herein.

**17.11.2** The District may issue a Construction Change Directive in the absence of agreement on the terms of a Change Order.

### **17.12 Force Account Directives**

**17.12.1** When work, for which a definite price has not been agreed upon in advance, is to be paid for on a force account basis, all direct costs necessarily incurred and paid by Developer for labor, material, and equipment used in the performance of that Work, shall be subject to the approval of the District and compensation will be determined as set forth herein.

**17.12.2** District will issue a Force Account Directive to proceed with the Work on a force account basis, and a not-to-exceed budget will be established by the District.

**17.12.3** All requirements regarding direct cost for labor, labor burden, material, equipment, and markups on direct costs for overhead and profit described in this section shall apply to Force Account Directives. However, the District will only pay for actual costs verified in the field by the District or its authorized representative(s) on a daily basis.

**17.12.4** Developer shall be responsible for all costs related to the administration of Force Account Directives. The markup for overhead and profit for Developer modifications shall be full compensation to Developer to administer Force Account Directives, and Developer shall not be entitled to separately recover additional amounts for overhead and/or profit.

**17.12.5** Developer shall notify the District or its authorized representative(s) at least twenty-four (24) hours prior to proceeding with any of the force account work. Furthermore, Developer shall notify the District when it has consumed eighty percent (80%) of the budget and shall not exceed the budget unless specifically authorized in writing by the District. Developer will not be compensated for force account work in the event that Developer fails to timely notify the District regarding the commencement of force account work or exceeding the force account budget.

**17.12.6** Developer shall diligently proceed with the work, and on a daily basis, submit a daily force account report using the Daily Force Account Report form no later than 5:00 p.m. each day. The report shall contain a detailed itemization of the daily labor, material, and equipment used on the force account work only. The names of the individuals performing the force account work shall be included on the daily force account reports. The type and model of equipment shall be identified and listed. The IOR or District representative will review the information contained in the reports, and sign the reports no later than the next work day, and return a copy of the report to Developer for its records. The District will not sign, nor will Developer receive compensation for, work the District cannot verify. Developer will provide a weekly force account summary indicating the status of each Force Account Directive in terms of percent complete of the not-to-exceed budget and the estimated percent complete of the work

**17.12.7** In the event Developer and the District reach a written agreement on a set cost for the work while the work is proceeding based on a Force Account Directive, Developer's signed daily force account reports shall be discontinued and all previously signed reports shall be invalid.

### **17.13 Price Request**

#### **17.13.1** Definition of Price Request

A Price Request is a written request prepared by the Architect or Construction Manager requesting Developer submit to the District, the Construction Manager and the Architect an estimate of the effect of a proposed change in the Work on the Guaranteed Maximum Price and the Contract Time.

#### **17.13.2** Scope of Price Request

A Price Request shall contain adequate information, including any necessary Drawings and Specifications, to enable Developer to provide the cost breakdowns required. Developer shall not be entitled to any additional compensation for preparing a response to a Price Request, whether ultimately accepted or not.

### **17.14 Accounting Records**

With respect to portions of the Work performed by Change Orders and Construction Change Directives, Developer shall keep and maintain cost-accounting records satisfactory to the District, including, without limitation, Job Cost Reports as provided in these General Conditions, which shall be available to the District on the same terms as any other books and records Developer is required to maintain under the Contract Documents. Such records shall include without limitation hourly records for Labor and

Equipment and itemized records of materials and Equipment used that day in connection with the performance of any Work. All records maintained hereunder shall be subject to inspection, review and/or reproduction by the District, the Construction Manager and the Architect or the Project Inspector upon request. In the event that Developer fails or refuses, for any reason, to maintain or make available for inspection, review and/or reproduction such records, the District's determination of the extent of adjustment to the Guaranteed Maximum Price shall be final, conclusive, dispositive and binding upon Developer.

#### **17.15 Notice Required**

If Developer desires to make a claim for an increase in the Guaranteed Maximum Price, or any extension in the Contract Time for completion, it shall notify the District pursuant to the provisions herein, including the Article on Claims and Disputes. No claim shall be considered unless made in accordance with this subparagraph. Developer shall proceed to execute the Work even though the adjustment may not have been agreed upon. Any change in the Guaranteed Maximum Price or extension of the Contract Time resulting from such claim shall be authorized by a Change Order.

#### **17.16 Applicability to Subcontractors**

Any requirements under this Article shall be equally applicable to Change Orders or Construction Change Directives issued to Subcontractors by Developer to the extent required by the Contract Documents.

#### **17.17 Alteration to Change Order Language**

Developer shall not alter Change Orders or reserve time in Change Orders. Change Orders altered in violation of this provision, if in conflict with the terms set forth herein, shall be construed in accordance with the terms set forth herein. Developer shall execute finalized Change Orders and proceed under the provisions herein with proper notice.

#### **17.18 Failure of Developer to Execute Change Order**

Developer shall be in default of the Contract Documents if Developer fails to execute a Change Order when Developer agrees with the addition and/or deletion of the Work in that Change Order.

### **18. Requests For Information**

**18.1** Any Request for Information shall reference all applicable Contract Document(s), including Specification section(s), detail(s), page number(s), drawing number(s), and sheet number(s), etc. Developer shall make suggestions and interpretations of the issue raised by each Request for Information. A Request for Information cannot modify the Guaranteed Maximum Price, Contract Time, or the Contract Documents.

**18.2** Developer may be responsible for any costs incurred for professional services that District may deduct from any amounts owing to Developer, if a Request for Information requests an interpretation or decision of a matter where the information sought is equally available to the party making the request. District may deduct from and/or invoice Developer for professional services arising therefrom.

## **19. Payments**

### **19.1 Guaranteed Maximum Price**

As compensation for Developer's construction of the Project, the District shall pay Developer pursuant to the terms of **Exhibit C** to the Facilities Lease. This is the total amount payable by the District to Developer for performance of the Work under the Contract.

### **19.2 Applications for Tenant Improvement Payments**

#### **19.2.1 Procedure for Applications for Tenant Improvement Payments**

**19.2.1.1** Not before the fifth (5th) day of each calendar month during the progress of the Work, Developer shall submit to the District and the Architect an itemized Application for Payment for operations completed in accordance with the Schedule of Values. Such application shall be on a form approved by the District and shall be notarized, if required, and supported by the following or each portion thereof unless waived by the District in writing:

**19.2.1.1.1** The amount paid to the date of the Application for Payment to Developer, to all its Subcontractors, and all others furnishing labor, material, or equipment under the Contract Documents.

**19.2.1.1.2** The amount being requested under the Application for Payment by Developer on its own behalf and separately stating the amount requested on behalf of each of the Subcontractors and all others furnishing labor, material, and equipment under the Contract Documents.

**19.2.1.1.3** The balance that will be due to each of such entities after said payment is made.

**19.2.1.1.4** A certification that the As-Built Drawings and annotated Specifications are current.

**19.2.1.1.5** Itemized breakdown of work done for the purpose of requesting partial payment.

**19.2.1.1.6** An updated and acceptable construction schedule in conformance with the provisions herein.

**19.2.1.1.7** The additions to and subtractions from the Guaranteed Maximum Price and Contract Time.

**19.2.1.1.8** A total of the retentions held.

**19.2.1.1.9** Material invoices, evidence of equipment purchases, rentals, and other support and details of cost as the District may require from time to time.

**19.2.1.1.10** The percentage of completion of Developer's Work by line item.

**19.2.1.1.11** Schedule of Values updated from the preceding Application for Payment.

**19.2.1.1.12** A duly completed and executed conditional waiver and release upon Tenant Improvement Payment compliant with Civil Code section 8132 from Developer and each subcontractor of any tier and supplier to be paid from the current Tenant Improvement Payment.

**19.2.1.1.13** A duly completed and executed unconditional waiver and release upon Tenant Improvement Payment compliant with Civil Code section 8134 from Developer and each subcontractor of any tier and supplier that was paid from the previous Tenant Improvement Payment submitted 60 days prior; and

**19.2.1.1.14** A certification by Developer of the following:

Developer warrants title to all Work performed as of the date of this payment application and that all such Work has been completed in accordance with the Contract Documents for the Project. Developer further warrants that all Work performed as of the date of this payment application is free and clear of liens, claims, security interests, or encumbrances in favor of Developer, Subcontractors, material and equipment suppliers, workers, or other persons or entities making a claim by reason of having provided labor, materials, and equipment relating to the Work, except those of which the District has been informed. Submission of sums which have no basis in fact or which Developer knows are false are at the sole risk of Developer and may be a violation of the False Claims Act set forth under Government Code section 12650 et seq.

**19.2.1.1.15** Developer shall be subject to the False Claims Act set forth in Government Code section 12650 et seq. for information provided with any Application for Tenant Improvement Payments.

**19.2.1.1.16** All remaining certified payroll records ("CPR(s)") for each journeyman, apprentice, worker, or other employee employed by Developer and/or each Subcontractor in connection with the Work for the period of the Application for Payment. As indicated herein, the District shall not make any payment to Developer until:

**19.2.1.1.16.1** Developer and/or its Subcontractor(s) provide electronic CPRs directly to the DIR on no less than every 30 days while Work is being performed and within 30 days after the final day of Work performed on the Project for any journeyman, apprentice, worker or other employee was employed in connection with the Work, or within ten (10) days of any request by the District or the DIR to the requesting entity; and

**19.2.1.1.16.2** Any delay in Developer and/or its Subcontractor(s) providing CPRs in a timely manner may directly delay Developer's payment.

**19.2.1.1.17** Applications received after June 20th will not be paid until the second week of July and applications received after December 12th will not be paid until the first week of January.

## **19.2.2 Prerequisites for Tenant Improvement Payments**

### **19.2.2.1 First Payment Request**

The following items, if applicable, must be completed before the District will accept and/or process Developer's first payment request:

**19.2.2.1.1** Installation of the Project sign.

**19.2.2.1.2** Installation of field office.

**19.2.2.1.3** Installation of temporary facilities and fencing.

**19.2.2.1.4** Schedule of Values.

**19.2.2.1.5** Developer's Preliminary Construction Schedule for the first ninety (90) days.

**19.2.2.1.6** Schedule of unit prices, if applicable.

**19.2.2.1.7** Submittal Schedule.

**19.2.2.1.8** Receipt by Architect of all submittals due as of the date of the payment application.

**19.2.2.1.9** List of Subcontractors, with names, license numbers, telephone numbers, and Scope of Work.

**19.2.2.1.10** All bonds and insurance endorsements; and

**19.2.2.1.11** Resumes of Developer's project manager, and if applicable, job site secretary, record documents recorder, and job site superintendent.

### **19.2.3 Subsequent Payment Requests**

The District will not process subsequent payment requests until and unless submittals and Shop Drawings necessary to maintain the Project schedule have been submitted to the Architect.

### **19.2.4 No Waiver of Criteria**

Any payments made to Developer where criteria set forth herein have not been met shall not constitute a waiver of said criteria by District. Instead, such payment shall be construed as a good faith effort by District to resolve differences so Developer may pay its Subcontractors and suppliers. Developer agrees that failure to submit such items may constitute a breach of contract by Developer and may subject Developer to termination.

### **19.3 District's Approval of Application for Payment**

**19.3.1** Upon receipt of an Application for Payment, The District shall act in accordance with both of the following:

**19.3.1.1** Each Application for Payment shall be reviewed by the District as soon as practicable after receipt for the purpose of determining that the Application for Payment is a proper Application for Payment.

**19.3.1.2** Any Application for Payment determined not to be a proper Application for Payment suitable for payment shall be returned to Developer as soon as practicable, but not later than seven (7) days, after receipt. An Application for Payment returned pursuant to this paragraph shall be accompanied by a document setting forth in writing the reasons why the Application for Payment is not proper. The number of days available to the District to make a payment without incurring interest pursuant to this section shall be reduced by the number of days by which the District exceeds this seven-day return requirement.

**19.3.2** An Application for Payment shall be considered properly executed if funds are available for payment of the Application for Payment, and payment is not delayed due to an audit inquiry by the financial officer of the District.

**19.3.3** District's review of the Developer's Application for Payment will be based on the District's and the Architect's observations at the Site and the data comprising the Application for Payment that the Work has progressed to the point indicated and that, to the best of the District's and the Architect's knowledge, information, and belief, the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to:

**19.3.3.1** Observation of the Work for general conformance with the Contract Documents.

**19.3.3.2** Results of subsequent tests and inspections.

**19.3.3.3** Minor deviations from the Contract Documents correctable prior to completion; and

**19.3.3.4** Specific qualifications expressed by the Architect.

**19.3.4** District's approval of the certified Application for Payment shall be based on Developer complying with all requirements for a fully complete and valid certified Application for Payment.

**19.3.5** Payments to Developer

**19.3.5.1** Within thirty (30) days after approval of the Application for Payment, Developer shall be paid a sum equal to ninety-five percent (95%), of the value of the Tenant Improvement Payment (as verified by Architect and Inspector and certified by Developer) up to the last day of the previous month, less the aggregate of previous payments and amount to be withheld. The value of the Work completed shall be Developer's best estimate. No inaccuracy or error in said estimate shall operate to release Developer, or any Surety upon any bond, from damages arising from such Work, or from the District's right to enforce

each and every provision of the Contract Documents, and the District shall have the right subsequently to correct any error made in any estimate for payment.

**19.3.5.2** Developer may not be entitled to have payment requests processed, or may be entitled to have only partial payment made for Work performed, so long as any direction given by the District concerning the Work, or any portion thereof, remains incomplete.

**19.3.6 No Waiver**

No payment by District hereunder shall be interpreted so as to imply that District has inspected, approved, or accepted any part of the Work. Notwithstanding any payment, the District may enforce each and every provision of this Contract. The District may correct or require correction of any error subsequent to any payment

**19.3.7 Warranty of Title**

**19.3.7.1** If a lien or a claim based on a stop payment notice of any nature should at any time be filed against the Work or any District property, by any entity that has supplied material or services at the request of Developer, Developer and Developer's Surety shall promptly, on demand by District and at Developer's and Surety's own expense, take any and all action necessary to cause any such lien or a claim based on a stop payment notice to be released or discharged immediately therefrom.

**19.3.7.2** If Developer fails to furnish to the District within ten (10) calendar days after demand by the District satisfactory evidence that a lien or a claim based on a stop payment notice has been released, discharged, or secured, the District may discharge such indebtedness and deduct the amount required therefor, together with any and all losses, costs, damages, and attorney's fees and expenses incurred or suffered by District from any sum payable to Developer under the Contract.

**19.4 Decisions to Withhold Payment**

**19.4.1 Reasons to Withhold Payment**

The District shall withhold payment in whole, or in part, as required by statute. In addition, the District may withhold payment in whole, or in part, to the extent reasonably necessary to protect the District if, in the District's opinion, the representations to the District required herein cannot be made. Payment, in whole, or in part, will be withheld based on the need to protect the District from loss because of, but not limited to, any of the following:

**19.4.1.1** Defective Work not remedied within FORTY-EIGHT (48) hours of written notice to Developer.

**19.4.1.2** Stop Payment Notices or other liens served upon the District as a result of the Contract.



**19.4.1.3** Failure to comply with the requirements of Public Contract Code section 2600 et seq. ("Skilled and Trained Workforce Requirements").

**19.4.1.4** Liquidated damages assessed against Developer.

**19.4.1.5** Reasonable doubt that the Work can be completed for the unpaid balance of the Guaranteed Maximum Price or by the Contract Time.

**19.4.1.6** Damage to the District or other contractor(s).

**19.4.1.7** Unsatisfactory prosecution of the Work by Developer.

**19.4.1.8** Failure to store and properly secure materials.

**19.4.1.9** Failure of Developer to submit, on a timely basis, proper, sufficient, and acceptable documentation required by the Contract Documents, including, without limitation, a Construction Schedule, Schedule of Submittals, Schedule of Values, Monthly Progress Schedules, Shop Drawings, Product Data and samples, Proposed product lists, executed Change Orders, and/or verified reports.

**19.4.1.10** Failure of Developer to maintain As-Built Drawings.

**19.4.1.11** Erroneous estimates by Developer of the value of the Work performed, or other false statements in an Application for Payment.

**19.4.1.12** Unauthorized deviations from the Contract Documents.

**19.4.1.13** Failure of Developer to prosecute the Work in a timely manner in compliance with the Construction Schedule, established progress schedules, and/or completion dates.

**19.4.1.14** Failure to provide acceptable electronic certified payroll records, as required by the Labor Code, by these Contract Documents or by written request for each journeyman, apprentice, worker, or other employee employed by Developer and/or by each Subcontractor in connection with the Work for the period of the Application for Payment or if payroll records are delinquent or inadequate.

**19.4.1.15** Failure to properly pay prevailing wages as required in Labor Code section 1720 et seq., failure to comply with any other Labor Code requirements, and/or failure to comply with labor compliance monitoring and enforcement by the DIR.

**19.4.1.16** Allowing an unregistered subcontractor, as described in Labor Code section 1725.5, to engage in the performance of any work under this Contract.

**19.4.1.17** Failure to comply with any, if applicable federal requirements regarding minimum wages, withholding, payrolls and basic records, apprentice and trainee employment requirements, equal employment opportunity requirements, Copeland Act requirements,

Davis-Bacon Act and related requirements, Contract Work Hours and Safety Standards Act requirements.

**19.4.1.18** Failure to properly maintain or clean up the Site.

**19.4.1.19** Failure to timely indemnify, defend, or hold harmless the District.

**19.4.1.20** Failure to perform any implementation and/or monitoring required by the General Permit, including without limitation any SWPPP for the Project and/or the imposition of any penalties or fines therefore whether imposed on the District or Developer.

**19.4.1.21** Any payments due to the District, including but not limited to payments for failed tests, utilities changes, or permits.

**19.4.1.22** Failure to pay any royalty, license or similar fees.

**19.4.1.23** Failure to pay Subcontractor(s) or supplier(s) as required by law and Developer's subcontract agreement and by the Contract Documents; and

**19.4.1.24** Developer is otherwise in breach, default, or in substantial violation of any provision of the Contract Documents.

**19.4.2** Reallocation of Withheld Amounts

**19.4.2.1** After prior written notice to Developer with details regarding the District's proposed application of withheld amounts, District may, in its discretion, apply any withheld amount to pay outstanding claims or obligations as defined herein. In so doing, District shall make such payments on behalf of Developer. If any payment is so made by District, then that amount shall be considered a payment made under the Contract Documents by District to Developer and District shall not be liable to Developer for any payment made in good faith. These payments may be made without prior judicial determination of claim or obligation. District will render Developer an accounting of funds disbursed on behalf of Developer.

**19.4.2.2** If Developer defaults or neglects to carry out the Work in accordance with the Contract Documents or fails to perform any provision thereof, District may, after FORTY-EIGHT (48) hours' written notice to Developer and opportunity to commence and pursue cure of default, and, without prejudice to any other remedy, make good such deficiencies. The District shall adjust the total Guaranteed Maximum Price by reducing the amount thereof by the cost of making good such deficiencies. If District deems it inexpedient to correct Work that is damaged, defective, or not done in accordance with the provisions of the Contract Documents, an equitable reduction in the Guaranteed Maximum Price (up to one hundred fifty percent (150%) of the estimated reasonable value of the nonconforming Work) shall be made therefor.

#### **19.4.3 Payment After Cure**

When Developer removes the grounds for declining approval, payment shall be made for amounts withheld because of them. No interest shall be paid on any retainage or amounts withheld due to the failure of Developer to perform in accordance with the terms and conditions of the Contract Documents.

### **19.5 Subcontractor Payments**

#### **19.5.1 Payments to Subcontractors**

No later than seven (7) days after receipt of any Tenant Improvement Payment, or pursuant to Business and Professions Code section 7108.5 and Public Contract Code section 7107, Developer shall pay to each Subcontractor, out of the amount paid to Developer on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled. Developer shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to its Sub-subcontractors in a similar manner.

#### **19.5.2 No Obligation of District for Subcontractor Payment**

The District shall have no obligation to pay, or to see to the payment of, money to a Subcontractor except as may otherwise be required by law.

#### **19.5.3 Joint Checks**

District shall have the right in its sole discretion, if necessary for the protection of the District, to issue joint checks made payable to Developer and Subcontractors and/or material or equipment suppliers. The joint check payees shall be responsible for the allocation and disbursement of funds included as part of any such joint payment. In no event shall any joint check payment be construed to create any contract between the District and a Subcontractor of any tier, or a material or equipment supplier, or any obligation from the District to such Subcontractor or a material or equipment supplier or rights in such Subcontractor against the District.

## **20. Completion of the Work**

### **20.1 Completion**

**20.1.1** District will accept completion of Project and have the Notice of Completion recorded when the entire Work shall have been completed to the satisfaction of District.

**20.1.2** The Work may only be accepted as complete by action of the governing board of the District.

**20.1.3** District, at its sole option, may accept completion of Project and have the Notice of Completion recorded when the entire Work shall have been completed to the satisfaction of District, except for minor corrective items, as distinguished from incomplete items. If Developer fails to complete all minor corrective items within fifteen (15) days after the date of the District's acceptance of completion, District shall withhold from the final payment one hundred fifty percent (150%) of an estimate of the amount sufficient to

complete the corrective items, as reasonably determined by District, until the item(s) are completed.

**20.1.4** At the end of the fifteen (15) day period, if there are any items remaining to be corrected, District may elect to proceed as provided herein related to adjustments to Guaranteed Maximum Price, and/or District's right to perform the Work of Developer.

## **20.2 Close-Out/Certification Procedures**

### **20.2.1 Punch List**

Developer shall notify the Architect when Developer considers the Work complete. Upon notification, Architect will prepare a list of minor items to be completed or corrected ("Punch List"). Developer 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 Developer to complete all Work in accordance with the Contract Documents.

### **20.2.2 Close-Out/Certification Requirements**

#### **20.2.2.1 Utility Connections**

Buildings shall be connected to water, gas, sewer, electric, phone, and internet services, complete and ready for use. Service connections shall be made and existing services reconnected.

#### **20.2.2.2 As-Built/Record Drawings and Record Specifications**

**20.2.2.2.1** Developer shall provide exact "as-built" drawings of the Work upon completion of the Project as indicated in the Contract Documents, including but not limited to the Specifications ("As-Built Drawings") as a condition precedent to approval of final payment.

**20.2.2.2.2** Developer is liable and responsible for any and all inaccuracies in the As-Built Drawings, even if inaccuracies become evident at a future date.

**20.2.2.2.3** Upon completion of the Work and as a condition precedent to approval of final payment, Developer shall obtain the Inspector's approval of the corrected prints and deliver the same to Architect in a form acceptable to the Architect as part of closeout.

#### **20.2.2.3 Construction Storm Water Permit, if applicable**

Developer shall submit to District all electric and hard copy records required by the Construction Storm Water Permit, if applicable, within seven (7) days of Completion of the Project.

### **20.2.3 Maintenance Manuals**

Developer shall prepare all operation and maintenance manuals and date as indicated in the Specifications.

#### **20.2.4 Source Programming**

Developer shall provide all source programming for all items in the Project.

#### **20.2.5 Verified Reports**

Developer shall completely and accurately fill out and file forms DSA 6-C or DSA 152 (or most current version applicable at the time the Work is performed), as appropriate. Refer to section 4-336 and section 4-343 of Part 1, Title 24 of the California Code of Regulations.

### **20.3 Final Inspection**

**20.3.1** Developer shall comply with Punch List procedures as provided herein and maintain the presence of its District-approved 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 Developer demobilize its forces prior to completion of the Punch List without District's prior written approval. Upon receipt of Developer's written notice that all of the Punch List items have been fully completed and the Work is ready for final inspection and District acceptance, Architect and Project Inspector will inspect the Work and shall submit to Developer and District a final inspection report noting the Work, if any, required in order to complete in accordance with the Contract Documents. Absent unusual circumstances, this report shall consist of the Punch List items not yet satisfactorily completed.

**20.3.2** Upon Developer's completion of all items on the Punch List and any other uncompleted portions of the Work, Developer shall notify the District and Architect, who shall again inspect such Work. If the Architect finds the Work complete and acceptable under the Contract Documents, the Architect will notify Developer, who shall then jointly submit to the Architect and the District its final Application for Payment.

#### **20.3.3 Final Inspection Requirements**

**20.3.3.1** Before calling for final inspection, Developer shall determine that the following have been performed:

**20.3.3.1.1** The Work has been completed.

**20.3.3.1.2** All life safety items are completed and in working order.

**20.3.3.1.3** Mechanical and electrical Work, including, without limitation, security system, data, fire alarm, are complete and tested, fixtures are in place, connected, and ready for tryout.

**20.3.3.1.4** Electrical circuits scheduled in panels and disconnect switches labeled.

**20.3.3.1.5** Painting and special finishes complete.

**20.3.3.1.6** Doors complete with hardware, cleaned of protective film, relieved of sticking or binding, and in working order.

**20.3.3.1.7** Tops and bottoms of doors sealed.

**20.3.3.1.8** Floors waxed and polished as specified.

**20.3.3.1.9** Broken glass replaced and glass cleaned.

**20.3.3.1.10** Grounds cleared of Developer's equipment, raked clean of debris, and trash removed from Site.

**20.3.3.1.11** Work cleaned, free of stains, scratches, and other foreign matter, damaged and broken material replaced.

**20.3.3.1.12** Finished and decorative work shall have marks, dirt, and superfluous labels removed.

**20.3.3.1.13** Final cleanup, as provided herein.

## **20.4 Costs of Multiple Inspections**

More than two (2) requests of the District to make a final inspection shall be considered an additional service of District, Architect, Construction Manager, and/or Project Inspector, and all subsequent costs will be invoiced to Developer and if funds are available, withheld from remaining payments.

## **20.5 Partial Occupancy or Use Prior to Completion**

### **20.5.1 District's Rights to Occupancy**

The District may occupy or use any completed or partially completed portion of the Work at any stage, and such occupancy shall not constitute the District's Final Acceptance of any part of the Work. Neither the District's Final Acceptance, the making of Final Payment, any provision in Contract Documents, nor the use or occupancy of the Work, in whole or in part, by District shall constitute acceptance of Work not in accordance with the Contract Documents nor relieve Developer or Developer's Performance Bond Surety from liability with respect to any warranties or responsibility for faulty or defective Work or materials, equipment and workmanship incorporated therein. The District and Developer shall agree in writing to the responsibilities assigned to each of them for payments, security, maintenance, heat, utilities, damage to the Work, insurance, the period for correction of the Work, and the commencement of warranties required by the Contract Documents. Any dispute as to responsibilities shall be resolved pursuant to the Claims and Disputes provisions herein, with the added provision that during the dispute process, the District shall have the right to occupy or use any portion of the Work that it needs or desires to use.

### **20.5.2 Inspection Prior to Occupancy or Use**

Immediately prior to partial occupancy or use, the District, Developer, and the Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

### **20.5.3 No Waiver**

Unless otherwise agreed upon, partial or entire occupancy or use of a portion or portions of the Work shall not constitute beneficial occupancy or District's acceptance of the Work not complying with the requirements of the Contract Documents.

## **21. Final Payment and Retention**

### **21.1 Final Payment**

Upon receipt of a final Application for Payment from Developer, the Architect will notify the District whether the Work is complete so that joint inspection of the Work can be scheduled. Thereafter, the District shall jointly inspect the Work and either accept the Work as complete or notify the Architect and Developer in writing of reasons why the Work is not complete. Upon District's acceptance of the Work of Developer as fully complete (that, absent unusual circumstances, will occur when the Punch List items have been satisfactorily completed), the District shall record a Notice of Completion with the County Recorder, and Developer shall, upon receipt of final payment from the District, pay the amount due Subcontractors.

### **21.2 Prerequisites for Final Payment**

The following conditions must be fulfilled prior to Final Payment:

**21.2.1** A full release of all Stop Payment Notices served in connection with the Work shall be submitted by Developer.

**21.2.2** A duly completed and executed conditional waiver and release upon final payment compliant with Civil Code section 8136 from each subcontractor of any tier and supplier to be paid from the final Tenant Improvement Payment.

**21.2.3** A duly completed and executed unconditional waiver and release upon Tenant Improvement Payment compliant with Civil Code section 8134 from each subcontractor of any tier and supplier that was paid from the previous Tenant Improvement Payment(s).

**21.2.4** A duly completed and executed "AGREEMENT AND RELEASE OF ANY AND ALL CLAIMS" from Developer.

**21.2.5** Developer shall have made all corrections to the Work that are required to remedy any defects therein, to obtain compliance with the Contract Documents or any requirements of applicable codes and ordinances, or to fulfill any of the orders or directions of District required under the Contract Documents.

**21.2.6** Each Subcontractor shall have delivered to Developer all written guarantees, warranties, applications, and bonds required by the Contract Documents for its portion of the Work.

**21.2.7** Developer must have completed all requirements set forth under "Close-Out/Certification Procedures," including, without limitation, submission of an approved set of complete Record Drawings.

**21.2.8** Architect shall have issued its written approval that final payment can be made.

**21.2.9** Developer shall have delivered to the District all manuals and materials required by the Contract Documents, which must be approved by the District.

**21.2.10** Developer shall have completed final clean up as provided herein.

### **21.3 Retention**

**21.3.1** The retention, less any amounts disputed by the District or that the District has the right to withhold pursuant to provisions herein, shall be paid:

**21.3.1.1** After approval by the District of the Architect of the Application and Certificate of Payment.

**21.3.1.2** After the satisfaction of the conditions set forth herein.

**21.3.1.3** No less than forty-five (45) days after the recording of the Notice of Completion by District; and

**21.3.1.4** After receipt of a duly completed and executed unconditional waiver and release upon Final Payment compliant with Civil Code section 8138 from each subcontractor of any tier and supplier that was paid from the Final Payment.

**21.3.2** No interest shall be paid on any retention, or on any amounts withheld due to a failure of Developer to perform, in accordance with the terms and conditions of the Contract Documents, except as provided to the contrary in any Escrow Agreement between the District and Developer pursuant to Public Contract Code section 22300.

### **21.4 Substitution of Securities**

The District will permit the substitution of securities in accordance with the provisions of Public Contract Code section 22300.

## **22. Uncovering of Work**

If a portion of the Work is covered without Inspector or Architect approval or not in compliance with the Contract Documents, it must, if required in writing by the District, the Project Inspector, or the Architect, be uncovered for the Project Inspector's or the Architect's observation and be corrected, replaced and/or recovered at Developer's expense without change in the Guaranteed Maximum Price or Contract Time.

## **23. Nonconforming Work and Correction of Work**

### **23.1 Nonconforming Work**

**23.1.1** Developer shall promptly remove from Premises all Work identified by District as failing to conform to the Contract Documents whether incorporated or not. Developer shall promptly replace and re-execute its own Work to comply with the Contract Documents without additional expense to the District and shall bear the expense of making good all work of other contractors destroyed or damaged by any removal or replacement pursuant hereto and/or any delays to the District or other contractors caused thereby.



**23.1.2** If Developer does not commence to remove Work that District has identified as failing to conform to the Contract Documents within a reasonable time, not to exceed FORTY-EIGHT (48) hours after written notice and complete removal of work within a reasonable time, District may remove it and may store any material at Developer's expense. If Developer does not pay expense(s) of that removal within ten (10) days' time thereafter, District may, upon ten (10) days' written notice, sell any material at auction or at private sale and shall deduct all costs and expenses incurred by the District and/or District may withhold those amounts from payment(s) to Developer.

## **23.2 Correction of Work**

### **23.2.1 Correction of Rejected Work**

Pursuant to the notice provisions herein, Developer shall promptly correct the Work rejected by the District, the Architect, or the Project Inspector as failing to conform to the requirements of the Contract Documents, whether observed before or after Completion and whether or not fabricated, installed, or completed. Developer shall bear costs of correcting the rejected Work, including additional testing, inspections, and compensation for the Inspector's or the Architect's services and expenses made necessary thereby.

### **23.2.2 One-Year Warranty Corrections**

If, within one (1) year after the date of Completion of the Work or a designated portion thereof, or after the date for commencement of warranties established hereunder, or by the terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, Developer shall correct it promptly after receipt of written notice from the District to do so. This period of one (1) year shall be extended with respect to portions of the Work first performed after Completion by the period of time between Completion and the actual performance of the Work. This obligation hereunder shall survive District's acceptance of the Work under the Contract Documents and termination of the Contract Documents. The District shall give such notice promptly after discovery of the condition.

## **23.3 District's Right to Perform Work**

**23.3.1** If Developer should neglect to prosecute the Work properly or fail to perform any provisions of the Contract Documents, the District, after providing FORTY-EIGHT (48) hours' written notice and an opportunity to cure the failure, to Developer, may, without prejudice to any other remedy it may have, make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due Developer.

**23.3.2** If it is found at any time, before or after completion of the Work, that Developer has varied from the Drawings and/or Specifications, including, but not limited to, variation in material, quality, form, or finish, or in the amount or value of the materials and labor used, District may require at its option:

**23.3.2.1** That all such improper Work be removed, remade or replaced, and all work disturbed by these changes be made good by Developer at no additional cost to the District.

**23.3.2.2** That the District deduct from any amount due Developer the sum of money equivalent to the difference in value between the work performed and that called for by the Drawings and Specifications; or

**23.3.2.3** That the District exercise any other remedy it may have at law or under the Contract Documents, including but not limited to the District hiring its own forces or another contractor to replace Developer's nonconforming Work, in which case the District shall either issue a deductive Change Order, a Construction Change Directive, or invoice Developer for the cost of that work. Developer shall pay any invoices within thirty (30) days of receipt of same or District may withhold those amounts from payment(s) to Developer.

## **24. Termination And Suspension**

The Parties' rights to terminate the Project are as indicated in the Facilities Lease. In the event of a termination of the Facilities Lease and notwithstanding any other provision in the Contract Documents, the Surety shall remain liable to all obligees under the Payment Bond and to the District under the Performance Bond for any claim related to the Project.

## **25. Claims Process**

### **25.1 Obligation to File Claims for Disputed Work**

**25.1.1** Should Developer otherwise seek extra time or compensation for any reason whatsoever ("Disputed Work"), then Developer shall first follow procedures set forth in the Contract Documents including, without limitation, Articles 15, 16 and 17, all of which are conditions precedent to submitting a Claim pursuant to Article 25. A Notice of Delay or Proposed Change Order are less formal procedures that proceed the formal claim and do not constitute a Claim. A Claim also does not include correspondence, RFIs, vouchers, invoices, progress payment applications, or other routine or authorized form of requests for progress payments in compliance with the Contract. If a dispute remains, then Developer shall give written notice to District that expressly invokes this Article 25 within the time limits set forth herein.

**25.1.2** Developer's sole and exclusive remedy for Disputed Work is to file a written claim setting forth Developer's position as required herein within the time limits set forth herein.

### **25.2 Duty to Perform during Claim Process**

Developer and its subcontractors shall continue to perform its Work under the Contract, including the Disputed Work, and shall not cause a delay of the Work during any dispute, claim, negotiation, mediation, or arbitration proceeding, except by written agreement by the District.

### **25.3 Definition of Claim**

**25.3.1** Pursuant to Public Contract Code section 9204, the term "Claim" means a separate demand by Developer sent by registered mail or certified mail with return receipt requested, for one or more of the following:

**25.3.1.1** A time extension, including without limitation, for relief of damages or penalties for delay assessed by the District under the Contract;

**25.3.1.2** Payment by the District of money or damages arising from work done by, or on behalf of, Developer pursuant to the Contract and payment of which is not otherwise expressly provided for or to which Developer is not otherwise entitled to; or

**25.3.1.3** An amount of payment disputed by the District.

## **25.4 Claims Presentation**

### **25.4.1 Form and Contents of Claim**

**25.4.1.1** If Developer intends to submit a Claim for an increase in the Guaranteed Maximum Price and/or Contract Time for any reason including, without limitation, the acts of District or its agents, Developer shall, within thirty (30) days after the event giving rise to the Claim, give notice of the Claim ("Notice of Potential Claim") in writing, specifically identifying Developer is invoking this Article 25 Claims Presentation. The Notice of Potential Claim shall provide Developer's preliminary request for an adjustment to the Guaranteed Maximum Price and/or Contract Time, with a description of the grounds therefore.

**25.4.1.2** Within thirty (30) days after serving the written Notice of Potential Claim, Developer shall provide a Claim including an itemized statement of the details and amounts of its Claim for any increase in the Guaranteed Maximum Price or Contract Time, as provided below, including a Time Impact Analysis and any and all other documentation substantiating Developer's claimed damages:

**25.4.1.2.1** The issues, events, conditions, circumstances and/or causes giving rise to the dispute;

**25.4.1.2.2** Citation to provisions in the Contract Documents, statute sections, and/or case law entitling Developer to an increase in the Guaranteed Maximum Price or Contract Time;

**25.4.1.2.3** The pertinent dates and/or durations and actual and/or anticipated effects on the Guaranteed Maximum Price, Contract Schedule milestones and/or Contract Time adjustments;

**25.4.1.2.4** The Time Impact Analysis of all time delays that shows actual time impact on the critical path; and

**25.4.1.2.5** The line-item costs for labor, material, and/or equipment, if applicable, for all cost impacts priced like a change order according to Article 17 and must be updated monthly as to cost and entitlement if a continuing claim.

**25.4.1.3** The Claim shall include the following certification by Developer:

**25.4.1.3.1** The undersigned Developer certifies under penalty of perjury that the attached dispute is made in good faith; that the supporting data is accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the adjustment for which Developer believes the District is liable; and that I am duly authorized to certify the claim on behalf of Developer.

**25.4.1.3.2** Furthermore, Developer understands that the value of the attached dispute expressly includes any and all of Developer's costs and expenses, direct and indirect, resulting from the Work performed on the Project, additional time required on the Project and/or resulting from delay to the Project including, without limitation, cumulative impacts. Any costs, expenses, damages, or time extensions not included are deemed waived.

**25.4.2** Developer shall bear all costs incurred in the preparation and submission of a Claim.

**25.4.3** Failure to timely submit a Claim and the requisite supporting documentation shall constitute a waiver of Developer's claim(s) against the District and Developer's Claim(s) for compensation or an extension of time shall be deemed waived, released, and discharged as to any entitlement for adjustment to Guaranteed Maximum Price and/or Contract Time.

## **25.5 Claim Resolution pursuant to Public Contract Code section 9204**

Developer may request to waive the claims procedure under Public Contract Code section 9204 and proceed directly to the commencement of a civil action or binding arbitration. If Developer chooses to proceed, Developer shall comply with the following steps:

### **25.5.1 STEP 1:**

**25.5.1.1** Upon receipt of a Claim by registered or certified mail, return receipt requested, including the documents necessary to substantiate it, the District shall conduct a reasonable review of the Claim and, within a period not to exceed 45 days, shall provide Developer a written statement identifying what portion of the Claim is disputed and what portion is undisputed. Upon receipt of a Claim, the District and Developer may, by mutual agreement, extend the time period to provide a written statement. If the District needs approval from its governing body to provide Developer a written statement identifying the disputed portion and the undisputed portion of the Claim, and the governing body does not meet within the 45 days or within the mutually agreed to extension of time following receipt of Claim sent by registered mail or certified mail, return receipt requested, the District shall have up to three (3) days following the next duly publicly noticed meeting of the governing body after the 45-day period, or extension, expires to provide Developer a written statement identifying the disputed portion and the undisputed portion.

**25.5.1.1.1** Any payment due on an undisputed portion of the Claim shall be processed and made within 60 days after the District issues its written statement. Amounts not paid in a timely manner as required by this section, shall bear interest at seven percent (7%) per annum.

**25.5.1.2** Upon receipt of a Claim, the parties may mutually agree to waive, in writing, mediation and proceed directly to the commencement of a civil action or binding arbitration, as applicable. In this instance, District and Developer must comply with the sections below regarding Public Contract Code section 20104 et seq. and Government Code Claim Act Claims.

**25.5.1.3** If the District fails to issue a written statement, or to otherwise meet the time requirements of this section, this shall result in the Claim being deemed rejected in its entirety. A claim that is denied by reason of the District's failure to have responded to a claim, or its failure to otherwise meet the time requirements of this section, shall not constitute an adverse finding with regard to the merits of the claim or the responsibility or qualifications of Developer.

## **25.5.2 STEP 2:**

**25.5.2.1** If Developer disputes the District's written response, or if the District fails to respond to a Claim within the time prescribed, Developer may demand in writing an informal conference to meet and confer for settlement of the issues in dispute. Upon receipt of a demand in writing sent by registered mail or certified mail, return receipt requested, the District shall schedule a meet and confer conference within 30 days for settlement of the dispute. Within 10 business days following the conclusion of the meet and confer conference, if the claim or any portion of the claim remains in dispute, the District shall provide Developer a written statement identifying the portion of the claim that remains in dispute and the portion that is undisputed.

**25.5.2.2** Any payment due on an undisputed portion of the claim shall be processed and made within 60 days after the District issues its written statement. Amounts not paid in a timely manner as required by this section, shall bear interest at seven percent (7%) per annum.

## **25.5.3 STEP 3:**

**25.5.3.1** Any disputed portion of the claim, as identified by Developer in writing, shall be submitted to nonbinding mediation, with the District and Developer sharing the associated costs equally. The District and Developer shall mutually agree to a mediator within 10 business days after the disputed portion of the claim has been identified in writing. If the parties cannot agree upon a mediator, each party shall select a mediator and those mediators shall select a qualified neutral third party to mediate with regard to the disputed portion of the claim. Each party shall bear the fees and costs charged by its respective mediator in connection with the selection of the neutral mediator. If mediation is unsuccessful, the parts of the claim remaining in dispute shall be subject to applicable procedures outside this section.

**25.5.3.1.1** For purposes of this section, mediation includes any nonbinding process, including, but not limited to, neutral evaluation or a dispute review board, in which an independent third party or board assists the parties in dispute resolution through negotiation or by issuance of an evaluation. Any mediation utilized shall conform to the timeframes in this section.

**25.5.3.2** Unless otherwise agreed to by the District and Developer in writing, the mediation conducted pursuant to this section shall excuse any further obligation under Public Contract Code section 20104.4 to mediate after litigation has been commenced.

#### **25.5.4 STEP 4:**

**25.5.4.1** If mediation under this section does not resolve the parties' dispute, the District may, but does not require arbitration of disputes under private arbitration or the Public Works Contract Arbitration Program.

### **25.6 Subcontractor Pass-Through Claims**

**25.6.1** If a subcontractor or a lower tier subcontractor lacks legal standing to assert a claim against a District because privity of contract does not exist, the contractor may present to the District a Claim on behalf of a subcontractor or lower tier subcontractor. A subcontractor may request in writing, either on his or her own behalf or on behalf of a lower tier subcontractor, that Developer present a Claim for work which was performed by the subcontractor or by a lower tier subcontractor on behalf of the subcontractor. The subcontractor requesting that the Claim be presented to the District shall furnish reasonable documentation to support the Claim.

**25.6.2** Within 45 days of receipt of this written request from a subcontractor, Developer shall notify the subcontractor in writing as to whether Developer presented the Claim to the District and, if Developer did not present the Claim, provide the subcontractor with a statement of the reasons for not having done so.

**25.6.3** Developer shall bind all its Subcontractors to the provisions of this section and will hold the District harmless against Claims by Subcontractors.

### **25.7 Government Code Claim Act Claim**

**25.7.1** If a Claim, or any portion thereof, remains in dispute upon satisfaction of all applicable Claim Resolution requirements, including those pursuant to Public Contract Code section 9204, Developer shall comply with all claims presentation requirements as provided in Chapter 1 (commencing with section 900) and Chapter 2 (commencing with section 910) of Part 3 of Division 3.6 of Title 1 of Government Code as a condition precedent to Developer's right to bring a civil action against the District.

**25.7.2** Developer shall bear all costs incurred in the preparation, submission and administration of a Claim. Any claims presented in accordance with the Government Code must affirmatively indicate Developer's prior compliance with the claims procedure herein of the claims asserted.

**25.7.3** For purposes of those provisions, the running of the time within which a claim pursuant to Public Contract Code section 20104.2 only must be presented to the District shall be tolled from the time the Developer submits its written claim pursuant to subdivision (a) until the time that the claim is denied as a result of the meet and confer process, including any period of time utilized by the meet and confer process.

**25.8 Claim Resolution pursuant to Public Contract Code section 20104 et seq.**

**25.8.1** In the event of a disagreement between the parties as to performance of the Work, the interpretation of this Contract, or payment or nonpayment for Work performed or not performed, the parties shall attempt to resolve all claims of three hundred seventy-five thousand dollars (\$375,000) or less which arise between Developer and District by those procedures set forth in Public Contract Code section 20104 et seq., to the extent applicable.

**25.8.1.1** Developer shall file with the District any written Claim, including the documents necessary to substantiate it, upon the application for final payment.

**25.8.1.2** For claims of less than fifty thousand dollars (\$50,000), the District shall respond in writing within forty-five (45) days of receipt of the Claim or may request in writing within thirty (30) days of receipt of the Claim any additional documentation supporting the claim or relating to defenses or claims the District may have against Developer.

**25.8.1.2.1** If additional information is required, it shall be requested and provided by mutual agreement of the parties.

**25.8.1.2.2** District's written response to the documented Claim shall be submitted to Developer within fifteen (15) days after receipt of the further documentation or within a period of time no greater than that taken by Developer to produce the additional information, whichever is greater.

**25.8.1.3** For claims of over fifty thousand dollars (\$50,000) and less than or equal to three hundred seventy-five thousand dollars (\$375,000), the District shall respond in writing to all written Claims within sixty (60) days of receipt of the claim, or may request, in writing, within thirty (30) days of receipt of the Claim any additional documentation supporting the Claim or relating to defenses or claims the District may have against Developer.

**25.8.1.3.1** If additional information is required, it shall be requested and provided upon mutual agreement of the District and Developer.

**25.8.1.3.2** The District's written response to the claim, as further documented, shall be submitted to Developer within thirty (30) days after receipt of the further documentation, or within a period of time no greater than that taken by Developer to produce the additional information or requested documentation, whichever is greater.

**25.8.1.4** If Developer disputes the District's written response, or the District fails to respond within the time prescribed, Developer may so notify the District, in writing, either within fifteen (15) days of receipt of the District's response or within fifteen (15) days of the District's failure to respond within the time prescribed, respectively, and demand an informal conference to meet and confer for settlement of the issues in dispute. Upon a demand, the District shall schedule a meet and confer conference within thirty (30) days for settlement of the dispute.

**25.8.1.5** Following the meet and confer conference, if the claim or any portion of it remains in dispute, Developer shall file a claim as provided in Chapter 1 (commencing with Section 900) and Chapter 2 (commencing with Section 910) of Part 3 of Division 3.6 of Title 1 of the Government Code. For purposes of those provisions the running of the time within which a claim must be filed shall be tolled from the time Developer submits its written Claim until the time the Claim is denied, including any period of time utilized by the meet and confer process.

**25.8.1.6** For any civil action filed to resolve claims filed pursuant to this section, within sixty (60) days, but no earlier than thirty (30) days, following the filing of responsive pleadings, the court shall submit the matter to nonbinding mediation unless waived by mutual stipulation of both parties. The mediation process shall provide for the selection within fifteen (15) days by both parties of a disinterested third person as mediator, shall be commenced within thirty (30) days of the submittal, and shall be concluded within fifteen (15) days from the commencement of the mediation unless a time requirement is extended upon a good cause showing to the court or by stipulation of both parties. If the parties fail to select a mediator within the 15-day period, any party may petition the court to appoint the mediator.

**25.8.1.7** If the matter remains in dispute, the case shall be submitted to judicial arbitration pursuant to Chapter 2.5 (commencing with Section 1141.10) of the Title 3 of Part 3 of the Code of Civil Procedure, notwithstanding Section 1141.11 of that code. The Civil Discovery Act, (commencing with Section 2016) of Chapter 1 of Title 4 of part 4 of the Code of Civil Procedure) shall apply to any proceeding brought under this subdivision consistent with the rules pertaining to judicial arbitration.

**25.8.1.8** The District shall not fail to pay money as to any portion of a Claim which is undisputed except as otherwise provided in the Contract Documents. In any suit filed pursuant to this section, the District shall pay interest at the legal rate on any arbitration award or judgment. Interest shall begin to accrue on the date the suit is filed in a court of law.

**25.8.2** Developer shall bind its Subcontractors to the provisions of this Section and will hold the District harmless against disputes by Subcontractors.

## **25.9 Claims Procedure Compliance**

**25.9.1** Failure to submit and administer claims as required in Article 25 shall waive Developer's right to claim on any specific issues not included in a timely



submitted claim. Claim(s) not raised in a timely protest and timely claim submitted under this Article 25 may not be asserted in any subsequent litigation, Government Code Claim, or legal action.

**25.9.2** District shall not be deemed to waive any provision under this Article 25, if at District's sole discretion, a claim is administered in a manner not in accord with this Article 25. Waivers or modifications of this Article 25 may only be made by a signed change order approved as to form by legal counsel for both District and Developer; oral or implied modifications shall be ineffective.

## **25.10 Claim Resolution Non-Applicability**

**25.10.1** The procedures for dispute and claim resolution set forth in this Article shall not apply to the following:

**25.10.1.1** Personal injury, wrongful death or property damage claims.

**25.10.1.2** Latent defect or breach of warranty or guarantee to repair.

**25.10.1.3** Stop payment notices.

**25.10.1.4** District's rights set forth in the Article on Suspension and Termination.

**25.10.1.5** Disputes arising out of labor compliance enforcement by the Department of Industrial Relations; or

**25.10.1.6** District rights and obligations as a public entity set forth in applicable statutes; provided, however, that penalties imposed against a public entity by statutes, including, but not limited to, Public Contract Code sections 20104.50 and 7107, shall be subject to the Claim Resolution requirements provided in this Article.

## **25.11 Attorney's Fees**

**25.11.1** Should litigation be necessary to enforce any terms or provisions of this Contract, then each party shall bear its own litigation and collection expenses, witness fees, court costs and attorney's fees.

## **26. State Labor, Wage & Hour, Apprenticeship, And Related Provisions**

### **26.1 Labor Compliance and Enforcement**

Since this Project is subject to labor compliance and enforcement by the Department of Industrial Relations ("DIR"), Developer specifically acknowledges and understands that it shall perform the Work of this Agreement while complying with all the applicable provisions of Division 2, Part 7, Chapter 1, of the Labor Code and Title 8 of the California Code of Regulations, including, without limitation, the requirement that Developer and all Subcontractors shall timely furnish complete and accurate electronic certified payroll records directly to the DIR. The District may not issue payment if this requirement is not met.

### **26.2 Wage Rates, Travel, and Subsistence**

**26.2.1** Pursuant to the provisions of Article 2 (commencing at section 1770), Chapter 1, Part 7, Division 2, of the Labor Code of California, the general

prevailing rate of per diem wages and the general prevailing rate for holiday and overtime work in the locality in which this public work is to be performed for each craft, classification, or type of worker needed to execute the Contract Documents are on file at the District's principal office and copies will be made available to any interested party on request. Developer shall obtain and post a copy of these wage rates at the job site.

**26.2.2** Holiday and overtime work, when permitted by law, shall be paid for at a rate of at least one and one-half times the above specified rate of per diem wages, unless otherwise specified. The holidays upon which those rates shall be paid need not be specified by the District but shall be all holidays recognized in the applicable collective bargaining agreement. If the prevailing rate is not based on a collectively bargained rate, the holidays upon which the prevailing rate shall be paid shall be as provided in Section 6700 of the Government Code.

**26.2.3** Developer shall pay and shall cause to be paid each worker engaged in Work on the Project not less than the general prevailing rate of per diem wages determined by the Director of the Department of Industrial Relations ("DIR") ("Director"), regardless of any contractual relationship which may be alleged to exist between Developer or any Subcontractor and such workers.

**26.2.4** If, prior to execution of the Facilities Lease, the Director determines that there has been a change in any prevailing rate of per diem wages in the locality in which the Work under the Contract Documents is to be performed, such change shall not alter the wage rates in the Contract Documents subsequently awarded.

**26.2.5** Pursuant to Labor Code section 1775, Developer shall, as a penalty, forfeit the statutory amount (believed by the District to be currently two hundred dollars (\$200) to District for each calendar day, or portion thereof, for each worker paid less than the prevailing rates, determined by the District and/or the Director, for the work or craft in which that worker is employed for any public work done under Contract by Developer or by any Subcontractor under it. The difference between such prevailing wage rates and the amount paid to each worker for each calendar day or portion thereof for which each worker was paid less than the prevailing wage rate, shall be paid to each worker by Developer.

**26.2.6** Any worker employed to perform Work on the Project, which Work is not covered by any classification listed in the general prevailing wage rate of per diem wages determined by the Director, shall be paid not less than the minimum rate of wages specified therein for the classification which most nearly corresponds to Work to be performed by him, and that minimum wage rate shall be retroactive to time of initial employment of the person in that classification.

**26.2.7** Pursuant to Labor Code section 1773.1, per diem wages are deemed to include employer payments for health and welfare, pension, vacation, travel time, subsistence pay, and apprenticeship or other training programs authorized by Labor Code section 3093, and similar purposes.

**26.2.8** Developer shall post at appropriate conspicuous points on the Project Site a schedule showing all determined minimum wage rates and all authorized deductions, if any, from unpaid wages actually earned. In addition, Developer

shall post a sign-in log for all workers and visitors to the Site, a list of all Subcontractors of any tier on the Site, and the required Equal Employment Opportunity poster(s).

### **26.3 Hours of Work**

**26.3.1** As provided in Article 3 (commencing at section 1810), Chapter 1, Part 7, Division 2, of the Labor Code, eight (8) hours of labor shall constitute a legal day of work. The time of service of any worker employed at any time by Developer or by any Subcontractor on any subcontract under the Contract Documents upon the Work or upon any part of the Work contemplated by the Contract Documents shall be limited and restricted by Developer to eight (8) hours per day, and forty (40) hours during any one week, except as hereinafter provided. Notwithstanding the provisions hereinabove set forth, Work performed by employees of Developer in excess of eight (8) hours per day and forty (40) hours during any one week, shall be permitted upon this public work upon compensation for all hours worked in excess of eight (8) hours per day at not less than one and one-half times the basic rate of pay.

**26.3.2** Developer shall keep and shall cause each Subcontractor to keep an accurate record showing the name of and actual hours worked each calendar day and each calendar week by each worker employed by Developer in connection with the Work or any part of the Work contemplated by the Contract Documents. The record shall be kept open at all reasonable hours to the inspection of District and to the Division of Labor Standards Enforcement of the DIR.

**26.3.3** Pursuant to Labor Code section 1813, Developer shall, as a penalty, forfeit the statutory amount (believed by the District to be currently twenty-five dollars (\$25)) to the District for each worker employed in the execution of the Contract Documents by Developer or by any Subcontractor for each calendar day during which a worker is required or permitted to work more than eight (8) hours in any one calendar day and forty (40) hours in any one calendar week in violation of the provisions of Article 3 (commencing at section 1810), Chapter 1, Part 7, Division 2, of the Labor Code.

**26.3.4** Any Work necessary to be performed after regular working hours, or on Sundays or other holidays shall be performed without additional expense to the District.

### **26.4 Payroll Records**

**26.4.1** Developer shall upload, and shall cause each Subcontractor performing any portion of the Work under this Contract to upload, an accurate and complete certified payroll record ("CPR") electronically using DIR's eCPR System by uploading the CPRs by electronic XML file or entering each record manually using the DIR's iform (or current form) online no less than every 30 days while Work is being performed and within 30 days after the final day of Work performed on the Project and within ten (10) days of any request by the District or Labor Commissioner at <http://www.dir.ca.gov/Public-Works/Certified/Payroll-Reporting.html> or current application and URL, showing the name, address, social security number, work classification, straight time, and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee

employed by Developer and/or each Subcontractor in connection with the Work.

**26.4.1.1** The CPRs enumerated hereunder shall be filed directly with the DIR on a weekly basis or to the requesting party, whether the District or DIR, within ten (10) days after receipt of each written request. The CPRs from Developer and each Subcontractor for each week shall be provided on or before ten (10) days after the end of the Sunday to Saturday conventional week covered by the CPRs. District may not make any payment to Developer until:

**26.4.1.1.1** Developer and/or its Subcontractor(s) provide CPRs acceptable to the District and DIR.

**26.4.1.1.2** Any delay in Developer and/or its Subcontractor(s) providing CPRs to the District or DIR in a timely manner may directly delay the District's review and/or audit of the CPRs and Developer's payment.

**26.4.2** All CPRs shall be available for inspection at all reasonable hours at the principal office of Developer on the following basis:

**26.4.2.1** A certified copy of an employee's CPR shall be made available for inspection or furnished to the employee or his/her authorized representative on request.

**26.4.2.2** CPRs shall be made available for inspection or furnished upon request or as required by regulation to a representative of the District, Division of Labor Standards Enforcement, Division of Apprenticeship Standards, and/or the DIR.

**26.4.2.3** CPRs shall be made available upon request by the public for inspection or copies thereof made; provided, however, that a request by the public shall be made through the District, Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement. If the requested CPRs have not been provided pursuant to the provisions herein, the requesting party shall, prior to being provided the records, reimburse the costs of preparation by Developer, Subcontractors, and the entity through which the request was made. The public shall not be given access to the records at the principal office of Developer.

**26.4.3** Any copy of records made available for inspection as copies and furnished upon request to the public or any public agency by District, Division of Apprenticeship Standards, Division of Labor Standards Enforcement, or DIR shall be marked or obliterated in such a manner as to prevent disclosure of an individual's name, address, and social security number. The name and address of Developer awarded the Project under the Contract Documents or performing under the Contract Documents shall not be marked or obliterated.

**26.4.4** Developer shall inform District of the location of the records enumerated hereunder, including the street address, city, and county, and shall, within five (5) working days of a change in location of the records, provide a notice of change of location and address.

**26.4.5** In the event of noncompliance with the requirements of this section, Developer shall have ten (10) days in which to comply subsequent to receipt of written notice specifying in what respects Developer must comply with this section. Should noncompliance still be evident after the ten (10) day period, Developer shall, as a penalty, forfeit up to one hundred dollars (\$100) to District for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated. Upon the request of the Labor Commissioner, these penalties shall be withheld from Tenant Improvement Payments then due.

**26.4.6 [Reserved]**

**26.5 [Reserved]**

**26.6 Apprentices**

**26.6.1** Developer acknowledges and agrees that, if the Contract Documents involve a dollar amount greater than or a number of working days greater than that specified in Labor Code section 1777.5, then this Contract is governed by the provisions of Labor Code Section 1777.5 and 29 CFR part 5. It shall be the responsibility of Developer to ensure compliance with this Article and with Labor Code section 1777.5 for all apprenticeship occupations.

**26.6.2** Apprentices of any crafts or trades may be employed and, when required by Labor Code section 1777.5, shall be employed provided they are properly registered in full compliance with the provisions of the Labor Code.

**26.6.3** Every apprentice shall be paid the standard wage paid to apprentices under the regulations of the craft or trade at which he/she is employed and shall be employed only at the work of the craft or trade to which she/he is registered.

**26.6.4** Only apprentices, as defined in section 3077 of the Labor Code, who are in training under apprenticeship standards and written apprentice agreements under Chapter 4 (commencing at section 3070), Division 3, of the Labor Code, are eligible to be employed. The employment and training of each apprentice shall be in accordance with the provisions of the apprenticeship standards and apprentice agreements under which he/she is training.

**26.6.5** Pursuant to Labor Code section 1777.5, if that section applies to this Contract as indicated above, Developer and any Subcontractors employing workers in any apprenticeable craft or trade in performing any Work under this Contract shall apply to the applicable joint apprenticeship committee for a certificate approving Developer or Subcontractor under the applicable apprenticeship standards and fixing the ratio of apprentices to journeymen employed in performing the Work.

**26.6.6** Pursuant to Labor Code section 1777.5, if that section applies to this Contract as indicated above, Developer and any Subcontractor may be required to make contributions to the apprenticeship program.

**26.6.7** If Developer or Subcontractor willfully fails to comply with Labor Code section 1777.5, then, upon a determination of noncompliance by the Administrator of Apprenticeship, it shall:

**26.6.7.1** Be denied the right to bid on any subsequent project for one (1) year from the date of such determination.

**26.6.7.2** Forfeit, as a penalty, to District the full amount stated in Labor Code section 1777.7. Interpretation and enforcement of these provisions shall be in accordance with the rules and procedures of the California Apprenticeship Council and under the authority of the Chief of the Division of Apprenticeship Standards.

**26.6.7.3** Developer and all Subcontractors shall comply with Labor Code section 1777.6, which section forbids certain discriminatory practices in the employment of apprentices.

**26.6.7.4** Developer shall become fully acquainted with the law regarding apprentices prior to commencement of the Work. Special attention is directed to sections 1777.5, 1777.6, and 1777.7 of the Labor Code, and Title 8, California Code of Regulations, Section 200 et seq. Questions may be directed to the State Division of Apprenticeship Standards, 455 Golden Gate Avenue, 9th Floor, San Francisco, California 94102.

## **26.7 Skilled and Trained Workforce**

**26.7.1** Developer and its subcontractors at every tier hereby provide an enforceable commitment to comply with Public Contract Code section 2600 et seq., which requires use of a skilled and trained workforce to perform all work on the Contract or Project that falls within an apprenticeable occupation in the building and construction trades.

**26.7.1.1** "Apprenticeable Occupation" means an occupation for which the Chief of the Division of Apprenticeship Standards of the Department of Industrial Relations ("Chief") had approved an apprenticeship program pursuant to Section 3075 of the Labor Code before January 1, 2014.

**26.7.1.2** "Skilled and Trained Workforce" means a workforce that meets all of the following conditions:

**26.7.1.2.1** All of the workers are either skilled journeypersons or apprentices registered in an apprenticeship program approved by the Chief.

**26.7.1.2.2** That either (A) the number of the skilled journeypersons employed to perform work on the Contract or Project by Developer or its subcontractors at every tier are graduates of an apprenticeship program for the applicable occupation that was either approved by the Chief pursuant to Labor Code section 3075 or located outside California and approved for federal purposes pursuant to the apprenticeship regulations adopted by the federal Secretary of Labor, or (B) the hours of work performed by skilled journeypersons who have graduated from an approved apprenticeship program meet at least the percentages set forth in the following chart:

REQUIREMENT	EXCLUDED OCCUPATIONS
0%	Teamster
At least 30%	Acoustical installer, bricklayer, carpenter, cement mason, drywall installer or lather, marble mason, finisher, or setter, modular furniture or systems installer, operating engineer, pile driver, plasterer, roofer or waterproofer, stone mason, surveyor, terrazzo worker or finisher, and tile layer, setter, or finisher
At least 60%	All remaining apprenticeable occupations

**26.7.1.2.3** For an apprenticeable occupation in which no apprenticeship program has been approved by the Chief before January 1, 1995, up to one-half of the above graduation percentage requirements set forth in the above chart may be satisfied by skilled journeypersons who commenced working in the apprenticeable occupation before the Chief's approval of an apprenticeship program for that occupation in the county in which the Project is located.

**26.7.1.2.4** The contractor or subcontractor need not meet the apprenticeship graduation requirements if:

**26.7.1.2.4.1** During a calendar month, Developer or subcontractor employs skilled journeypersons to perform fewer than 10 hours of work on the Contract or Project; or

**26.7.1.2.4.2** The subcontractor was not a listed subcontractor under Public Contract Code section 4104 or a substitute for a listed subcontractor, and the subcontract does not exceed one-half of one percent (0.5%) of the price of the prime contract.

**26.7.1.3** "Skilled Journeyperson" means a worker who either:

**26.7.1.3.1** Graduated from an apprenticeship program for the applicable occupation that was approved by the Chief or located outside of California and approved for federal purposes pursuant to the apprenticeship regulations adopted by the federal Secretary of Labor; or

**26.7.1.3.2** Has at least as many hours of on-the-job experience in the applicable occupation as would be required to graduate from an apprenticeship program for the applicable occupation that is approved by the Chief.

**26.7.2** Developer and its subcontractors will demonstrate its compliance with the Skilled and Trained Workforce requirements by either of the following:

**26.7.2.1** Provide monthly reports to the District demonstrating that Developer and its subcontractors are complying with the requirements of Public Contract Code section 2600 et seq., which shall be a public

record under California Public Records Act, Government Code section 6250 et seq.; or

**26.7.2.2** Provide evidence that Developer and its subcontractors have agreed to be bound by: (1) a project labor agreement entered into by the District that binds all contractors and all its subcontractors at every tier performing work on the Project to use a skilled and trained workforce; (2) the extension or renewal of a project labor agreement entered into by the District prior to January 1, 2017; or (3) a project labor agreement that binds all contractors and all its subcontractors at every tier performing work on the Project to use a skilled and trained workforce.

**26.8 [Reserved]**

**26.9 Non-Discrimination**

**26.9.1** Developer herein agrees to comply with the provisions of the California Fair Employment and Housing Act as set forth in Part 2.8 of Division 3 of Title 2 of the California Government Code, commencing at section 12900; the Federal Civil Rights Act of 1964, as set forth in Public Law 88-352, and all amendments thereto; Executive Order 11246; and all administrative rules and regulations found to be applicable to Developer and Subcontractor.

**26.9.2** Special requirements for Federally Assisted Construction Contracts: During the performance of the requirement of the Contract Documents, Developer agrees to incorporate in all subcontracts the provisions set forth in Chapter 60-1.4(b) of Title 41 published in Volume 33 No. 104 of the Federal Register dated May 28, 1968.

**26.10 Labor First Aid**

Developer shall maintain emergency first aid treatment for Developer's laborers and mechanics on the Project which complies with the Federal Occupational Safety and Health Act of 1970 (29 U.S.C. § 651 et seq.) and the California Occupational Safety and Health Act of 1973 (Lab. Code, § 6300 et seq.; 8 Cal. Code of Regs., § 330 et seq.).

**27. [Reserved]**

**28. Miscellaneous**

**28.1 Assignment of Antitrust Actions**

Although this project may not have been formally bid, the following provisions may apply:

**28.1.1** Section 7103.5(b) of the Public Contract Code states:

In entering into a public works contract or subcontract to supply goods, services, or materials pursuant to a public works contract, the contractor or subcontractor offers and agrees to assign to the awarding body all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Sec. 15) or under the Cartwright Act (Chapter 2 (commencing with Section 16700) of Part 2 of Division 7 of the Business and



Professions Code), arising from purchases of goods, services, or materials pursuant to the public works contract or the subcontract. This assignment shall be made and become effective at the time the awarding body tenders final payment to the contractor, without further acknowledgment by the parties.

**28.1.2** Section 4552 of the Government Code states in pertinent part:

In submitting a bid to a public purchasing body, the bidder offers and agrees that if the bid is accepted, it will assign to the purchasing body all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Sec. 15) or under the Cartwright Act (Chapter 2 (commencing with Section 16700) of Part 2 of Division 7 of the Business and Professions Code), arising from purchases of goods, materials, or services by the bidder for sale to the purchasing body pursuant to the bid. Such assignment shall be made and become effective at the time the purchasing body tenders final payment to the bidder.

**28.1.3** Section 4553 of the Government Code states in pertinent part:

If an awarding body or public purchasing body receives, either through judgment or settlement, a monetary recovery for a cause of action assigned under this chapter, the assignor shall be entitled to receive reimbursement for actual legal costs incurred and may, upon demand, recover from the public body any portion of the recovery, including treble damages, attributable to overcharges that were paid by the assignor but were not paid by the public body as part of the bid price, less the expenses incurred in obtaining that portion of the recovery.

**28.1.4** Section 4554 of the Government Code states in pertinent part:

Upon demand in writing by the assignor, the assignee shall, within one year from such demand, reassign the cause of action assigned under this part if the assignor has been or may have been injured by the violation of law for which the cause of action arose and (a) the assignee has not been injured thereby, or (b) the assignee declines to file a court action for the cause of action.

**28.1.5** Under this Article, "public purchasing body" is District and "bidder" is Developer.

**28.2 Excise Taxes**

If, under Federal Excise Tax Law, any transaction hereunder constitutes a sale on which a Federal Excise Tax is imposed and the sale is exempt from such Federal Excise Tax because it is a sale to a State or Local Government for its exclusive use, District, upon request, will execute documents necessary to show (1) that District is a political subdivision of the State for the purposes of such exemption, and (2) that the sale is for the exclusive use of District. No Federal Excise Tax for such materials shall be included in any Guaranteed Maximum Price.

**28.3 Taxes**

Guaranteed Maximum Price is to include any and all applicable sales taxes or other taxes that may be due in accordance with section 7051 et seq. of the Revenue and Taxation Code, Regulation 1521 of the State Board of Equalization or any other tax code that may be applicable.

#### **28.4 Shipments**

Developer is responsible for any or all damage or loss to shipments until delivered and accepted on Site, as indicated in the Contract Documents. There must be no charge for containers, packing, unpacking, drayage, or insurance. The total Guaranteed Maximum Price shall be all inclusive (including sales tax) and no additional costs of any type will be considered.

#### **28.5 Compliance with Government Reporting Requirements**

If this Contract is subject to federal or other governmental reporting requirements because of federal or other governmental financing in whole or in part for the Project of which it is part, or for any other reason, Developer shall comply with those reporting requirements at the request of the District at no additional cost.

[END OF DOCUMENT]

**SUMMARY OF WORK**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Site Access Conditions and Requirements;
- B. Special Conditions.

**1.02 SUMMARY OF WORK COVERED BY CONTRACT DOCUMENTS**

- A. The Work of this Contract consists of the following:
  - Replacement of existing mechanical units with new all-electric Heat Pump HVAC units in bldgs. A, B, C, E, F, G, and H and associate site work.
  - Upgrade of existing electrical infrastructure- transformer and switchgear, and associated site work.
  - Upgrade of existing Tech/ Low-voltage systems throughout campus, excluding Bldg D, MPR, TKK.
  - Upgrade of existing Fire alarm systems throughout campus, excluding bldgs. MPR and TKK.
  - Renovation of existing entry plaza.
  - Installation of a new fence trash enclosure.

**1.03 CONTRACTS**

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

**1.04 CODES, REGULATIONS, AND STANDARDS**

- A. The codes, regulations, and standards adopted by the state and federal agencies having jurisdiction shall govern minimum requirements for this 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.
- B. Codes, regulations, and standards shall be as published effective as of date of bid opening, unless otherwise specified or indicated.

**1.05 PROJECT RECORD DOCUMENTS**

- A. Contractor shall maintain on Site one set of the following record documents; Contractor shall record actual revisions to the Work:

- (1) Contract Drawings.
  - (2) Specifications.
  - (3) Addenda.
  - (4) Change Orders and other modifications to the Contract.
  - (5) Reviewed shop drawings, product data, and samples.
  - (6) Field test records.
  - (7) Inspection certificates.
  - (8) Manufacturer's certificates.
- B. Contractor shall store Record Documents separate from documents used for construction. Provide files, racks, and secure storage for Record Documents and samples.
- C. Contractor shall record information concurrent with construction progress.
- D. Specifications: Contractor shall legibly mark and record at each product section of the Specifications the description of the actual product(s) installed, including the following:
- (1) Manufacturer's name and product model and number.
  - (2) Product substitutions or alternates utilized.
  - (3) Changes made by Addenda and Change Orders and written directives.

#### **1.06 EXAMINATION OF EXISTING CONDITIONS**

- A. Contractor shall be held to have examined the Project Site and acquainted itself with the conditions of the Site and of the streets or roads approaching the Site.
- B. 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.
- C. 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.

#### **1.07 CONTRACTOR'S USE OF PREMISES**

- A. 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.

- B. 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.
- C. Contractor shall not interfere with use of or access to occupied portions of the building(s) or adjacent property.
- D. Contractor shall maintain corridors, stairs, halls, and other exit-ways of building clear and free of debris and obstructions at all times.
- E. 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.
- F. The Contractor shall install the construction fence and maintain that it will be locked when not in use. Keys to this fencing will be provided to the District.

#### **1.08 PROTECTION OF EXISTING STRUCTURES AND UTILITIES**

- A. 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.
- B. 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.

#### **1.09 UTILITY SHUTDOWNS AND INTERRUPTIONS**

- A. 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. The 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.
- B. 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.

#### **1.10 STRUCTURAL INTEGRITY**

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

**PART 2 – PRODUCTS Not Used.**

**PART 3 – EXECUTION Not Used.**

END OF DOCUMENT

**ALLOWANCE**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

A. Non-specified work.

**1.2 RELATED SECTIONS**

A. Document 01 11 00 (Summary of Work)

**1.3 ALLOWANCES**

- A. Included in the Contract, a stipulated sum/price of **[INSERT AMOUNT]** as an allowance for Unforeseen Conditions within the limits set forth in the Contract Documents. This Allowance shall not be utilized without written approval by the District.
- B. Contractor's costs, without overhead and profit, for products, delivery, installation, labor, insurance, payroll, taxes, bonding and equipment rental will be included in Allowance Expenditure Directive authorizing expenditure of funds from this Allowance. No overhead and profit shall be added to the Allowance Expenditure Directive.
- C. Funds will be drawn from Allowance only with District approval evidenced by an Allowance Expenditure Directive.
- D. At Contract closeout, funds remaining in Allowance will be credited to District by Change Order.
- E. Whenever costs are more than the Allowance, the amount covered by the Allowance will be approved at cost. The Contract Price shall be adjusted by Change Order for amounts in excess of the Allowance.

**PART 2 PRODUCTS**

Not used.

**PART 3 EXECUTION**

Not used.

END OF DOCUMENT

**ALTERNATES AND UNIT PRICING**

**PART 1 – ALTERNATES**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A.** General Conditions;
- B.** Special Conditions;
- C.** Bid Form and Proposal;
- D.** Instruction to Bidders.

**1.02 DESCRIPTION**

The items of work indicated below propose modifications to, substitutions for, additions to and/or deletions from the various parts of the Work specified in other Sections of the Specifications. The acceptance or rejection of any of the alternates is strictly at the option of the District subject to District's acceptance of Contractor's stated prices contained in this Proposal.

**1.03 GENERAL**

Where an item is omitted, or scope of Work is decreased, all Work pertaining to the item whether specifically stated or not, shall be omitted and where an item is added or modified or where scope of Work is increased, all Work pertaining to that 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.

**1.04 BASE BID**

The Base Bid includes all work required to construct the Project completely and in accordance with the Contract Documents.

**1.05 ALTERNATES**

- A.** \_\_\_\_\_
- B.** \_\_\_\_\_

The above Alternate descriptions are general in nature and for reference purposes only. The Contract Documents, including, without limitation, the Drawings and Specifications, must be referred to for the complete scope of Work.



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**PART 2 - UNIT PRICING**

**2.01 GENERAL**

Contractor shall completely state all required figures based on Unit Prices listed below. 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.

**2.02 UNIT PRICES**

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

A. \_\_\_\_\_

B. \_\_\_\_\_

END OF DOCUMENT

**PRODUCT OPTIONS AND SUBSTITUTIONS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. Instructions to Bidders;
- B. General Conditions, including, without limitation, Substitutions For Specified Items; and
- C. Special Conditions.

**1.02 SUBSTITUTIONS OF MATERIALS AND EQUIPMENT**

- A. Catalog numbers and specific brands or trade names followed by the designation "or equal" are used in conjunction with material and equipment required by the Specifications to establish the standards of quality, utility, and appearance required. Substitutions which are equal in quality, utility, and appearance to those specified may be reviewed subject to the provisions of the General Conditions.
- B. Wherever more than one manufacturer's product is specified, the first-named product is the basis for the design used in the work and the use of alternative-named manufacturers' products or substitutes may require modifications in that design. If such alternatives are proposed by Contractor and are approved by the District and/or the Architect, Contractor shall assume all costs required to make necessary revisions and modifications of the design resulting from the substitutions requested by the Contractor.
- C. When materials and equipment are specified by first manufacturer's name and product number, second manufacturer's name and "or approved equal," supporting data for the second product, if proposed by Contractor, shall be submitted in accordance with the requirements for substitutions. The District's Board has found and determined that certain item(s) shall be used on this Project based on the purpose(s) indicated pursuant to Public Contract Code section 3400(c). These findings, as well as the products and brand or trade names, have been identified in the Notice to Bidders.
- D. The Contractor will not be allowed to substitute specified items unless the request for substitution is submitted as follows:
  - (1) District must receive any notice of request for substitution of a specified item a minimum of ten (10) calendar days prior to bid opening.

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- (2) Within 35 days after the date of the Notice of Award, the Contractor shall submit data substantiating the request(s) for all substitution(s) containing sufficient information to assess acceptability of product or system and impact on Project, including, without limitation, the requirements specified in the Special Conditions and the technical Specifications. Insufficient information shall be grounds for rejection of substitution.
- E. If the District and/or Architect, in reviewing proposed substitute materials and equipment, require revisions or corrections to be made to previously accepted Shop Drawings and supplemental supporting data to be resubmitted, Contractor shall promptly do so. If any proposed substitution is judged by the District and/or Architect to be unacceptable, the specified material or equipment shall be provided.
- F. Samples may be required. Tests required by the District and/or Architect for the determination of quality and utility shall be made at the expense of Contractor, with acceptance of the test procedure first given by the District.
- G. In reviewing the supporting data submitted for substitutions, the District and/or Architect will use for purposes of comparison all the characteristics of the specified material or equipment as they appear in the manufacturer's published data even though all the characteristics may not have been particularly mentioned in the Contract Documents. If more than two (2) submissions of supporting data are required, the cost of reviewing the additional supporting data shall be borne by Contractor, and the District will deduct the costs from the Contract Price. The Contractor shall be responsible for any re-design costs occasioned by District's acceptance and/or approval of any substitute.
- H. The Contractor shall, in the event that a substitute is less costly than that specified, credit the District with one hundred percent (100%) of the net difference between the substitute and the originally specified material. In this event, the Contractor agrees to execute a deductive Change Order to reflect that credit. In the event Contractor furnishes a material, process, or article more expensive than that specified, the difference in the cost of that material, process, or article so furnished shall be borne by Contractor.
- I. In no event shall the District be liable for any increase in Contract Price or Contract Time due to any claimed delay in the evaluation of any proposed substitute or in the acceptance or rejection of any proposed substitute.

**PART 2 – PRODUCTS Not Used.**

**PART 3 – EXECUTION Not Used.**

END OF DOCUMENT

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**CHANGES IN THE WORK**

**CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE PROVISIONS IN THE AGREEMENT, GENERAL CONDITIONS, AND SPECIAL CONDITIONS, IF USED, RELATED TO CHANGES AND/OR REQUESTS FOR CHANGES.**

END OF DOCUMENT

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SECTION 01 26 73 – DSA CONSTRUCTION CHANGE DOCUMENT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing DSA Construction Change Documents for modifications of portions of the project affecting the Structural Safety, Access Compliance, and Fire and Life Safety.

1.02 DEFINITIONS

- A. DSA: Division of the State Architect.

1.03 CONSTRUCTION CHANGE DOCUMENT

- A. Construction Change Document: Architect will submit a Construction Change Document on DSA Form 140 Application for Approval of Construction Change Document to DSA. Upon DSA approval of a Construction Change Document, Architect will notify Contractor to proceed with the change in the Work, for subsequent inclusion in a Change Order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

HMC Architects

3584002100

DSA CONSTRUCTION CHANGE  
DOCUMENT PROCEDURES  
01 26 73 - 1

**PROJECT MEETINGS**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions; and
- B. Special Conditions.

**1.02 PROGRESS MEETINGS:**

- A. Contractor shall schedule and hold regular weekly progress meetings after a minimum of one week's prior written notice of the meeting date and time to all Invitees as indicated below.
- B. Location: Contractor's field office.
- C. The Contractor shall notify and invite the following entities ("Invitees"):
  - (1) District Representative.
  - (2) Contractor.
  - (3) Contractor's Project Manager.
  - (4) Contractor's Superintendent.
  - (5) Subcontractors, as appropriate to the agenda of the meeting.
  - (6) Suppliers, as appropriate to the agenda of the meeting.
  - (7) Construction Manager, if any.
  - (8) Architect
  - (9) Engineer(s), if any and as appropriate to the agenda of the meeting.
  - (10) Others, as appropriate to the agenda of the meeting.
- D. The District's and/or the Architect's Consultants will attend at their discretion, in response to the agenda.
- E. The District representative, the Construction Manager, and/or another District Agent shall take and distribute meeting notes to attendees and other concerned parties. If exceptions are taken to anything in the meeting notes,

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those exceptions shall be stated in writing to the District within five (5)  
working days following District's distribution of the meeting notes.

**1.03 PRE-INSTALLATION/PERFORMANCE MEETING:**

- A. Contractor shall schedule a meeting prior to the start of each of the following portions of the Work: cutting and patching of plaster and roofing, and other weather-exposed and moisture-resistant products. Contractor shall invite all Invitees to this meeting, and others whose work may affect or be affected by the quality of the cutting and patching work.
- B. Contractor shall review in detail prior to this meeting, the manufacturer's requirements and specifications, applicable portions of the Contract Documents, Shop Drawings, and other submittals, and other related work. At this meeting, invitees shall review and resolve conflicts, incompatibilities, or inadequacies discovered or anticipated.
- C. Contractor shall review in detail Project conditions, schedule, requirements for performance, application, installation, and quality of completed Work, and protection of adjacent Work and property.
- D. Contractor shall review in detail means of protecting the completed Work during the remainder of the construction period.

**PART 2 - PRODUCTS Not Used.**

**PART 3 - EXECUTION Not Used.**

END OF DOCUMENT

**SCHEDULING OF WORK**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions;
- C. Summary of Work; and
- D. Submittals.

**1.02 SECTION INCLUDES**

- A. Scheduling of Work under this Contract shall be performed by Contractor in accordance with requirements of this Section.
  - (1) Development of schedule, cost and resource loading of the schedule, monthly payment requests, and project status reporting requirements of the Contract shall employ computerized Critical Path Method ("CPM") scheduling ("CPM Schedule").
  - (2) CPM Schedule shall be cost loaded based on Schedule of Values as approved by District.
  - (3) Submit schedules and reports as specified in the General Conditions.
- B. Upon Award of Contract, Contractor shall immediately commence development of Initial and Original CPM Schedules to ensure compliance with CPM Schedule submittal requirements.

**1.03 CONSTRUCTION SCHEDULE**

- A. Within ten (10) days of issuance of the Notice to Proceed and before request for first progress payment, the Contractor shall prepare and submit to the Project Manager a construction progress schedule conforming to the Milestone Schedule below.
- B. The Construction Schedule shall be continuously updated, and an updated schedule shall be submitted with each application for progress payment. Each revised schedule shall indicate the work actually accomplished during the previous period and the schedule for completion of the remaining work.



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C. Milestone Schedule:

<b>ACTIVITY DESCRIPTION</b>	<b>REQUIRED COMPLETION</b>
<b>CONSTRUCTION STARTS</b>	<b>[DATE]</b>
<b>FINAL PROJECT COMPLETION</b>	<b>[DATE]</b>

#### **1.04 QUALIFICATIONS**

- A. Contractor shall employ experienced scheduling personnel qualified to use the latest version of [i.e., Primavera Project Planner]. Experience level required is set forth below. Contractor may employ such personnel directly or may employ a consultant for this purpose.
- (1) The written statement shall identify the individual who will perform CPM scheduling.
  - (2) Capability and experience shall be verified by description of construction projects on which individual has successfully applied computerized CPM.
  - (3) Required level of experience shall include at least two (2) projects of similar nature and scope with value not less than three fourths ( $\frac{3}{4}$ ) of the Total Bid Price of this Project. The written statement shall provide contact persons for referenced projects with current telephone and address information.
- B. District reserves the right to approve or reject Contractor's scheduler or consultant at any time. District reserves the right to refuse replacing of Contractor's scheduler or consultant, if District believes replacement will negatively affect the scheduling of Work under this Contract.

#### **1.05 GENERAL**

- A. Progress Schedule shall be based on and incorporate milestone and completion dates specified in Contract Documents.
- B. Overall time of completion and time of completion for each milestone shown on Progress Schedule shall adhere to times in the Contract, unless an earlier (advanced) time of completion is requested by Contractor and agreed to by District. Any such agreement shall be formalized by a Change Order.
- (1) District is not required to accept an early completion schedule, i.e., one that shows an earlier completion date than the Contract Time.
  - (2) Contractor shall not be entitled to extra compensation in event agreement is reached on an earlier completion schedule and Contractor completes its Work, for whatever reason, beyond completion date shown in its early completion schedule but within the Contract Time.

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- (3) A schedule showing the work completed in less than the Contract Time, and that has been accepted by District, shall be considered to have Project Float. The Project Float is the time between the scheduled completion of the work and the Completion Date. Project Float is a resource available to both District and the Contractor.
- C. Ownership Project Float: Neither the District nor Contractor owns Project Float. The Project owns the Project Float. As such, liability for delay of the Completion Date rests with the party whose actions, last in time, actually cause delay to the Completion Date.
  - (1) For example, if Party A uses some, but not all of the Project Float and Party B later uses remainder of the Project Float as well as additional time beyond the Project Float, Party B shall be liable for the time that represents a delay to the Completion Date.
  - (2) Party A would not be responsible for the time since it did not consume the entire Project Float and additional Project Float remained; therefore, the Completion Date was unaffected by Party A.
- D. Progress Schedule shall be the basis for evaluating job progress, payment requests, and time extension requests. Responsibility for developing Contract CPM Schedule and monitoring actual progress as compared to Progress Schedule rests with Contractor.
- E. Failure of Progress Schedule to include any element of the Work, or any inaccuracy in Progress Schedule, will not relieve Contractor from responsibility for accomplishing the Work in accordance with the Contract. District's acceptance of schedule shall be for its use in monitoring and evaluating job progress, payment requests, and time extension requests and shall not, in any manner, impose a duty of care upon District, or act to relieve Contractor of its responsibility for means and methods of construction.
- F. Software: Use **[i.e., District Project Planner for Windows, latest version]**. Such software shall be compatible with Windows operating system. Contractor shall transmit contract file to District on compact disk at times requested by District.
- G. Transmit each item under the form approved by District.
  - (1) Identify Project with District Contract number and name of Contractor.
  - (2) Provide space for Contractor's approval stamp and District's review stamps.
  - (3) Submittals received from sources other than Contractor will be returned to the Contractor without District's review.

**1.06 INITIAL CPM SCHEDULE**

- A. Initial CPM Schedule submitted for review at the pre-construction conference shall serve as Contractor's schedule for up to ninety (90) calendar days after the Notice to Proceed.

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- B. Indicate detailed plan for the Work to be completed in first ninety (90) days of the Contract; details of planned mobilization of plant and equipment; sequence of early operations; procurement of materials and equipment. Show Work beyond ninety (90) calendar days in summary form.
- C. Initial CPM Schedule shall be time scaled.
- D. Initial CPM Schedule shall be cost and resource loaded. Accepted cost and resource loaded schedule will be used as basis for monthly progress payments until acceptance of the Original CPM Schedule. Use of Initial CPM Schedule for progress payments shall not exceed ninety (90) calendar days.
- E. District and Contractor shall meet to review and discuss the Initial CPM Schedule within seven (7) calendar days after it has been submitted to District.
  - (1) District's review and comment on the schedule shall be limited to Contract conformance (with sequencing, coordination, and milestone requirements).
  - (2) Contractor shall make corrections to schedule necessary to comply with Contract requirements and shall adjust schedule to incorporate any missing information requested by District. Contractor shall resubmit Initial CPM Schedule if requested by District.
- F. If, during the first ninety (90) days after Notice to Proceed, the Contractor is of the opinion that any of the Work included on its Initial CPM Schedule has been impacted, the Contractor shall submit to District a written Time Impact Evaluation ("TIE") in accordance with Article 1.12 of this Section. The TIE shall be based on the most current update of the Initial CPM Schedule.

**1.07 ORIGINAL CPM SCHEDULE**

- A. Submit a detailed proposed Original CPM Schedule presenting an orderly and realistic plan for completion of the Work in conformance with requirements as specified herein.
- B. Progress Schedule shall include or comply with following requirements:
  - (1) Time scaled, cost and resource (labor and major equipment) loaded CPM schedule.
  - (2) No activity on schedule shall have duration longer than fifteen (15) work days, with exception of submittal, approval, fabrication and procurement activities, unless otherwise approved by District.
    - (a) Activity durations shall be total number of actual work days required to perform that activity.
  - (3) The start and completion dates of all items of Work, their major components, and milestone completion dates, if any.

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- (4) District furnished materials and equipment, if any, identified as separate activities.
- (5) Activities for maintaining Project Record Documents.
- (6) Dependencies (or relationships) between activities.
- (7) Processing/approval of submittals and shop drawings for all material and equipment required per the Contract. Activities that are dependent on submittal acceptance or material delivery shall not be scheduled to start earlier than expected acceptance or delivery dates.
  - (a) Include time for submittals, re-submittals and reviews by District. Coordinate with accepted schedule for submission of Shop Drawings, samples, and other submittals.
  - (b) Contractor shall be responsible for all impacts resulting from re-submittal of Shop Drawings and submittals.
- (8) Procurement of major equipment, through receipt and inspection at jobsite, identified as separate activity.
  - (a) Include time for fabrication and delivery of manufactured products for the Work.
  - (b) Show dependencies between procurement and construction.
- (9) Activity description; what Work is to be accomplished and where.
- (10) The total cost of performing each activity shall be total of labor, material, and equipment, excluding overhead and profit of Contractor. Overhead and profit of the General Contractor shall be shown as a separate activity in the schedule. Sum of cost for all activities shall equal total Contract value.
- (11) Resources required (labor and major equipment) to perform each activity.
- (12) Responsibility code for each activity corresponding to Contractor or Subcontractor responsible for performing the Work.
- (13) Identify the activities which constitute the controlling operations or critical path. No more than twenty-five (25%) of the activities shall be critical or near critical. Near critical is defined as float in the range of one (1) to (10) days.
- (14) Twenty (20) workdays for developing punch list(s), completion of punch-list items, and final clean up for the Work or any designated portion thereof. No other activities shall be scheduled during this period.
- (15) Interface with the work of other contractors, District, and agencies such as, but not limited to, utility companies.

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- (16) Show detailed Subcontractor Work activities. In addition, furnish copies of Subcontractor schedules upon which CPM was built.
  - (a) Also furnish for each Subcontractor, as determined by District, submitted on Subcontractor letterhead, a statement certifying that Subcontractor concurs with Contractor's Original CPM Schedule and that Subcontractor's related schedules have been incorporated, including activity duration, cost and resource loading.
  - (b) Subcontractor schedules shall be independently derived and not a copy of Contractor's schedule.
  - (c) In addition to Contractor's schedule and resource loading, obtain from electrical, mechanical, and plumbing Subcontractors, and other Subcontractors as required by District, productivity calculations common to their trades, such as units per person day, feet of pipe per day per person, feet of wiring per day per person, and similar information.
  - (d) Furnish schedule for Contractor/Subcontractor CPM schedule meetings which shall be held prior to submission of Original CPM schedule to District. District shall be permitted to attend scheduled meetings as an observer.
- (17) Activity durations shall be in Work days.
- (18) Submit with the schedule a list of anticipated non-Work days, such as weekends and holidays. The Progress Schedule shall exclude in its Work day calendar all non-Work days on which Contractor anticipates critical Work will not be performed.
- C. Original CPM Schedule Review Meeting: Contractor shall, within sixty (60) days from the Notice to Proceed date, meet with District to review the Original CPM Schedule submittal.
  - (1) Contractor shall have its Project Manager, Project Superintendent, Project Scheduler, and key Subcontractor representatives, as required by District, in attendance. The meeting will take place over a continuous one (1) day period.
  - (2) District's review will be limited to submittal's conformance to Contract requirements including, but not limited to, coordination requirements. However, review may also include:
    - (a) Clarifications of Contract Requirements.
    - (b) Directions to include activities and information missing from submittal.
    - (c) Requests to Contractor to clarify its schedule.

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- (3) Within five (5) days of the Schedule Review Meeting, Contractor shall respond in writing to all questions and comments expressed by District at the Meeting.

**1.08 ADJUSTMENTS TO CPM SCHEDULE**

- A. Adjustments to Original CPM Schedule: Contractor shall have adjusted the Original CPM Schedule submittal to address all review comments from original CPM Schedule review meeting and resubmit network diagrams and reports for District's review.
- (1) District, within ten (10) days from date that Contractor submitted the revised schedule, will either:
- (a) Accept schedule and cost and resource loaded activities as submitted, or
- (b) Advise Contractor in writing to review any part or parts of schedule which either do not meet Contract requirements or are unsatisfactory for District to monitor Project's progress, resources, and status or evaluate monthly payment request by Contractor.
- (2) District may accept schedule with conditions that the first monthly CPM Schedule update be revised to correct deficiencies identified.
- (3) When schedule is accepted, it shall be considered the "Original CPM Schedule" which will then be immediately updated to reflect the current status of the work.
- (4) District reserves right to require Contractor to adjust, add to, or clarify any portion of schedule which may later be discovered to be insufficient for monitoring of Work or approval of partial payment requests. No additional compensation will be provided for such adjustments, additions, or clarifications.
- B. Acceptance of Contractor's schedule by District will be based solely upon schedule's compliance with Contract requirements.
- (1) By way of Contractor assigning activity durations and proposing sequence of Work, Contractor agrees to utilize sufficient and necessary management and other resources to perform work in accordance with the schedule.
- (2) Upon submittal of schedule update, updated schedule shall be considered "current" CPM Schedule.
- (3) Submission of Contractor's schedule to District shall not relieve Contractor of total responsibility for scheduling, sequencing, and pursuing Work to comply with requirements of Contract Documents, including adverse effects such as delays resulting from ill-timed Work.

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- C. Submittal of Original CPM Schedule, and subsequent schedule updates, shall be understood to be Contractor's representation that the Schedule meets requirements of Contract Documents and that Work shall be executed in sequence indicated on the schedule.
- D. Contractor shall distribute Original CPM Schedule to Subcontractors for review and written acceptance, which shall be noted on Subcontractors' letterheads to Contractor and transmitted to District for the record.

**1.09 MONTHLY CPM SCHEDULE UPDATE SUBMITTALS**

- A. Following acceptance of Contractor's Original CPM Schedule, Contractor shall monitor progress of Work and adjust schedule each month to reflect actual progress and any anticipated changes to planned activities.
  - (1) Each schedule update submitted shall be complete, including all information requested for the Original CPM Schedule submittal.
  - (2) Each update shall continue to show all Work activities including those already completed. These completed activities shall accurately reflect "as built" information by indicating when activities were actually started and completed.
- B. A meeting will be held on approximately the twenty-fifth (25th) of each month to review the schedule update submittal and progress payment application.
  - (1) At this meeting, at a minimum, the following items will be reviewed: Percent (%) complete of each activity; Time Impact Evaluations for Change Orders and Time Extension Request; actual and anticipated activity sequence changes; actual and anticipated duration changes; and actual and anticipated Contractor delays.
  - (2) These meetings are considered a critical component of overall monthly schedule update submittal and Contractor shall have appropriate personnel attend. At a minimum, these meetings shall be attended by Contractor's General Superintendent and Scheduler.
  - (3) Contractor shall plan on the meeting taking no less than four (4) hours.
- C. Within five (5) working days after monthly schedule update meeting, Contractor shall submit the updated CPM Schedule update.
- D. Within five (5) work days of receipt of above noted revised submittals, District will either accept or reject monthly schedule update submittal.
  - (1) If accepted, percent (%) complete shown in monthly update will be basis for Application for Payment by the Contractor. The schedule update shall be submitted as part of the Contractor's Application for Payment.

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- (2) If rejected, update shall be corrected and resubmitted by Contractor before the Application for Payment is submitted.
- E. Neither updating, changing or revising of any report, curve, schedule, or narrative submitted to District by Contractor under this Contract, nor District's review or acceptance of any such report, curve, schedule or narrative shall have the effect of amending or modifying in any way the Completion Date or milestone dates or of modifying or limiting in any way Contractor's obligations under this Contract.

**1.10 SCHEDULE REVISIONS**

- A. Updating the Schedule to reflect actual progress shall not be considered revisions to the Schedule. Since scheduling is a dynamic process, revisions to activity durations and sequences are expected on a monthly basis.
- B. To reflect revisions to the Schedule, the Contractor shall provide District with a written narrative with a full description and reasons for each Work activity revised. For revisions affecting the sequence of work, the Contractor shall provide a schedule diagram which compares the original sequence to the revised sequence of work. The Contractor shall provide the written narrative and schedule diagram for revisions two (2) working days in advance of the monthly schedule update meeting.
- C. Schedule revisions shall not be incorporated into any schedule update until the revisions have been reviewed by District. District may request further information and justification for schedule revisions and Contractor shall, within three (3) days, provide District with a complete written narrative response to District's request.
- D. If the Contractor's revision is still not accepted by District, and the Contractor disagrees with District's position, the Contractor has seven (7) calendar days from receipt of District's letter rejecting the revision to provide a written narrative providing full justification and explanation for the revision. The Contractor's failure to respond in writing within seven (7) calendar days of District's written rejection of a schedule revision shall be contractually interpreted as acceptance of District's position, and the Contractor waives its rights to subsequently dispute or file a claim regarding District's position.
- E. At District's discretion, the Contractor can be required to provide Subcontractor certifications of performance regarding proposed schedule revisions affecting said Subcontractors.

**1.11 RECOVERY SCHEDULE**

- A. If the Schedule Update shows a completion date twenty-one (21) calendar days beyond the Contract Completion Date, or individual milestone completion dates, the Contractor shall submit to District the proposed revisions to recover the lost time within seven (7) calendar days. As part of this submittal, the Contractor shall provide a written narrative for each revision made to recapture the lost time. If the revisions include sequence changes, the Contractor shall provide a schedule diagram comparing the original sequence to the revised sequence of work.



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- B. The revisions shall not be incorporated into any schedule update until the revisions have been reviewed by District.
- C. If the Contractor's revisions are not accepted by District, District and the Contractor shall follow the procedures in paragraph 1.09.C, 1.09.D and 1.09.E above.
- D. At District's discretion, the Contractor can be required to provide Subcontractor certifications for revisions affecting said Subcontractors.

**1.12 TIME IMPACT EVALUATION ("TIE") FOR CHANGE ORDERS, AND OTHER DELAYS**

- A. When Contractor is directed to proceed with changed Work, the Contractor shall prepare and submit within fourteen (14) calendar days from the Notice to Proceed a TIE which includes both a written narrative and a schedule diagram depicting how the changed Work affects other schedule activities. The schedule diagram shall show how the Contractor proposes to incorporate the changed Work in the schedule and how it impacts the current schedule-update critical path. The Contractor is also responsible for requesting time extensions based on the TIE's impact on the critical path. The diagram must be tied to the main sequence of schedule activities to enable District to evaluate the impact of changed Work to the scheduled critical path.
- B. Contractor shall be required to comply with the requirements of Paragraph 1.09.A for all types of delays such as, but not limited to, Contractor/Subcontractor delays, adverse weather delays, strikes, procurement delays, fabrication delays, etc.
- C. Contractor shall be responsible for all costs associated with the preparation of TIEs, and the process of incorporating them into the current schedule update. The Contractor shall provide District with four (4) copies of each TIE.
- D. Once agreement has been reached on a TIE, the Contract Time will be adjusted accordingly. If agreement is not reached on a TIE, the Contract Time may be extended in an amount District allows, and the Contractor may submit a claim for additional time claimed by contractor.

**1.13 TIME EXTENSIONS**

- A. The Contractor is responsible for requesting time extensions for time impacts that, in the opinion of the Contractor, impact the critical path of the current schedule update. Notice of time impacts shall be given in accord with the General Conditions.
- B. Where an event for which District is responsible impacts the projected Completion Date, the Contractor shall provide a written mitigation plan, including a schedule diagram, which explains how (e.g., increase crew size, overtime, etc.) the impact can be mitigated. The Contractor shall also include a detailed cost breakdown of the labor, equipment, and material the Contractor would expend to mitigate District-caused time impact. The Contractor shall submit its mitigation plan to District within fourteen (14)

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calendar days from the date of discovery of the impact. The Contractor is responsible for the cost to prepare the mitigation plan.

- C. Failure to request time, provide TIE, or provide the required mitigation plan will result in Contractor waiving its right to a time extension and cost to mitigate the delay.
- D. No time will be granted under this Contract for cumulative effect of changes.
- E. District will not be obligated to consider any time extension request unless the Contractor complies with the requirements of Contract Documents.
- F. Failure of the Contractor to perform in accordance with the current schedule update shall not be excused by submittal of time extension requests.
- G. If the Contractor does not submit a TIE within the required fourteen (14) calendar days for any issue, it is mutually agreed that the Contractor does not require a time extension for said issue.

**1.14 SCHEDULE REPORTS**

- A. Submit four (4) copies of the following reports with the Initial CPM Schedule, the Original CPM Schedule, and each monthly update.
- B. Required Reports:
  - (1) Two activity listing reports: one sorted by activity number and one by total Project Float. These reports shall also include each activity's early/late and actual start and finish dates, original and remaining duration, Project Float, responsibility code, and the logic relationship of activities.
  - (2) Cost report sorted by activity number including each activity's associated cost, percentage of Work accomplished, earned value- to date, previous payments, and amount earned for current update period.
  - (3) Schedule plots presenting time-scaled network diagram showing activities and their relationships with the controlling operations or critical path clearly highlighted.
  - (4) Cash flow report calculated by early start, late start, and indicating actual progress. Provide an exhibit depicting this information in graphic form.
  - (5) Planned versus actual resource (i.e., labor) histogram calculated by early start and late start.
- C. Other Reports:

In addition to above reports, District may request, from month to month, any two of the following reports. Submit four (4) copies of all reports.

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- (1) Activities by early start.
  - (2) Activities by late start.
  - (3) Activities grouped by Subcontractors or selected trades.
  - (4) Activities with scheduled early start dates in a given time frame, such as fifteen (15) or thirty (30) day outlook.
- D. Furnish District with report files on compact disks containing all schedule files for each report generated.

**1.15 PROJECT STATUS REPORTING**

- A. In addition to submittal requirements for CPM scheduling identified in this Section, Contractor shall provide a monthly project status report (i.e., written narrative report) to be submitted in conjunction with each CPM Schedule as specified herein. Status reporting shall be in form specified below.
- B. Contractor shall prepare monthly written narrative reports of status of Project for submission to District. Written status reports shall include:
- (1) Status of major Project components (percent (%) complete, amount of time ahead or behind schedule) and an explanation of how Project will be brought back on schedule if delays have occurred.
  - (2) Progress made on critical activities indicated on CPM Schedule.
  - (3) Explanations for any lack of work on critical path activities planned to be performed during last month.
  - (4) Explanations for any schedule changes, including changes to logic or to activity durations.
  - (5) List of critical activities scheduled to be performed next month.
  - (6) Status of major material and equipment procurement.
  - (7) Any delays encountered during reporting period.
  - (8) Contractor shall provide printed report indicating actual versus planned resource loading for each trade and each activity. This report shall be provided on weekly and monthly basis.
    - (a) Actual resource shall be accumulated in field by Contractor, and shall be as noted on Contractor's daily reports. These reports will be basis for information provided in computer-generated monthly and weekly printed reports.
    - (b) Contractor shall explain all variances and mitigation measures.

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- (9) Contractor may include any other information pertinent to status of Project. Contractor shall include additional status information requested by District at no additional cost.
- (10) Status reports, and the information contained therein, shall not be construed as claims, notice of claims, notice of delay, or requests for changes or compensation.

**1.16 WEEKLY SCHEDULE REPORT**

At the Weekly Progress Meeting, the Contractor shall provide and present a time-scaled three (3) week look-ahead schedule that is based and correlated by activity number to the current schedule (i.e., Initial, Original CPM, or Schedule Update).

**1.17 DAILY CONSTRUCTION REPORTS**

On a daily basis, Contractor shall submit a daily activity report to District for each workday, including weekends and holidays when worked. Contractor shall develop the daily construction reports on a computer-generated database capable of sorting daily Work, manpower, and man-hours by Contractor, Subcontractor, area, sub-area, and Change Order Work. Upon request of District, furnish computer disk of this data base. Obtain District's written approval of daily construction report data base format prior to implementation. Include in report:

- A. Project name and Project number.
- B. Contractor's name and address.
- C. Weather, temperature, and any unusual site conditions.
- D. Brief description and location of the day's scheduled activities and any special problems and accidents, including Work of Subcontractors. Descriptions shall be referenced to CPM scheduled activities.
- E. Worker quantities for its own Work force and for Subcontractors of any tier.
- F. Equipment, other than hand tools, utilized by Contractor and Subcontractors.

**1.18 PERIODIC VERIFIED REPORTS**

Contractor shall complete and verify construction reports on a form prescribed by the Division of the State Architect and file reports on the first day of February, May, August, and November during the preceding quarter year; at the completion of the Contract; at the completion of the Work; at the suspension of Work for a period of more than one (1) month; whenever the services of Contractor or any of Contractor's Subcontractors are terminated for any reason; and at any time a special verified report is required by the Division of the State Architect. Refer to section 4-336 and section 4-343 of Part 1, Title 24 of the California Code of Regulations.

**PART 2 – PRODUCTS Not Used.**

**PART 3 – EXECUTION Not Used.**

END OF DOCUMENT

**SUBMITTALS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Contractor's Submittals and Schedules, Drawings and Specifications;
- B. Special Conditions.

**1.02 SECTION INCLUDES:**

- A. Definitions:
  - (1) Shop Drawings and Product Data are as indicated in the General Conditions and include, but are not limited to, fabrication, erection, layout and setting drawings, formwork and falsework drawings, manufacturers' standard drawings, descriptive literature, catalogues, brochures, performance and test data, wiring and control diagrams. In addition, there are other drawings and descriptive data pertaining to materials, equipment, piping, duct and conduit systems, and methods of construction as may be required to show that the materials, equipment or systems and all positions conform to the requirement of the Contract Documents, including, without limitation, the Drawings.
  - (2) "Manufactured" applies to standard units usually mass-produced; "fabricated" means specifically assembled or made out of selected materials to meet design requirements. Shop Drawings shall establish the actual detail of manufactured or fabricated items, indicated proper relation to adjoining work and amplify design details of mechanical and electrical equipment in proper relation to physical spaces in the structure.
  - (3) Manufacturer's Instructions: Where any item of Work is required by the Contract Documents to be furnished, installed, or performed, at a minimum, in accordance with a specified product manufacturer's instructions, the Contractor shall procure and distribute copies of these to the District, the Architect, and all other concerned parties and shall furnish, install, or perform the work, at a minimum, in accordance with those instructions.
- B. Samples, Shop Drawings, Product Data, and other items as specified, in accordance with the following requirements:
  - (1) Contractor shall submit all Shop Drawings, Product Data, and Samples to the District, the Architect, the Project Inspector, and the Construction Manager.

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- (2) Contractor shall comply with all time frames herein and in the General Conditions and, in any case, shall submit required information in sufficient time to permit proper consideration and action before ordering any materials or items represented by such Shop Drawings, Product Data, and/or Samples.
- (3) Contractor shall allow sufficient time so that no delay occurs due to required lead time in ordering or delivery of any item to the Site. Contractor shall be responsible for any delay in progress of Work due to its failure to observe these requirements.
- (4) Time for completion of Work shall not be extended on account of Contractor's failure to promptly submit Shop Drawings, Product Data, and/or Samples.
- (5) Reference numbers on Shop Drawings shall have Architectural and/or Engineering Contract Drawings reference numbers for details, sections, and "cuts" shown on Shop Drawings. These reference numbers shall be in addition to any numbering system that Contractor chooses to use or has adopted as standard.
- (6) When the magnitude or complexity of submittal material prevents a complete review within the stated time frame, Contractor shall make this submittal in increments to avoid extended delays.
- (7) Contractor shall certify on submittals for review that submittals conform to Contract requirements. Also certify that Contractor-furnished equipment can be installed in allocated space. In event of any variance, Contractor shall specifically state in transmittal and on Shop Drawings, portions vary and require approval of a substitute. Submittals shall not be used as a means of requesting a substitution.
- (8) Unless specified otherwise, sampling, preparation of samples, and tests shall be in accordance with the latest standard of the American Society for Testing and Materials.
- (9) Upon demand by Architect or District, Contractor shall submit samples of materials and/or articles for tests or examinations and consideration before Contractor incorporates same in Work. Contractor shall be solely responsible for delays due to sample(s) not being submitted in time to allow for tests. Acceptance or rejection will be expressed in writing. Work shall be equal to approved samples in every respect. Samples that are of value after testing will remain the property of Contractor.

C. Submittal Schedule:

- (1) Contractor shall prepare its proposed submittal schedule that is coordinated with the proposed construction schedule and submit both to the District within ten (10) days after the date of the Notice to Proceed. Contractor's proposed schedules shall become the Project Construction Schedule and the Project Submittal Schedule after each is approved by the District.

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- (2) Contractor is responsible for all lost time should the initial submittal be rejected, marked "revise and resubmit", etc.
- (3) All Submittals shall be forwarded to the District by the date indicated on the approved Submittal Schedule, unless an earlier date is necessary to maintain the Construction Schedule, in which case those Submittals shall be forwarded to the District so as not to delay the Construction Schedule.
- (4) Contractor may be assessed \$100 a day for each day it is late in submitting a shop drawing or sample. No extensions of time will be granted to Trade Contractor or any Subcontractor because of its failure to have shop drawings and samples submitted in accordance with the Schedule.

**1.03 SHOP DRAWINGS:**

- A. Contractor shall submit one reproducible transparency and six (6) opaque reproductions. The District will review and return the reproducible copy and one (1) opaque reproduction to Contractor.
- B. Before commencing installation of any Work, the Contractor shall submit and receive approval of all drawings, descriptive data, and material list(s) as required to accomplish Work.
- C. Review of Shop Drawings is regarded as a service to assist Contractor and in all cases original Contract Documents shall take precedence as outlined under General Conditions.
- D. No claim for extra time or payment shall be based on work shown on Shop Drawings unless the claim is (1) noted on Contractor's transmittal letter accompanying Shop Drawings and (2) Contractor has complied with all applicable provisions of the General Conditions, including, without limitation, provisions regarding changes and payment, and all required written approvals.
- E. District shall not review Shop Drawings for quantities of materials or number of items supplied.
- F. District's and/or Architect's review of Shop Drawing will be general. District and/or Architect review does not relieve Contractor of responsibility for dimensions, accuracy, proper fitting, construction of Work, furnishing of materials, or Work required by Contract Documents and not indicated on Shop Drawings. The District's and/or Architect's review of Shop Drawings is not to be construed as approving departures from Contract Documents.
- G. Review of Shop Drawings and Schedules does not relieve Contractor from responsibility for any aspect of those Drawings or Schedules that is a violation of local, County, State, or Federal laws, rules, ordinances, or rules and regulations of commissions, boards, or other authorities or utilities having jurisdiction.
- H. Before submitting Shop Drawings for review, Contractor shall check Shop Drawings of its subcontractors for accuracy, and confirm that all Work

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contiguous with and having bearing on other work shown on Shop Drawings is accurately drawn and in conformance with Contract Documents.

- I. Submitted drawings and details must bear stamp of approval of Contractor:
  - (1) Stamp and signature shall clearly certify that Contractor has checked Shop Drawings for compliance with Drawings.
  - (2) If Contractor submits a Shop Drawing without an executed stamp of approval, or whenever it is evident (despite stamp) that Drawings have not been checked, the District and/or Architect will not consider them and will return them to the Contractor for revision and resubmission. In that event, it will be deemed that Contractor has not complied with this provision and Contractor shall bear risk of all delays to same extent as if it had not submitted any Shop Drawings or details.
- J. Submission of Shop Drawings (in either original submission or when resubmitted with correction) constitutes evidence that Contractor has checked all information thereon and that it accepts and is willing to perform Work as shown.
- K. Contractor shall pay for cost of any changes in construction due to improper checking and coordination. Contractor shall be responsible for all additional costs, including coordination. Contractor shall be responsible for costs incurred by itself, the District, the Architect, the Project Inspector, the Construction Manager, any other Subcontractor or contractor, etc., due to improperly checked and/or coordination of submittals.
- L. Shop Drawings must clearly delineate the following information:
  - (1) Project name and address.
  - (2) Specification number and description.
  - (3) Architect's name and project number.
  - (4) Shop Drawing title, number, date, and scale.
  - (5) Names of Contractor, Subcontractor(s) and fabricator.
  - (6) Working and erection dimensions.
  - (7) Arrangements and sectional views.
  - (8) Necessary details, including complete information for making connections with other Work.
  - (9) Kinds of materials and finishes.
  - (10) Descriptive names of materials and equipment, classified item numbers, and locations at which materials or equipment are to be installed in the Work. Contractor shall use same reference identification(s) as shown on Contract Drawings.



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- M. Contractor shall prepare composite drawings and installation layouts when required to solve tight field conditions.
- (1) Shop Drawings shall consist of dimensioned plans and elevations and must give complete information, particularly as to size and location of sleeves, inserts, attachments, openings, conduits, ducts, boxes, structural interferences, etc.
  - (2) Contractor shall coordinate these composite Shop Drawings and installation layouts in the field between itself and its Subcontractor(s) for proper relationship to the Work, the work of other trades, and the field conditions. The Contractor shall check and approve all submittal(s) before submitting them for final review.

**1.04 PRODUCT DATA OR NON REPRODUCIBLE SUBMITTALS:**

- A. Contractor shall submit manufacturer's printed literature in original form. Any fading type of reproduction will not be accepted. Contractor must submit a minimum of six (6) each, to the District. District shall return one (1) to the Contractor, who shall reproduce whatever additional copies it requires for distribution.
- B. Contractor shall submit six (6) copies of a complete list of all major items of mechanical, plumbing, and electrical equipment and materials in accordance with the approved Submittal Schedule, except as required earlier to comply with the approved Construction Schedule. Other items specified are to be submitted prior to commencing Work. Contractor shall submit items of like kind at one time in a neat and orderly manner. Partial lists will not be acceptable.
- C. Submittals shall include manufacturer's specifications, physical dimensions, and ratings of all equipment. Contractor shall furnish performance curves for all pumps and fans. Where printed literature describes items in addition to that item being submitted, submitted item shall be clearly marked on sheet and superfluous information shall be crossed out. If highlighting is used, Contractor shall mark all copies.
- D. Equipment submittals shall be complete and include space requirements, weight, electrical and mechanical requirements, performance data, and supplemental information that may be requested.
- E. Imported Materials Certification must be submitted at least ten (10) days before material is delivered.

**1.05 SAMPLES:**

- A. Contractor shall submit for approval Samples as required and within the time frame in the Contract Documents. Materials such as concrete, mortar, etc., which require on-site testing will be obtained from Project Site.
- B. Contractor shall submit four (4) samples except where greater or lesser number is specifically required by Contract Documents including, without limitation, the Specifications.

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- (1) Samples must be of sufficient size and quality to clearly illustrate functional characteristics, with integrally related parts and attachment devices.
- (2) Samples must show full range of texture, color, and pattern.
- C. Contractor shall make all Submittals, unless it has authorized Subcontractor(s) to submit and Contractor has notified the District in writing to this effect.
- D. Samples to be shipped prepaid or hand-delivered to the District.
- E. Contractor shall mark samples to show name of Project, name of Contractor submitting, Contract number and segment of Work where representative Sample will be used, all applicable Specifications Sections and documents, Contract Drawing Number and detail, and ASTM or FS reference, if applicable.
- F. Contractor shall not deliver any material to Site prior to receipt of District's and/or Architect's completed written review and approval. Contractor shall furnish materials equal in every respect to approved Samples and execute Work in conformance therewith.
- G. District's and/or Architect's review, acceptance, and/or approval of Sample(s) will not preclude rejections of any material upon discovery of defects in same prior to final acceptance of completed Work.
- H. After a material has been approved, no change in brand or make will be permitted.
- I. Contractor shall prepare its Submittal Schedule and submit Samples of materials requiring laboratory tests to specified laboratory for testing not less than ninety (90) days before such materials are required to be used in Work.
- J. Samples which are rejected must be resubmitted promptly after notification of rejection and be marked "Resubmitted Sample" in addition to other information required.
- K. Field Samples and Mock-Ups are to be removed by Contractor at District's direction:
  - (1) Size: As Specified.
  - (2) Furnish catalog numbers and similar data, as requested.

**1.06 REVIEW AND RESUBMISSION REQUIREMENTS:**

- A. The District will arrange for review of Sample(s), Shop Drawing(s), Product Data, and other submittal(s) by appropriate reviewer and return to Contractor as provided below within twenty-one (21) days after receipt or within twenty-one (21) days after receipt of all related information necessary for such review, whichever is later.
- B. One (1) copy of product or materials data will be returned to Contractor with the review status.

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- C. Samples to be incorporated into the Work will be returned to Contractor, together with a written notice designating the Sample with the appropriate review status and indicating errors discovered on review, if any. Other Samples will not be returned, but the same notice will be given with respect thereto, and that notice shall be considered a return of the Sample.
- D. Contractor shall revise and resubmit any Sample(s), Shop Drawing(s), Product Data, and other submittal(s) as required by the reviewer. Such resubmittals will be reviewed and returned in the same manner as original Sample(s), Shop Drawing(s), Product Data, and other submittal(s), within fourteen (14) days after receipt thereof or within fourteen (14) days after receipt of all related information necessary for such review. Such resubmittal shall not delay the Work.
- E. Contractor may proceed with any of the Work covered by Sample(s), Shop Drawing(s), Product Data, and other submittal(s) upon its return if designated as no exception taken, or revise as noted, provided the Contractor proceeds in accordance with the District and/or the Architect's notes and comments.
- F. Contractor shall not begin any of the work covered by a Sample(s), Shop Drawing(s), Product Data, and other submittal(s), designated as revise and resubmit or rejected, until a revision or correction thereof has been reviewed and returned to Contractor.
- G. Sample(s), Shop Drawing(s), Product Data, and other submittal(s) designated as revise and resubmit or rejected and requiring resubmittal, shall be revised or corrected and resubmitted to the District no later than fourteen (14) days or a shorter period as required to comply with the approved Construction Schedule, after its return to Contractor.
- H. Neither the review nor the lack of review of any Sample(s), Shop Drawing(s), Product Data, and other submittal(s) shall waive any of the requirements of the Contract Documents, or relieve Contractor of any obligation thereunder.
- I. District's and/or Architect's review of Shop Drawings does not relieve the Contractor of responsibility for any errors that may exist. Contractor is responsible for the dimensions and design of adequate connections and details and for satisfactory construction of all the Work.

**PART 2 – PRODUCTS Not Used.**

**PART 3 - EXECUTION Not Used.**

END OF DOCUMENT

**SITE STANDARDS**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including without limitation, Site Access, Conditions, and Regulations;
- B. Special Conditions;
- C. Drug-Free Workplace Certification;
- D. Tobacco-Free Environment Certification;
- E. Criminal Background Investigation/Fingerprinting Certification;
- F. Temporary Facilities and Controls.

**1.02 REQUIREMENTS OF THE DISTRICT:**

- A. Drug-Free Schools and Safety Requirements:
  - (1) All school sites and other District Facilities have been declared "Drug-Free Zones." No drugs, alcohol and/or smoking are allowed at any time in any buildings and/or grounds on District property. No students, staff, visitors, or contractors are to use drugs on these sites.
  - (2) Smoking and the use of tobacco products by all persons is prohibited on or in District property. District property includes school buildings, school grounds, school-owned vehicles and vehicles owned by others while on District property. Contractor shall post: "Non-Smoking Area" in a highly visible location in each work area, staging area, and parking area. 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 is to be kept clean at all times.
  - (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.
- B. Language: Profanity or other unacceptable and/or loud language will not be tolerated, "Cat calls" or other derogatory language toward students, staff, volunteers, parents or public will not be allowed.

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C. Disturbing the Peace (Noise and Lighting):

- (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.
- (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 mobile phones or other handheld communication radios.
- (3) If portable lights are used after dark, all light must be located so as not to direct light into neighboring property.

D. Traffic:

- (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.
- (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.
- (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.
- (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 softscape areas that could otherwise be damaged.

- E. 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.

**PART 2 - PRODUCTS Not Used.**

**PART 3 - EXECUTION Not Used.**

END OF DOCUMENT

**REGULATORY REQUIREMENTS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Obtaining of Permits, Licenses and Registrations and Work to Comply with All Applicable Laws and Regulations;
- B. Special Conditions; and
- C. Quality Control.

**1.02 DESCRIPTION:**

This section covers the general requirements for regulatory requirements pertaining to the Work and is supplementary to all other regulatory requirements mentioned or referenced elsewhere in the Contract Documents.

**1.03 REQUIREMENTS OF REGULATORY AGENCIES:**

- A. All statutes, ordinances, laws, rules, codes, regulations, standards, and the lawful orders of all public authorities having jurisdiction over the Work, are hereby incorporated into these Contract Documents as if repeated in full herein and are intended to be included in any reference to Code or Building Code, unless otherwise specified, including, without limitation, the references in the list below. Contractor shall make available at the Site copies of all the listed documents applicable to the Work as the District and/or Architect may request, including, without limitation, applicable portions of the California Code of Regulations ("CCR").
  - (1) California Building Standards Administrative Code, Part 1, Title 24, CCR.
  - (2) California Building Code (CBC), Part 2, Title 24, CCR; (International Building Code volumes 1-2 and California Amendments).
  - (3) California Electrical Code (CEC), Part 3, Title 24, CCR; (National Electrical Code and California Amendments).
  - (4) California Mechanical Code (CMC), Part 4, Title 24, CCR; (Uniform Mechanical Code and California Amendments).
  - (5) California Plumbing Code (CPC), Part 5, Title 24, CCR; (Uniform Plumbing Code and California Amendments).

- (6) California Fire Code (CFC), Part 9, Title 24, CCR; (International Fire Code and California Amendments).
- (7) California Green Building Standards Code (CALGreen), Part 11, Title 24, CCR.
- (8) California Referenced Standards Code, Part 12, Title 24, CCR.
- (9) State Fire Marshal Regulations, Public Safety, Title 19, CCR.
- (10) Partial List of Applicable National Fire Protection Association (NFPA) Standards:
  - (a) NFPA 13 - Automatic Sprinkler System.
  - (b) NFPA 14 - Standpipes Systems.
  - (c) NFPA 17A - Wet Chemical System
  - (d) NFPA 24 - Private Fire Mains.
  - (e) (California Amended) NFPA 72 - National Fire Alarm Codes.
  - (f) NFPA 253 - Critical Radiant Flux of Floor Covering System.
  - (g) NFPA 2001 - Clean Agent Fire Extinguishing Systems.
- (11) California Division of the State Architect interpretation of Regulations ("DSA IR"), including, without limitation:
  - (a) DSA IR A-6 — Construction Change Document Submittal and Approval Processes.
  - (b) DSA IR A-7 — Project Inspector Certification and Approval.
  - (c) DSA IR A-8 — Project Inspector and Assistant Inspector Duties and Performance.
  - (d) DSA IR A-12 — Assistant Inspector Approval.
- (12) DSA Procedures ("DSA PR")
  - (a) DSA PR 13-01 – Construction Oversight Process
  - (b) DSA PR 13-02 – Project Certification Process

B. This Project shall be governed by applicable regulations, including, without limitation, the State of California's Administrative Regulations for the Division of the State Architect-Structural Safety (DSA/SS), Chapter 4, Part 1, Title 24, CCR, and the most current version on the date the bids are opened and as it pertains to school construction including, without limitation:

- (1) Test and testing laboratory per Section 4-335. District shall pay for the testing laboratory.
- (2) Special inspections per Section 4-333(c).
- (3) Deferred Approvals per section 4-317(g).
- (4) Verified reports per Sections 4-336 & 4-343(c).
- (5) Duties of the Architect & Engineers shall be per Sections 4-333(a) and 4-341.
- (6) Duties of the Contractor shall be per Section 4-343.
- (7) Duties of Project Inspector shall be per Section 4-342.
- (8) Addenda and Construction Change Documents per Section 4-338.

Contractor shall keep and make available all applicable parts of the most current version of Title 24 referred to in the plans and specifications at the Site during construction.

C. Items of deferred approval shall be clearly marked on the first sheet of the Architect's and/or Engineer's approved Drawings. All items later submitted for approval shall be per Title 24 requirements to the DSA.

- (1) Contractor shall submit the following to Architect for review and endorsement:
  - (a) Product information on proposed material/system supplier.
  - (b) Drawings, specifications, and calculations prepared, signed, and stamped by an architect or engineer licensed in the State of California for that portion of the Work.
  - (c) All other requirements as may be required by DSA.
- (2) Cost of preparing and submitting documentation per DSA Deferred Approval requirements including required modifications to Drawings and Specifications, whether or not indicated in the Contract Documents, shall be borne by Contractor.
- (3) Contractor shall not begin fabrication and installation of deferred approval items without first obtaining DSA approval of Drawings and Specifications.
- (4) Schedule of Work Subject to DSA Deferred Approval: None

**PART 2 – PRODUCTS Not Used.**

**PART 3 – EXECUTION Not Used.**

END OF DOCUMENT



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**ABBREVIATIONS AND ACRONYMS**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions including without limitation, Definitions;
- B. Special Conditions.

**1.02 DOCUMENT INCLUDES:**

- A. Abbreviations used throughout the Contract Documents.
- B. Reference to a technical society, organization, or body is by abbreviation, as follows:

1.	AA	The Aluminum Association
2.	AASHTO	American Association of State Highway and Transportation Officials
3.	ABPA	Acoustical and Board Products Association
4.	ACI	American Concrete Institute
5.	AGA	American Gas Association
6.	AGC	Associated General Contractors of America
7.	AHC	Architectural Hardware Consultant
8.	AHRI	Air Conditioning, Heating, Refrigeration Institute
9.	AI	Asphalt Institute
10.	AIA	American Institute of Architects
11.	AISC	American Institute of Steel Construction
12.	AISI	American Iron and Steel Institute
13.	AMCA	Air Movement and Control Association
14.	ANSI	American National Standards Institute
15.	APA	APA – The Engineered Wood Association
16.	ASCE	American Society of Civil Engineers
17.	ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
18.	ASME	American Society of Mechanical Engineers
19.	ASTM	American Society of Testing and Materials International
20.	AWPA	American Wood Protection Association
21.	AWPI	American Wood Preservers Institute
22.	AWS	American Welding Society
23.	AWSC	American Welding Society Code
24.	AWI	Architectural Woodwork Institute
25.	AWWA	American Water Works Association
26.	BIA	The Brick Industry Association

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27.	CCR	California Code of Regulations
28.	CLFMI	Chain Link Fence Manufacturers Institute
29.	CRA	California Redwood Association
30.	CRSI	Concrete Reinforcing Steel Institute
31.	CS	Commercial Standards
32.	CSI	Construction Specifications Institute
33.	CTI	Cooling Technology Institute
34.	FGIA	Fenestration and Glazing Industry Alliance
35.	FGMA	Flat Glass Manufacturers' Association
36.	FIA	Factory Insurance Association
37.	FM	Factory Mutual Global
38.	FS/FED SPEC	Federal Specification
39.	FTI	Facing Title Institute
40.	GA	Gypsum Association
41.	IAPMO	International Association of Plumbing and Mechanical Officials
42.	ICC	International Code Council
43.	IEEE	Institute of Electrical and Electronics Engineers
44.	IES	Illuminating Engineering Society
45.	MCAC	Mason Contractors Association of California
46.	MIMA	Mineral Wool Insulation Manufacturers Association
47.	MLMA	Metal Lath Manufacturers Association
48.	MS/MIL SPEC	Military Specifications
49.	NAAMM	National Association of Architectural Metal Manufacturers
50.	NBHA	National Builders Hardware Association
51.	NCMA	National Concrete Masonry Association
52.	NCSEA	National Council of Structural Engineers Associations
53.	NEC	National Electrical Code
54.	NEMA	National Electrical Manufacturers Association
55.	NIST	National Institute of Standards and Technology
56.	NSI	Natural Stone Institute
57.	NTMA	National Terrazzo and Mosaic Association, Inc.
58.	ORS	Office of Regulatory Services (California)
59.	OSHA	Occupational Safety and Health Act
60.	PCI	Precast/Prestressed Concrete Institute
61.	PCA	Portland Cement Association
62.	PCA	Painting Contractors Association
63.	PDI	Plumbing Drainage Institute
64.	PEI	Porcelain Enamel Institute, Inc.
65.	PG&E	Pacific Gas & Electric Company
66.	PS	Product Standards
67.	SDI	Steel Door Institute; Steel Deck Institute
68.	SJI	Steel Joist Institute
69.	SSPC	Society for Protective Coatings
70.	TCNA	Tile Council of North America, Inc.
71.	TPI	Truss Plate Institute
72.	UBC	Uniform Building Code
73.	UL	Underwriters Laboratories Code

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74.	UMC	Uniform Mechanical Code
75.	USDA	United States Department of Agriculture
76.	VI	Vermiculite Institute
77.	WCLIB	West Coast Lumber Inspection Bureau
78.	WDMA	Window and Door Manufacturers Association
79.	WEUSER	Western Electric Utilities Service Engineering Requirements
80.	WIC	Woodwork Institute of California

**PART 2 - PRODUCTS Not Used.**

**PART 3 - EXECUTION Not Used.**

END OF DOCUMENT

**DEFINITIONS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions including without limitation, Definitions;
- B. Special Conditions.

**1.02 QUALITY ASSURANCE**

- A. For products or workmanship specified by association, trade, or Federal Standards, Contractor shall comply with requirements of the standard, except when more rigid requirements are specified in the Contract Documents, or are required by applicable codes.
- B. Contractor shall conform to current reference standard publication date in effect on the date of bid opening.
- C. Contractor shall obtain copies of standards unless specifically required not to by the Contract Documents.
- D. Contractor shall maintain a copy of all standards at jobsite during submittals, planning, and progress of the specific Work, until final completion, unless specifically required not to by the Contract Documents.
- E. Should specified reference standards conflict with Contract Documents, Contractor shall request clarification from the District and/or the Architect before proceeding.
- F. The contractual relationship of the parties to the Contract shall not be altered from the contractual relationship as indicated in the Contract Documents by mention or inference otherwise in any referenced document.
- G. Governing Codes shall be as shown in the Contract Documents including, without limitation, the Specifications.

END OF DOCUMENT

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**REFERENCES**

**PART 1 - GENERAL**

**1.01 SCHEDULE OF REFERENCES:**

**The following information is intended only for the general assistance of the Contractor, and the District does not represent that all of the information is current. It is the Contractor's responsibility to verify the correct information for each of the entities listed.**

AA	The Aluminum Association 1400 Crystal Drive, Suite 430 Arlington, VA 22202 <a href="http://www.aluminum.org">www.aluminum.org</a>	703/358-2960
AABC	Associated Air Balance Council 2401 Pennsylvania Avenue NW, Suite 330 Washington, DC 20037 <a href="http://www.aabc.com">www.aabc.com</a>	202/737-0202
AASHTO	American Association of State Highway and Transportation Officials 555 12th St. NW - Suite 1000 Washington, DC 20004 <a href="http://www.transportation.org">www.transportation.org</a>	202/624-5800
AATCC	American Association of Textile Chemists and Colorists P.O. Box 12215 Research Triangle Park, NC 27709-2215 <a href="http://www.aatcc.org">www.aatcc.org</a>	919/549-8141
ACA	American Coatings Association 901 New York Ave., NW, Suite 300 West Washington, DC 20001 <a href="http://www.paint.org">www.paint.org</a>	202/462-6272
ACI	American Concrete Institute 38800 Country Club Dr. Farmington Hills, MI 48331-3439 <a href="http://www.concrete.org">www.concrete.org</a>	248/848-3800
ACPA	American Concrete Pipe Association 5605 N. MacArthur Blvd., Suite 340 Irving, TX 75038 <a href="http://www.concrete-pipe.org">www.concrete-pipe.org</a>	972/506-7216

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ADC	Air Duct Council 1901 N. Roselle Road, Suite 800 Schaumburg, IL 60195 <a href="http://www.flexibleduct.org">www.flexibleduct.org</a>	847/706-6750
AF&PA	American Forest and Paper Association 1101 K Street, NW, Suite 700 Washington, DC 20005 <a href="http://www.afandpa.org">www.afandpa.org</a>	202/463-2700
AGA	American Gas Association 400 North Capitol Street, NW, Suite 450 Washington, DC 20001 <a href="http://www.aga.org">www.aga.org</a>	202/824-7000
AGC	Associate General Contractors of America 2300 Wilson Blvd., Suite 300 Arlington, VA 22201 <a href="http://www.agc.org">www.agc.org</a>	703/548-3118
AHA	American Hardboard Association 1210 West Northwest Highway Palatine, IL 60067 <a href="http://domensino.com/AHA/default.htm">http://domensino.com/AHA/default.htm</a>	847/934-8800
AI	Asphalt Institute 2696 Research Park Drive Lexington, KY 40511-8480 <a href="http://www.asphaltinstitute.org">www.asphaltinstitute.org</a>	859/288-4960
AIA	The American Institute of Architects 1735 New York Ave., NW Washington, DC 20006-5292 <a href="http://www.aia.org">www.aia.org</a>	202/626-7300
AISC	American Institute of Steel Construction 130 East Randolph Street, Suite 2000 Chicago, IL 60601 <a href="http://www.aisc.org">www.aisc.org</a>	312.670.2400
AISI	American Iron and Steel Institute 25 Massachusetts Ave., NW, Suite 800 Washington, DC 20001 <a href="http://www.steel.org">www.steel.org</a>	202/452-7100
AITC	American Institute of Timber Construction 1010 South 336th Street, #210 Federal Way, WA 98003-7394 <a href="https://www.plib.org/aitc/">https://www.plib.org/aitc/</a>	253/835-3344

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ALI	Associated Laboratories, Inc. P.O. Box 152837 Dallas, TX 75315 <a href="http://www.assoc-labs.com">www.assoc-labs.com</a>	214/565-0593
ALSC	American Lumber Standards Committee, Inc. 7470 New Technology Way, Suite F Frederick, MD 21703 <a href="http://www.alsc.org">www.alsc.org</a>	301/972-1700
AMCA	Air Movement and Control Association International, Inc. 30 W. University Drive Arlington Heights, IL 60004 <a href="http://www.amca.org">www.amca.org</a>	847/394-0150
AMPP (formerly SSPC)	Association for Materials Protection and Performance (merger of Society for Protective Coatings and National Association of Corrosion Engineers International) (formerly Steel Structures Painting Council) 800 Trumbull Drive Pittsburgh, PA 15205 <a href="http://www.sspc.org">www.sspc.org</a>	412/281-2331 877/281-7772
ANLA	AmericanHort (merger of American Nursery & Landscape Association and OFA – The Association of Horticultural Professionals) 2130 Stella Court Columbus, OH 43215 <a href="http://www.americanhort.org">www.americanhort.org</a>	614/487-1117
ANSI	American National Standards Institute 1899 L Street, NW, 11th Floor Washington, DC 20036 <a href="http://www.ansi.org">www.ansi.org</a>	202/293-8020
APA	APA-The Engineered Wood Association 7011 S. 19th Street Tacoma, WA 98466-5333 <a href="http://www.apawood.org">www.apawood.org</a>	253/565-6600

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APA	Architectural Precast Association 325 John Knox Rd, Suite L-103 Tallahassee, FL 32303 <a href="http://www.archprecast.org">www.archprecast.org</a>	850/205-5637
APCIA	American Property Casualty Insurance Association (merger of American Insurance Association (formerly the National Board of Fire Underwriters) with the Property Casualty Insurers Association of America) 555 12th St, NW, Suite 550 Washington DC 20004 <a href="http://www.apci.org">www.apci.org</a>	202/828-7100
AHRI	Air Conditioning and Refrigeration Institute (now Air-Conditioning, Heating, & Refrigeration Institute) 2311 Wilson Blvd, Suite 400 Arlington, VA 22201 <a href="http://www.ahrinet.org">www.ahrinet.org</a>	703/524-8800
ARMA	Asphalt Roofing Manufacturers Association 2331 Rock Spring Road Forest Hill, MD 21050 <a href="http://www.asphaltroofing.org">www.asphaltroofing.org</a>	443/640-1075
ASA	The Acoustical Society of America Suite 300 1305 Walt Whitman Road Melville, NY 11747-4300 <a href="https://acousticalsociety.org/">https://acousticalsociety.org/</a>	516/576-2360
ASCE	American Society of Civil Engineers 1801 Alexander Bell Drive Reston, VA 20191 <a href="http://www.asce.org">www.asce.org</a>	800/548-2723 703/295-6300
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 180 Technology Parkway Peachtree Corners, GA 30092 <a href="http://www.ashrae.org">www.ashrae.org</a>	800/527-4723 404/636-8400
ASLA	American Society of Landscape Architects 636 Eye Street, NW Washington, DC 20001-3736 <a href="http://www.asla.org">www.asla.org</a>	202/898-2444
ASME	American Society of Mechanical Engineers Two Park Avenue New York, NY 10016-5990 <a href="http://www.asme.org">www.asme.org</a>	800/834-2763



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ASPE	American Society of Plumbing Engineers 6400 Shafer Court, Suite 350 Rosemont, IL 60018 <a href="http://aspe.org">http://aspe.org</a>	847/296-0002
ASQ	American Society for Quality P.O. Box 3005 Milwaukee, WI 53201-3005 or 600 North Plankinton Avenue Milwaukee, WI 53203 <a href="http://asq.org">http://asq.org</a>	800/248-1946 414/272-8575
ASSE	American Society of Sanitary Engineering 18927 Hickory Creek Dr., Suite 220 Mokena, IL 60448 <a href="http://www.asse-plumbing.org">www.asse-plumbing.org</a>	708/995-3019
ASTM	ASTM International 100 Barr Harbor Drive PO Box C700 West Conshohocken, PA, 19428-2959 <a href="http://www.astm.org">www.astm.org</a>	610/832-9500
AWCI	Association of the Wall and Ceiling Industry 513 West Broad Street, Suite 210 Falls Church, VA 22046 <a href="http://www.awci.org">www.awci.org</a>	703/538-1600
AWPA	American Wood Protection Association (formerly American Wood Preservers Institute) P.O. Box 361784 Birmingham, AL 35236-1784 <a href="http://www.awpa.com">www.awpa.com</a>	205/733-4077
AWS	American Welding Society 8669 NW 36 Street, Suite 130 Miami, FL 33166 <a href="http://www.aws.org">www.aws.org</a>	800/443-9353 305/443-9353
AWI	Architectural Woodwork Institute 46179 Westlake Drive, Suite 120 Potomac Falls, VA 20165-5874 <a href="http://www.awinet.org">www.awinet.org</a>	571/323-3636
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235 <a href="http://www.awwa.org">www.awwa.org</a>	800/926-7337 303/794-7711

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BHMA	Builders Hardware Manufacturers Association 355 Lexington Avenue, 15th Floor New York, NY 10017 <a href="http://www.buildershardware.com">www.buildershardware.com</a>	212/297-2122
BIA	The Brick Industry Association 12007 Sunrise Valley Drive, Suite 430 Reston, VA 20191 <a href="http://www.gobrick.com">www.gobrick.com</a>	703/620-0010
CGA	Compressed Gas Association 8484 Westpark Drive, Suite 220 McLean, VA 22102 <a href="http://www.cganet.com">www.cganet.com</a>	703/788-2700
CISCA	Ceilings & Interior Systems Construction Association 1010 Jorie Blvd, Suite 30 Oak Brook, IL 60523 <a href="http://www.cisca.org">www.cisca.org</a>	630/584-1919
CISPI	Cast Iron Soil Pipe Institute 2401 Fieldcrest Dr. Mundelein, IL 60060 <a href="http://www.cispi.org">www.cispi.org</a>	224/864-2910
CLFMI	Chain Link Fence Manufacturers Institute 10015 Old Columbia Road, Suite B-215 Columbia, MD 21046 <a href="http://chainlinkinfo.org">chainlinkinfo.org</a>	301/596-2583
CPA	Composite Panel Association 19465 Deerfield Avenue, Suite 306 Leesburg, VA 20176 <a href="http://www.compositepanel.org">www.compositepanel.org</a>	703/724-1128
CPSC	Consumer Product Safety Commission 4330 East-West Highway Bethesda, MD 20814 <a href="http://www.cpsc.gov">www.cpsc.gov</a>	800/638-2772
CRA	California Redwood Association 818 Grayson Road, Suite 201 Pleasant Hill, CA 94523 <a href="http://www.calredwood.org">www.calredwood.org</a>	925/935-1499

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CRI	Carpet and Rug Institute 100 S. Hamilton Street Dalton, GA 30722-2048 <a href="http://www.carpet-rug.org">www.carpet-rug.org</a>	706/278-3176
CRSI	Concrete Reinforcing Steel Institute 933 N. Plum Grove Road Schaumburg, IL 60173-4758 <a href="http://www.crsi.org">www.crsi.org</a>	847/517-1200
CSI	The Construction Specifications Institute 123 North Pitt St, Suite 450 Alexandria, VA 22314 <a href="http://www.csinet.org">www.csinet.org</a>	800/689-2900
CTIOA	Ceramic Tile Institute of America 12061 Jefferson Blvd. Culver City, CA 90230-6219 <a href="http://www.ctioa.org">www.ctioa.org</a>	310/574-7800
DHA	Decorative Hardwoods Association (formerly Hardwood Plywood & Veneer Association) 42777 Trade West Dr. Sterling, VA 20166 <a href="https://www.decorativehardwoods.org/">https://www.decorativehardwoods.org/</a>	703/435-2900
DHI	Door and Hardware Institute (formerly National Builders Hardware Association) 2001 K Street NW, 3rd Floor North Washington, DC 20006 <a href="http://www.dhi.org">www.dhi.org</a>	202/367-1134
DIPRA	Ductile Iron Pipe Research Association P.O. Box 190306 Birmingham, AL 35219 <a href="http://www.dipra.org">www.dipra.org</a>	205/402-8700
DOC	U.S. Department of Commerce 1401 Constitution Ave., NW Washington, DC 20230 <a href="http://www.commerce.gov">www.commerce.gov</a>	202/482-2000
DOT	U.S. Department of Transportation 1200 New Jersey Avenue, SE Washington, DC 20590 <a href="http://www.dot.gov">www.dot.gov</a>	855/368-4200
EJMA	Expansion Joint Manufacturers Association, Inc. 25 North Broadway Tarrytown, NY 10591 <a href="http://www.ejma.org">www.ejma.org</a>	914/332-0040

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EPA	Environmental Protection Agency Ariel Rios Building 1200 Pennsylvania Avenue, N.W. Washington, DC 20460 <a href="http://www.epa.gov">www.epa.gov</a>	202/272-0167
FCICA	Floor Covering Installation Contractors Association 800 Roosevelt Rd., Bldg. C, Suite 312 Glen Ellyn, IL 60137 <a href="http://www.fcica.com">www.fcica.com</a>	630/672-3702
FGIA	Fenestration and Glazing Industry Alliance 1900 E Golf Rd, Suite 1250 Schaumburg, IL 60173 <a href="https://fgiaonline.org/">https://fgiaonline.org/</a>	847/303-5664
FM Global	Factory Mutual Insurance Company Amy Daley Global Practice Leader – Education, Public Entities, Health Care FM Global 270 Central Avenue Johnston, RI 02919-4949 <a href="http://www.fmglobal.com">www.fmglobal.com</a>	401/275-3000 401/275-3029
FS	General Services Administration (GSA) Index of Federal Specifications, Standards and Commercial Item Descriptions 470 East L'Enfant Plaza, SW, Suite 8100 Washington, DC 20407 <a href="http://www.gsa.gov">www.gsa.gov</a>	202/619-8925
GA	The Gypsum Association 962 Wayne Ave., Suite 620 Silver Spring, MD 20910 <a href="http://www.gypsum.org">www.gypsum.org</a>	301/277-8686
HMA	Hardwood Manufacturers Association One Williamsburg Place, Suite 108 Warrendale, PA 15086 <a href="http://hmamembers.org">http://hmamembers.org</a>	412/244-0440

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IAPMO	International Association of Plumbing and Mechanical Officials (formerly the Western Plumbing Officials Association) 4755 E. Philadelphia St. Ontario, CA 91761 <a href="http://www.iapmo.org">www.iapmo.org</a>	909/472-4100
ICC	International Code Council 500 New Jersey Avenue, NW, 6th Floor Washington, DC 20001 <a href="http://www.iccsafe.org">www.iccsafe.org</a>	888/422-7233
IEEE	Institute of Electrical and Electronics Engineers 3 Park Avenue, 17th Floor New York, NY 10016-5997 <a href="http://www.ieee.org">www.ieee.org</a>	212/419-7900
IES	Illuminating Engineering Society 120 Wall Street, Floor 17 New York, NY 10005-4001 <a href="http://www.ies.org">www.ies.org</a>	212/248-5000
ITRK	Intertek Testing Services 3933 US Route 11 Cortland, NY 13045 <a href="http://www.intertek.com">www.intertek.com</a>	607/753-6711
MCAA	Mechanical Contractors Association of America 1385 Piccard Drive Rockville, MD 20850 <a href="http://www.mcaa.org">www.mcaa.org</a>	301/869-5800
MMPA (formerly WMMPA)	Moulding & Millwork Producers Association (formerly Wood Moulding & Millwork Producers Association) 507 First Street Woodland, CA 95695 <a href="http://www.wmmpa.com">www.wmmpa.com</a>	530/661-9591 800/550-7889
MSS	Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc. 127 Park Street, NE Vienna, VA 22180-4602 <a href="http://mss-hq.org">http://mss-hq.org</a>	703/281-6613
NAAMM	National Association of Architectural Metal Manufacturers 800 Roosevelt Rd. Bldg. C, Suite 312 Glen Ellyn, IL 60137 <a href="http://www.naamm.org">www.naamm.org</a>	630/942-6591

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NAIMA	North American Insulation Manufacturers Association P.O. Box 1906 Alexandria, VA 22313 <a href="https://insulationinstitute.org/">https://insulationinstitute.org/</a>	703/684-0084
NALP	National Association of Landscape Professionals (formerly Professional Landcare Network) 12500 Fair Lakes Circle, Suite 200 Fairfax, VA 22033 <a href="https://www.landscap Professionals.org/">https://www.landscap Professionals.org/</a>	703/736-9666
NAPA	National Asphalt Pavement Association 6406 Ivy Lane, Suite 350 Greenbelt, MD 20770-1441 <a href="http://www.asphalt pavement.org">www.asphalt pavement.org</a>	888/468-6499 301/731-4748
NCSPA	National Corrugated Steel Pipe Association 14070 Proton Road, Suite 100 Dallas, TX 75244 <a href="http://www.ncspa.org">www.ncspa.org</a>	972/850-1907
NCMA	National Concrete Masonry Association 13750 Sunrise Valley Drive Herndon, VA 20171-4662 <a href="http://www.ncma.org">www.ncma.org</a>	703/713-1900
NEBB	National Environmental Balancing Bureau 8575 Grovemont Circle Gaithersburg, MD 20877 <a href="http://www.nebb.org">www.nebb.org</a>	301/977-3698
NECA	National Electrical Contractors Association 1201 Pennsylvania Ave. NW Washington, D.C., 20004 <a href="http://www.necanet.org">www.necanet.org</a>	202/991-6300
NEMA	National Electrical Manufacturers Association 1300 North 17th Street N, Suite 900 Rosslyn, VA 22209 <a href="http://www.nema.org">www.nema.org</a>	703/841-3200
NEII	National Elevator Industry, Inc. 5537 SW Urish Road Topeka, KS 66610 <a href="https://nationalelevatorindustry.org/">https://nationalelevatorindustry.org/</a>	703/589-9985
NFPA	National Fire Protection Association 1 Batterymarch Park Quincy, MA 02169-7471 <a href="http://www.nfpa.org">www.nfpa.org</a>	800/344-3555 855/274-8525

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NGA (formerly GANA)	National Glass Association (merged with Glass Association of North America) 1945 Old Gallows Road Suite 750 Vienna, VA 22182 <a href="http://www.glass.org">www.glass.org</a>	866/342-5642 Ext 127
NHLA	National Hardwood Lumber Association PO Box 34518 Memphis, TN 38184 <a href="http://www.nhla.com">www.nhla.com</a>	901/377-1818
NIA	National Insulation Association 516 Herndon Pkwy., Ste. D Herndon, VA 20170 <a href="http://www.insulation.org">www.insulation.org</a>	703/464-6422
NRCA	National Roofing Contractors Association 10255 W. Higgins Road, Suite 600 Rosemont, IL 60018-5607 <a href="http://www.nrca.net">www.nrca.net</a>	847/299-9070
NSF	NSF International 789 N. Dixboro Road Ann Arbor, MI 48113-0140 <a href="http://www.nsf.org">www.nsf.org</a>	800/673-6275 734/769-8010
NSI	Natural Stone Institute (formerly Marble Institute of America) 380 E. Lorain St. Oberlin, OH 44074 <a href="https://www.naturalstoneinstitute.org/">https://www.naturalstoneinstitute.org/</a>	440/250-9222
NTMA	National Terrazzo and Mosaic Association 209 N. Crockett Street, Suite 2 PO Box 2605 Fredericksburg, TX 78624 <a href="http://www.ntma.com">www.ntma.com</a>	800/323-9736
OSHA	Occupational Safety and Health Act U.S. Department of Labor Occupational Safety & Health Administration 200 Constitution Ave., NW Washington, DC 20210 <a href="http://www.osha.gov">www.osha.gov</a>	800/321-OSHA (6742)

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PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077 or 200 Massachusetts Ave NW, Suite 200 Washington, DC 20001 <a href="http://www.cement.org">www.cement.org</a>	847/966-6200 202/408-9494
PCA	Painting Contractors Association (formerly Painting and Decorating Contractors of America) 2316 Millpark Drive Maryland Heights, MO 63043 <a href="https://www.pcapainted.org/">https://www.pcapainted.org/</a>	800/322-7322
PCI	Precast/Prestressed Concrete Institute 8770 W. Bryn Mawr Ave., Suite 1150 Chicago, IL 60631 <a href="http://www.pci.org">www.pci.org</a>	312/786-0300
PDI	Plumbing & Drainage Institute 800 Turnpike Street, Suite 300 North Andover, MA 01845 <a href="http://pdionline.org">http://pdionline.org</a>	978/557-0720 800/589-8956
PEI	Porcelain Enamel Institute, Inc. P.O. Box 920220 Norcross, GA 30010 <a href="http://www.porcelainenamel.com">www.porcelainenamel.com</a>	770/676-9366
PG&E	Pacific Gas & Electric Company P.O. Box 997300 Sacramento, CA 95899-7300 <a href="http://www.pge.com">www.pge.com</a>	800/743-5000
PLIB	Pacific Lumber Inspection Bureau (formerly West Coast Lumber Inspection Bureau) 1010 South 336th Street, Suite 210 Federal Way, WA 98003-7394 <a href="https://www.plib.org/">https://www.plib.org/</a>	253/835-3344
RFCI	Resilient Floor Covering Institute 115 Broad Street, Suite 201 La Grange, GA 30240 <a href="http://www.rfci.com">www.rfci.com</a>	706/882-3833
SDI	Steel Deck Institute P.O. Box 426 Glenshaw, PA 15116 <a href="http://www.sdi.org">www.sdi.org</a>	412/487-3325



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SDI	Steel Door Institute 30200 Detroit Road Westlake, OH 44145 <a href="http://www.steeldoor.org">www.steeldoor.org</a>	440/899-0010
SJI	Steel Joist Institute 140 West Evans Street, Suite 203 Florence, SC 29501 <a href="http://steeljoist.org">http://steeljoist.org</a>	843/407-4091
SMA	Stucco Manufacturers Association 5753 E Santa Ana Cyn Rd, #G-156 Anaheim, CA 92807 <a href="http://www.stuccomfgassoc.com">www.stuccomfgassoc.com</a>	714/473-9579
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 4201 Lafayette Center Drive Chantilly, VA 20151-1219 <a href="http://www.smacna.org">www.smacna.org</a>	703/803-2980
SPI	SPI: The Plastics Industry Trade Association, Inc. 1425 K St. NW, Suite 500 Washington, DC 20005 <a href="http://www.plasticsindustry.org">www.plasticsindustry.org</a>	202/974-5200
TCA	The Tile Council of North America 100 Clemson Research Blvd. Anderson, SC 29625 <a href="http://www.tcnatile.com">www.tcnatile.com</a>	864/646-8453
TPI	Truss Plate Institute 2670 Crain Highway, Suite 203 Waldorf, MD 20601 <a href="http://www.tpinst.org">www.tpinst.org</a>	240/587-5582
TPI	Turfgrass Producers International 444 E. Roosevelt Road #346 Lombard, IL 60148 <a href="http://www.turfgrasssod.org">www.turfgrasssod.org</a>	800/405-8873 847/649-5555
TCIA	Tree Care Industry Association (formerly the National Arborist Association) 670 N Commercial Street, Suite 201 Manchester, NH 03101 <a href="http://www.tcia.org">www.tcia.org</a>	603/314-5380 800/733-2622

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TVI	The Vermiculite Institute c/o The Schundler Company 10 Central Street Nahant, MA 01908 <a href="http://www.vermiculiteinstitute.org">www.vermiculiteinstitute.org</a>	732/287-2244
UL	Underwriters Laboratories Inc. 333 Pfingsten Road Northbrook, IL 60062-2096 <a href="http://www.ul.com">www.ul.com</a>	847/272-8800 877/854-3577
UNI	Uni-Bell PVC Pipe Association 201 E. John Carpenter Freeway, Suite 750 Irving, TX 75062 <a href="http://www.uni-bell.org">www.uni-bell.org</a>	972/243-3902
USDA	U.S. Department of Agriculture 1400 Independence Ave., S.W. Washington, DC 20250 <a href="http://www.usda.gov">www.usda.gov</a>	202/720-2791
WA	Wallcoverings Association 35 E Wacker Dr., Suite 850 Chicago, IL 60601 <a href="http://www.wallcoverings.org">www.wallcoverings.org</a>	312/224-2574
WCMA	Window Covering Manufacturers Association 355 Lexington Avenue 15th Floor New York, NY 10017 <a href="http://www.wcmanet.org">www.wcmanet.org</a>	212/297-2122
WDMA	Window & Door Manufacturers Association 2001 K Street NW, 3rd Floor North Washington, D.C. 20006 <a href="http://www.wdma.com">www.wdma.com</a>	202/367-1157
WI	Woodwork Institute 1455 Response Road, Suite 110 Sacramento, CA 95815 <a href="http://www.wicnet.org">www.wicnet.org</a>	916/372-9943
WRI	Wire Reinforcement Institute 942 Main Street, Suite 300 Hartford, CT 06103 <a href="http://www.wirereinforcementinstitute.org">www.wirereinforcementinstitute.org</a>	860/240-9545
WWCA	Western Wall & Ceiling Contractors Association 1910 N. Lime St. Orange, CA 92865 <a href="http://www.wwcca.org">www.wwcca.org</a>	714/221-5520

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WWPA	Western Wood Products Association (formerly Redwood Inspection Service) 1500 SW First Ave., Suite 870 Portland, OR 97201 <a href="http://www.wwpa.org">www.wwpa.org</a>	503/224-3930
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**PART 2 - PRODUCTS Not Used.**

**PART 3 - EXECUTION Not Used.**

END OF DOCUMENT

**MATERIALS AND EQUIPMENT**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Purchase of Materials and Equipment;
- B. Special Conditions;
- C. Imported Materials Certification.

**1.02 MATERIAL AND EQUIPMENT**

- A. Only items approved by the District and/or Design Professional shall be used.
- B. Contractor shall submit lists of products and other product information in accordance with the Contract Documents, including, without limitation, the provisions regarding the submittals.

**1.03 MATERIAL AND EQUIPMENT COLORS**

- A. The District and/or Architect will provide a schedule of colors.
- B. 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.
- C. Contractor shall request priority in writing for any item requiring advance ordering to maintain the approved Construction Schedule.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Contractor shall deliver manufactured materials in original packages, containers, or bundles (with seals unbroken), bearing name or identification mark of manufacturer.
- B. 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.
- C. 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.

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- D. Materials are not acceptable 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.
- E. Contractor shall store material so as to cause no obstructions of sidewalks, roadways, access to the Site or buildings, and underground services. Contractor shall protect material and equipment furnished under Contract.
- F. Contractor may store materials on Site with prior written approval by the District, all material 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 a bonded warehouse and with appropriate insurance coverage at no cost to District.
- G. When any room in Project is used as a shop or storeroom, the 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.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

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

### **2.02 FACILITIES AND EQUIPMENT**

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

### **2.03 MATERIAL REFERENCE STANDARDS**

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

### **PART 3 - EXECUTION**

#### **3.01 WORKMANSHIP**

- A. 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).
- B. Work shall be executed by tradespersons skilled in their respective lines of Work. When completed, parts shall have been durably and substantially built and present a neat appearance.

#### **3.02 COORDINATION**

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

#### **3.03 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 manner to assure well-balanced performance, in accordance with manufacturer's recommendations and by Contract Documents. For example, electric water coolers require water, electricity, and drain services; roof drains require drain system; 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," "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.

#### **3.04 APPROVED INSTALLER OR APPLICATOR**

Installation by a manufacturer's approved installer or applicator is an understood part of Specifications and only approved installer or applicator is to provide on-site Work where specified manufacturer has on-going program of approving (i.e. certifying, bonding, re-warranting) installers or applicators. Newly established relationships between a manufacturer and an installer or applicator who does not have other approved applicator work in progress or completed is not approved for this Project.

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**3.05 MANUFACTURER'S RECOMMENDATIONS**

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

**QUALITY CONTROL**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Inspector, Inspections and Tests, Uncovering of Work and Non-conforming of Work and Correction of Work;
- B. Special Conditions.

**1.02 RELATED CODES:**

- A. The Work is governed by requirements of Title 24, California Code of Regulations ("CCR"), and the Contractor shall keep a copy of these available at the job Site for ready reference during construction.
- B. The Division of the State Architect ("DSA") shall be notified at or before the start of construction.

**1.03 OBSERVATION AND SUPERVISION:**

- A. 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, CCR, Part 1, Title 24, Section 4-341.
- B. One or more Project Inspector(s) approved by DSA and employed by or in contract with the District, referred to hereinafter as the "Project Inspector", will observe the work in accordance with CCR, Part 1, Title 24, Sections 4-333(b) and 4-342:
  - (1) The Project Inspector and Special Inspector(s) 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. The Contractor shall provide facilities and operation of equipment as needed, and access as required and shall provide assistance for sampling or measuring materials.
  - (2) The Project Inspector will notify the District and Architect and call the attention of the Contractor to any observed failure of Work or material to conform to Contract Documents.
  - (3) The Project Inspector shall observe and monitor all testing and inspection activities required.



The Contractor shall conform with all applicable laws as indicated in the Contract Documents, including, without limitation, to CCR, Part 1, Title 24, Section 4-343. The Contractor shall supervise and direct the Work and maintain a competent superintendent on the job who is authorized to act in all matters pertaining to the Work. The Contractor's superintendent shall also 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 Part 1, Title 24, Section 4-336.

#### **1.04 TESTING AGENCIES:**

- A. Testing agencies and tests shall be in conformance with the General Documents and the requirements of Part 1, Title 24, Section 4- 335.
- B. Testing and inspection in connection with earthwork shall be under the direction of the District's consulting soils engineer, if any, referred to hereinafter as the "Soils Engineer."
- C. Testing and inspection of construction materials and workmanship shall be performed by a qualified laboratory, referred to hereinafter as the "Testing 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.

#### **1.05 TESTS AND INSPECTIONS:**

- A. The Contractor shall be responsible for notifying the District and Project Inspector of all required tests and inspections. Contractor shall notify the District and Project Inspector at least seventy-two hours (72) hours in advance of performing any Work requiring testing or inspection.
- B. The Contractor shall provide access to Work to be tested and furnish incidental labor, equipment, and facilities to facilitate all inspections and tests.
- C. The District will pay for first inspections and tests required by the "CCR", and other inspections or tests that the District and/or the Architect may direct to have made, including the following principal items:
  - (1) Tests and observations for earthwork and paving.
  - (2) Tests for concrete mix designs, including tests of trial batches.
  - (3) Tests and inspections for structural steel work.
  - (4) Field tests for framing lumber moisture content.
  - (5) Additional tests directed by the District that establish that materials and installation comply with the Contract Documents.
  - (6) Tests and observations of welding and expansion anchors.

- D. The District may at its discretion, pay and then back charge the Contractor for:
  - (1) Retests or reinspections, if required, and tests or inspections required due to Contractor error or lack of required identifications of material.
  - (2) Uncovering of work in accordance with Contract Documents.
  - (3) Testing done on weekends, holidays, and overtime will be chargeable to the Contractor for the overtime portion.
  - (4) Testing done off Site.
- E. Testing and inspection reports and certifications:
  - (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.
    - (a) The District;
    - (b) The Construction Manager, if any;
    - (c) The Architect;
    - (d) The Consulting Engineer, if any;
    - (e) Other engineers on the Project, as appropriate;
    - (f) The Project Inspector; and
    - (g) The Contractor.
  - (2) When the test or inspection is one required by the CCR, a copy of the report shall also be provided to the DSA.

## **PART 2 - PRODUCTS**

### **2.01 TYPE OF TESTS AND INSPECTIONS**

- A. Testing and inspection shall be in accordance with DSA Form 103 (or current version)
- B. Slump Test  
ASTM C 143
- C. Concrete Tests

Testing agency shall test concrete used in the work per the following paragraphs:

- (1) Compressive Strength:

- (a) Minimum number of tests required: One (1) set of three (3) cylinders for each 50 cubic yards (CBC Section 1905A1.17 & ACI 318-19 Section 26.12.2) of concrete or major fraction thereof, placed in one (1) day. See Title 24, Section 26.12.2
- (b) Two cylinders of each set shall be tested at twenty-eight (28) days. One (1) cylinder shall be held in reserve and tested only when directed by the Architect or District.
- (c) Concrete shall test the minimum ultimate compressive strength in twenty-eight 28 days, as specified on the structural drawings.
- (d) In the event that the twenty-eight (28) day test falls below the minimum specified strength, the effective concrete in place shall be tested by taking cores in accordance with UBC Standard No. 26-13 and tested as required for cylinders.
- (e) In the event that the test on core specimens falls below the minimum specified strength, the concrete will be deemed defective and shall be removed and replaced upon such direction of the Architect, and in a manner acceptable to the Division of the State Architect.

D. Reinforcing, Steel

E. Structural Steel Per Title 24 and as noted:

- (1) Material: Steel per CBC Section 1705A.2.1 & CBC Table 1705A.2.1
- (2) Qualification of Welders (AISC 360 Section N3)
- (3) Shop fabrication (CBC Section 1705A.2.5 & CBC Table 1705A.2.1)
- (4) Shop and field welding (CBC Section 1705A.2.5 & CBC Table 1705A.2.1)

**PART 3 - EXECUTION Not Used.**

END OF DOCUMENT

**TEMPORARY FACILITIES AND CONTROLS**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions;
- C. Site Standards; and
- D. Construction Waste Management and Disposal.

**1.02 TEMPORARY UTILITIES:**

- A. Electric Power and Lighting:
  - (1) Contractor will pay for power during the course of the Work. To the extent power is available in the building(s) or on the Site, Contractor may use the District's existing utilities by making prearranged payments to the District for the utilities used by Contractor and all Subcontractors. Contractor shall be responsible for providing temporary facilities required to deliver that power service from its existing location in the building(s) or on the Site to point of intended use.
  - (2) Contractor shall verify characteristics of power available in building(s) or on the Site. Contractor shall take all actions required to make modifications where power of higher voltage or different phases of current are required. Contractor shall be fully responsible for providing that service and shall pay all costs required therefor.
  - (3) 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.
  - (4) Contractor shall be responsible for maintaining existing lighting levels in the project vicinity should temporary outages or service interruptions occur.
- B. Heat and Ventilation:
  - (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

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protect materials and finishes from damage due to improper temperature and humidity conditions. Portable heaters shall be standard units complete with controls.

- (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.
- (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.

C. Water:

- (1) Contractor shall pay for water used during the course of the Work. Contractor shall coordinate and pay for installation or use of water meter in compliance with local water agency requirements. To the extent water is then available in the building(s) or on the Site, Contractor may use the District's existing utilities by making prearranged payments to the District for the utilities used by Contractor and all Subcontractors. Contractor shall be responsible for providing temporary facilities required to deliver such utility service from its existing location in the building(s), on the Site, or other location approved by the local water agency, to point of intended use.
- (2) Contractor shall use backflow preventers on water lines at point of connection to District's water supply. Backflow preventers shall comply with requirements of Uniform Plumbing Code.
- (3) Contractor shall make potable water available for human consumption.

D. Sanitary Facilities:

- (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 Inspector or Contractor completes all other work at the Site.
- (2) Use of toilet facilities in the Work under construction shall not be permitted except by consent of the Inspector and the District.

E. Telephone Service:

- (1) Contractor shall arrange with local telephone service company for telephone service as required 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.
- (2) Contractor shall pay the costs for telephone and fax lines installation, maintenance, service, and removal.

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F. Fire Protection:

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

G. Trash Removal:

- (1) Contractor shall provide trash removal on a timely basis. Under no circumstance shall Contractor use District trash service.

H. Field Office:

- (1) If Contractor chooses to provide a field office, it shall be an acceptable construction trailer that is well-lit and ventilated. The construction trailer shall be equipped with shelves, desks, filing cabinet, chairs, and such other items of equipment needed. Trailer and equipment are the property of the Contractor and must be removed from the Site upon completion of the Work. Contractor may use the corridor adjacent to the construction area for an office area, if approved in writing by District.
- (2) Contractor shall provide any additional electric lighting and power required for the trailer. Contractor shall make adequate provisions for heating and cooling as required.

I. Temporary Facilities:

- (1)

**1.03 CONSTRUCTION AIDS:**

A. Plant and Equipment:

- (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 workers. Include elevators, hoists, debris chutes, and other equipment, tools, and appliances necessary for performance of the Work.
- (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.

- B. None of the District's tools and equipment shall be used by Contractor for the performance of the Work.

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**1.04 BARRIERS AND ENCLOSURES:**

- A. Contractor shall obtain the District's written permission for locations and types of temporary barriers and enclosures, including fire-rated materials proposed for use, prior to their installation.
- B. 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, the public, and workers. Contractor shall also protect the Work and existing facilities from the elements, and adjacent construction and improvements, persons, and trees and plants from damage and injury from demolition and construction operations.
- C. Contractor shall provide site access to existing facilities for persons using other buildings and portions of the Site, the public, and for deliveries and other services and activities.
- D. Tree and Plant Protection:
  - (1) Contractor shall preserve and protect existing trees and plants on the Premises that are not designated or required to be removed, and those adjacent to the Premises.
  - (2) Contractor shall provide barriers to a minimum height of 4'-0" around drip line of each tree and plant, around each group of trees and plants, as applicable, in the proximity of demolition and construction operations, or as denoted on the Plans.
  - (3) Contractor shall not park trucks, store materials, perform Work or cross over landscaped areas. Contractor shall not dispose of paint thinners, water from cleaning, plastering or concrete operations, or other deleterious materials in landscaped areas, storm drain systems, or sewers. Plant materials damaged as a result of the performance of the Work shall, at the option of the District and at Contractor's expense, either be replaced with new plant materials equal in size to those damaged or by payment of an amount representing the value of the damaged materials as determined by the District.
  - (4) Contractor shall remove soil that has been contaminated during the performance of the Work by oil, solvents, and other materials which could be harmful to trees and plants, and replace with good soil, at Contractor's expense.
  - (5) Excavation around Trees:
    - (a) Excavation within drip lines of trees shall be done only where absolutely necessary and with written permission from the District.
    - (b) Where trenching for utilities is required within drip lines, tunneling under and around roots shall be by hand digging and shall be approved by the District. Main lateral roots and taproots shall not be cut. All roots 2 inches in diameter and

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larger shall be tunneled under and heavily wrapped with wet burlap so as to prevent scarring or excessive drying. Smaller roots that interfere with installation of new work may be cut with prior approval by the District. Roots must first be cut with a Vermeer, or equivalent, root cutter prior to any trenching.

- (c) Where excavation for new construction is required within drip line of trees, hand excavation shall be employed to minimize damage to root system. Roots shall be relocated in backfill areas wherever possible. If encountered immediately adjacent to location of new construction, roots shall be cut approximately 6 inches back from new construction.
- (d) Approved excavations shall be carefully backfilled with the excavated materials approved for backfilling. Backfill shall conform to adjacent grades without dips, sunken areas, humps, or other surface irregularities. Do not use mechanical equipment to compact backfill. Tamp carefully using hand tools, refilling and tamping until Final Acceptance as necessary to offset settlement.
- (e) Exposed roots shall not be allowed to dry out before permanent backfill is placed. Temporary earth cover shall be provided, or roots shall be wrapped with four layers of wet, untreated burlap and temporarily supported and protected from damage until permanently relocated and covered with backfill.
- (f) Accidentally broken roots should be sawed cleanly 3 inches behind ragged end.

**1.05 SECURITY:**

The Contractor shall be responsible for project security for materials, tools, equipment, supplies, and completed and partially completed Work.

**1.06 TEMPORARY CONTROLS:**

A. Noise Control:

- (1) Contractor acknowledges that adjacent facilities may remain in operation during all or a portion of the Work period, and it shall take all reasonable precautions to minimize noise as required by applicable laws and the Contract Documents.
- (2) Notice of proposed noisy operations, including without limitation, operation of pneumatic demolition tools, concrete saws, and other equipment, shall be submitted to the District a minimum of forty-eight (48) hours in advance of their performance.

B. Noise and Vibration:

- (1) Equipment and impact tools shall have intake and exhaust mufflers.



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- (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.

C. Dust and Dirt:

- (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.
- (2) Contractor shall periodically water exterior demolition and construction areas to minimize the generation of dust and dirt.
- (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.
- (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.

D. Water:

- (1) 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.

E. Pollution:

- (1) No burning of refuse, debris, or other materials shall be permitted on or in the vicinity of the Premises.
- (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.

F. Lighting:

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

**1.07 JOB SIGN(S):**

A. General:

- (1) Contractor shall provide and maintain a Project identification sign with the design, text, and colors designated by the District and/or the Design Professional; locate sign as approved by the District.

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- (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.

B. Materials:

- (1) Structure and Framing: Structurally sound, new or used wood or metal; wood shall be nominal 3/4-inch exterior grade plywood.
- (2) Sign Surface: Minimum 3/4-inch exterior grade plywood.
- (3) Rough Hardware: Galvanized.
- (4) Paint: Exterior quality, of type and colors selected by the District and/or the Design Professional.

C. Fabrication:

- (1) Contractor shall fabricate to provide smooth, even surface for painting.
- (2) Size: 4'-0" x 8'-0", unless otherwise indicated.
- (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.
- (4) Text and Graphics: As indicated.

**1.08 PUBLICITY RELEASES:**

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

**PART 2 – PRODUCTS Not used.**

**PART 3 – EXECUTION Not used.**

END OF DOCUMENT

**CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions; and
- C. Temporary Facilities and Controls.

**1.02 SECTION INCLUDES:**

- A. Administrative and procedural requirements for the following:
  - (1) Salvaging non-hazardous construction waste.
  - (2) Recycling non-hazardous construction waste.
  - (3) Disposing of non-hazardous construction waste.

**1.03 DEFINITIONS:**

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

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**1.04 PERFORMANCE REQUIREMENTS:**

- A. General: Develop waste management plan that results in end-of Project rates for salvage/recycling of sixty-five percent (65%) by weight (or by volume, but not a combination) of total waste generated by the Work.

**1.05 SUBMITTALS:**

- A. Waste Management Plan: Submit waste management plan within 30 days of date established for commencement of the Work.
- B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit copies of report. Include the following information:
  - (1) Material category.
  - (2) Generation point of waste.
  - (3) Total quantity of waste in tons or cubic yards.
  - (4) Quantity of waste salvaged, both estimated and actual in tons or cubic yards.
  - (5) Quantity of waste recycled, both estimated and actual in tons or cubic yards.
  - (6) Total quantity of waste recovered (salvaged plus recycled) in tons or cubic yards.
  - (7) Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- C. Waste Reduction Calculations: Before request for final payment, submit copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

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- H. CHPS Submittal: CHPS letter template for Credit ME2.0 and ME2.1, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.
- I. Qualification Data: For Waste Management Coordinator.
- J. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- K. Submittal procedures and quantities are specified in Document 01 33 00.

**1.06 QUALITY ASSURANCE:**

- A. Waste Management Coordinator Qualifications: LEED Accredited Professional by U.S. Green Building Council.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference: Conduct conference at Project site to comply with requirements. Review methods and procedures related to waste management including, but not limited to, the following:
  - (1) Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
  - (2) Review requirements for documenting quantities of each type of waste and its disposition.
  - (3) Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
  - (4) Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
  - (5) Review waste management requirements for each trade.

**1.07 WASTE MANAGEMENT PLAN:**

- A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measurement throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

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

**PART 2 - PRODUCTS Not Used.**

**PART 3 - EXECUTION**

**3.01 PLAN IMPLEMENTATION:**

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- (1) Comply with Document 01 50 00 for operation, termination, and removal requirements.
- B. [Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.]
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

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- (1) Distribute waste management plan to everyone concerned within 3 days of submittal return.
  - (2) Distribute waste management plan to entities when they first begin work on site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- (1) Designate and label specific areas of Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
  - (2) Comply with Document 01 50 00 for controlling dust and dirt, environmental protection, and noise control.

**3.02 RECYCLING CONSTRUCTION WASTE:**

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to the Contractor.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
  - (1) Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project Site. Include list of acceptable and unacceptable materials at each container and bin.
    - (a) Inspect containers and bins for contamination and remove contaminated materials if found.
  - (2) Stockpile processed materials on site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - (3) Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  - (4) Store components off the ground and protect from the weather.
  - (5) Remove recyclable waste off District property and transport to recycling receiver or processor.

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- D. Packaging:
  - (1) Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - (2) Polystyrene Packaging: Separate and bag material.
  - (3) Pallets: As much as possible, require deliveries using pallets to remove pallets from Project Site. For pallets that remain on Site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - (4) Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- E. Site-Clearing Wastes: Chip brush, branches, and trees on site.
- F. Wood Materials:
  - (1) Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - (2) Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- G. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.
  - (1) Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

**3.03 DISPOSAL OF WASTE:**

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project Site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - (1) Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on site.
  - (2) Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off District property and legally dispose of them.

END OF DOCUMENT



**FIELD OFFICES**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions; and
- C. Temporary Facilities and Controls.

**1.02 SECTION INCLUDES:**

- A. Requirements for Field Offices and Field Office Trailers.

**1.03 SUMMARY:**

- A. General: Contractor shall provide District's Field Office Trailer and contents, for District's use exclusively, during the term of the Contract.
- B. Property: Trailer, furniture, furnishings, equipment, and the like, supplied by the Contractor with the Office Trailer shall remain the property of the Contractor; District property items installed, delivered, and the like by District within the Office Trailer will remain District's property.
- C. Modifications: District reserves the right to modify the trailer or contents, or both, as may be deemed proper by District.
- D. Condition: Trailer and contents shall be clean, neat, substantially finished, in good, proper, and safe condition for use, operation, and the like; the trailer and contents shall not be required to be new.
- E. Installation Timing: Provide safe, fully furnished, functional, proper, complete, and finished trailer properly ready for entire use, within fourteen (14) calendar days of District's notification of the issuance of Notice to Proceed.

**1.04 SUBMITTALS:**

- A. General: Submit submittals to District in quantity, format, type, and the like, as specified herein.
- B. Office Trailer Data: One (1) copy of manufacturer's descriptive data, technical descriptions, regulatory compliance, industry standards, installation, removal, and maintenance instructions.

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- C. Equipment Data: Two (2) copies of manufacturer data for each type of equipment, if directed by District.
- D. Furniture and Furnishings Data: Two (2) copies of manufacturer data for each type of equipment, if directed by District.
- E. Plans: One (1) reproducible copy of appropriately scaled plans of trailer layout. Plans shall include, but not be limited to: lighting; furniture; equipment; telephone and electrical outlets; and the like.
- F. Product Samples: One (1) complete and entire unit of each type, if directed by District.

**1.05 QUALITY ASSURANCE**

- A. Standards: In the event that provisions of codes, regulations, safety orders, Contract Documents, referenced manufacturer's specifications, manufacturer's instructions, industry standards, and the like, are in conflict, the more restrictive and higher quality shall govern.
- B. Installer: Installer or Installers engaged by Contractor must have a minimum of five (5) years of documented and properly authenticated successful experience of specialization in the installation of the items or systems, or both, specified herein.
- C. Manufacturer: Contractor shall obtain products from nationally and industry recognized Manufacturer with five (5) years minimum, of immediately recent, continuous, documented and properly authenticated successful experience of specialization in the manufacture of the product specified herein.
- D. State Personnel Training: Provide proper training for maintenance and operations, including emergency procedures, and the like, as directed by District.
- E. Units: Shall be sound and free of defects, and shall not include any damage or defect that will impair the safety, installation, performance, or the durability of the entire Office Trailer and appurtenant systems.

**1.06 REGULATORY REQUIREMENTS**

- A. General: Work shall be executed in accordance with applicable Codes, Regulations, Statutes, Enactments, Rulings, Laws, each authority having jurisdiction, and including, but not limited to, Regulatory Requirements specified herein.
- B. California Building Standards Code ("CBSC").
- C. California Code of Regulations, Title 25, Chapter 3, Sub Chapter 2, Article 3 ("CCR").
- D. Coach Insignia: Trailer shall display California Commercial Coach Insignia; such insignia shall be deemed to show that the trailer is in accordance with the Construction and Fire Safety requirements of CCR.

## **PART 2 – PRODUCTS**

### **2.01 FIELD OFFICE TRAILER**

- A. General: Provide entire Field Office Trailer of type, function, operation, capacity, size, complete with controls, safety devices, accessories, and the like, for proper and durable installation. Partitions, walls, ceiling, and other interior and exterior surfaces shall be appropriately finished, including, but not limited to, trim, painting, wall base, floor covering, suspended or similar ceiling, and the like; provide systems, components, units, nuts, bolts, screws, anchoring devices, fastening devices, washers, accessories, adhesives, sealants, and other items of type, grade, and class required for the particular use, not identified but required for a complete, weather-tight, appropriately operating, and finished installation.
- B. Manufacturers: General Electric Capital Modular Space; The Space Place, Inc.; or equal.
- C. Program: Provide a wheel-mounted trailer with stairs, landings, platforms, ramps, and the like, in good, proper, safe, clean, and properly finished condition; with proper heavy duty locks, and other proper and effective security at all doors, windows, and the like. Trailer shall be maintained in good, proper, safe, clean, and properly finished condition during the Contract.
  - (1) Nominal Trailer Size: Four hundred eighty (480) square feet, minimum.
  - (2) Stairs, Platform: Properly finished stairs, platforms, and ramps.
  - (3) Doors: Two (2), three (3) foot wide exterior doors with locksets; finished ramp, steps, and entry platform at each exterior door.
  - (4) Keys: Submit five (5) keys for each door, window, furniture unit, and the like. There shall be no other key copies or originals available; each key shall be identified for District; and shall be labeled, or tagged or both, as directed by District.
  - (5) HVAC:
  - (6) Lighting: Sixty-five (65) foot-candles illumination minimum at any point, at thirty (30) inches above finished floor throughout from fluorescent light source, exclusively, or as directed by District.
  - (7) Electrical Outlets: One (1) duplex outlet evenly spaced every twelve (12) linear horizontal feet of wall face, and electrical service ready for use.
  - (8) Telephones and Telephone Outlets: Two (2) telephone lines wired, connected to telephone utility service, and ready for use, and two (2) telephone instruments, each with two (2)-line capability, speed dial and hands-free feature. Locate each outlet as directed by District.

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- (9) Voicemail Messaging System or Answering Machine: One (1) unit, two (2)-line; digital.

**2.02 FIELD OFFICE TRAILER ITEMS**

- A. General: Provide the Field Office Trailer with the following arranged into two (2) workstations:
- (1) Desks: Two (2) desks: thirty-six (36) inches by sixty (60) inches; steel, laminated plastic top; locking, one (1) or two (2) file drawers single pedestal; steel; provide five (5) keys to District.
  - (2) Tables: Two (2) tables; thirty-six (36) inches by sixty (60) inches; twenty-nine (29) inches high; steel, laminated plastic top tables; one (1) at each desk.
  - (3) Chairs: Two (2) chairs: swivel; steel; with seat cushion and arms; one (1) at each desk.
  - (4) Waste Baskets: Two (2) waste baskets, one at each desk.
- B. Furniture and Equipment: Provide in the space located to effect efficient and logical use.
- (1) File cabinet: One (1); four (4) drawer; lateral; steel locking.
  - (2) Plan Table: One (1) plan table: thirty-six (36) inches deep by seventy-two (72) inches wide by forty-two (42) inches high; adjustable; wood or steel; with lockable plan and pencil drawers.
  - (3) Drafting Stool: One (1) drafting stool; swiveling; steel; padded; adjustable; with footrest and casters.
  - (4) Bookshelf: One (1) bookshelf: thirty-six (36) inches deep by seventy-two (72) inches wide by forty-two (42) inches high; adjustable; wood or steel; with lockable plan and pencil drawer.
  - (5) Plan Rack: One (1) wheel mounted plan rack.
  - (6) Waste Baskets: One (1) large waste basket.
  - (7) Coat/Hat Hanger: Wall mounted with minimum capacity for four (4) garments and ten (10) hats.
  - (8) Document Management System: Shall include an integrated high-volume printer, copier, and facsimile machine, including stand, base, and storage cabinet; and shall include the following features:
    - (a) Type: Laser, dry electrostatic transfer, plain paper, digital, multi-function imaging system.
    - (b) Network: Ethernet or Token Ring network ready, Plug-and-Play.

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- (c) Print, send/receive facsimile from any connected workstation.
- (d) Resolution: Six hundred (600) dots per inch by six hundred (600) dots per inch, minimum.
- (e) Print Speed: Twenty (20) pages per minute, minimum.
- (f) Copies: Twenty (20) copies per minute, minimum.
- (g) Document Handler: Forty (40) sheet, minimum
- (h) Collator: Forty (40) bin, minimum, with stapling.
- (i) Duplexing: Capable.
- (j) Paper Size: Capable of handling paper sizes to eleven (11) inches by seventeen (17) inches.
- (k) Paper Cassettes: One (1) each for eight and one half (8.5) inches by eleven (11) inches, eight and one half (8.5) inches by fourteen (14) inches, and eleven (11) inches by seventeen (17) inches paper sizes; minimum two hundred fifty (250) sheets per cassette.
- (l) Reduction/Enlargement: Capable of reduction to twenty-five percent (25%) and enlargement to two hundred percent (200%).
- (m) Facsimile Electronic Storage: Capable of storing minimum of fifty (50) speed dial numbers, group faxing and broadcast faxing.
- (n) Facsimile Scanning: Capable of scanning into memory a minimum of one hundred (100) pages with maximum scan time of three (3) seconds per page.
- (o) Halftone: Sixty-four (64) levels.
- (p) Redial: Automatic and Manual.
- (9) Maintenance: Contractor shall purchase service agreements for each unit of equipment for the duration of the project plus two (2) months, and shall maintain all equipment in proper working condition. Service agreements shall include provision for replacement of toner cartridges and other items required to effect proper unit use. Service agreements shall also provide for:
  - (a) Unlimited Service Calls.
  - (b) Same Day Response.
  - (c) All parts, labor, preventative maintenance and mileage.

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- (d) All chemicals, such as toner, fixing agent, and the like.
- (e) System training and setup.
- (10) Portable Toilets: Two (2); each shall include a urinal; each unit shall be a properly enclosed chemical unit conforming to ANSI Z4.3.
  - (a) Location: As directed by District.
  - (b) Maintenance: Maintain each unit and surrounding areas in a clean, hygienic and orderly manner, at all time. Empty, clean, and sanitize each unit each day at a location and time as directed by District.
  - (c) Removal: Relocate, or remove from the site, each Portable Toilet. Upon such directive by District, the Contractor shall forthwith relocate or remove each Portable Toilet and submit the affected areas to a condition which existed prior to the installation of each Portable Toilet, within three (3) calendar days, or as directed by District in writing, at no cost to District.

## **2.03 UTILITY AND SERVICES**

- A. Telephone Service: Contractor shall provide and interface the entire telephone service, and shall properly and timely pay for telephone service for District's non-long-distance use.
- B. Electrical Service: Provide all proper connections and continuously pay for service for the duration of the Work.

## **2.04 FINISHES**

- A. General: Manufacturer standard finish system over surfaces properly cleaned, pretreated, and prepared to obtain proper bond; all visible surfaces shall be coated.
- B. Finish: Color as selected by District from manufacturer standard palette.

## **PART 3 – EXECUTION**

### **3.01 INSTALLATION**

- A. General: Properly prepare area and affected items to receive the Work. Set Work accurately in location, alignment, and elevation; rigidly, securely, and firmly anchor to appropriate structure; install plumb, straight, square, level, true, without racking, rigidly anchored to proper solid blocking, substrate, and the like; provide appropriate type and quantity of reinforcements, fasteners, adhesives, self-adhesive and other tapes; lubricants, coatings, accessories, and the like, as required for a complete, structurally rigid, stable, sound, and appropriately finished installation, in accordance with manufacturer's published instructions, and as indicated. The more restrictive and higher quality requirement shall govern. Moving parts shall be properly secured, without binding, looseness, noise, and the like.

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- B. Installation: Install in accordance with 25 CCR 3.2.3 and as directed by District; jack up trailer and level both ways; mount on proper concrete piers with all load off wheels; provide required tie down and accessories per Section 4368 of referenced CCR, and as directed by District.
- C. Rejected Work: Work, materials, unit, items, systems, and the like, not accepted by District shall be deemed rejected, and shall forthwith be removed and replaced with proper and new Work, materials, unit, items, systems, and the like at no cost to District.
- D. Standard: Comply with manufacturer's published instructions, or with instructions as shown or indicated; the more restrictive and higher quality requirement shall govern.
- E. Location: As directed by District.
- F. Fire Resistance: Construct and install in accordance with UL requirements.
- G. Maintenance: Contractor shall maintain trailer and adjacent areas in a safe, clean and hygienic condition throughout the duration of the Work, and as directed by District. Properly repair or replace furniture or other items, as directed by District. Properly remove unsafe, damaged, or broken furniture, or similar items, and replace with safe and proper items. Contractor shall pay cost of all services, repair, and maintenance, or replacement of each item.
- H. Janitorial Service: Provide professional janitorial services, including, but not limited to, trash, waste paper baskets, fill paper dispensers; clean and dust all furniture, files, and the like; sweep and mop resilient and similar flooring; and vacuum carpeting and similar flooring.
  - (1) Frequency: Two (2) times per week, minimum.
- I. Removal: Properly remove the Office Trailer and contents from the Site upon completion of the Contract, or as directed by District in writing. Forthwith properly patch and repair affected areas; replace damaged items with new items. Carefully and properly inventory, clean, pack, store, and protect District property; submit District property to District at a date, time and location as directed by District.

END OF DOCUMENT

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SECTION 01 56 39 – TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Furnish all labor, materials, equipment, facilities, transportation and services to complete tree protection and related work as shown on the drawings and/or specified herein.
- B. Description of Work:
  - 1. Protection of existing trees and vegetation to remain.
  - 2. Trimming of existing trees.
  - 3. Maintenance of existing trees during construction.
  - 4. Removal and re-installation of existing trees.
  - 5. Contractor shall retain the services of a certified arborist to perform routine visits and oversee the protection of the existing trees within the project area during demolition, construction and maintenance and to especially review and recommend treatment when roots are encountered and to perform routine maintenance during the construction phase.
- C. Traffic:
  - 1. Do not interfere with or close public ways without permission of the Owner's Representative.
  - 2. Do not interfere with adjacent private properties without permission of the Owner's Representative.
- D. Site Utilities:
  - 1. Advise utility companies of excavation activities before starting excavations.
  - 2. Locate and identify underground utilities passing through work area before starting work.
  - 3. In event unidentified underground utilities are encountered during work, advise utility owner immediately before proceeding. Add any new utility information to project record drawings for actual location.
  - 4. Protect all existing-to-remain utilities.
  - 5. Do not interrupt existing utilities without advance notice to and approval from the Owner's Representative.



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1.3 SUBMITTALS

- A. Qualification Data: For qualified tree service firm.
- B. Existing Conditions: Submit documentation of existing trees and plantings indicated to remain and/or relocate, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
  - 1. Use sufficiently detailed photographs.
  - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- C. 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.
- D. Written Maintenance Recommendations: From certified arborist, for care and protection of trees affected by construction during and after completing the Work and for removal and re-installation of existing trees.

1.4 QUALITY ASSURANCE

- A. Arborist Qualifications: Certified Arborist as certified by the International Society of Arboriculture (ISA) and having performed similar services for a minimum of five (5) years.
- B. Certified Arborist Written Recommendations: Contractor shall retain the services of a reputable Arborist certified by the International Society of Arboriculture (ISA) for review and prepare written recommendations for existing to remain shrubs and trees within the project area under the following circumstances. Contractor shall submit the written recommendations to the Owner's Representative for review. Contractor shall implement Arborist recommendations.
  - 1. Grading, excavation, trenching or any other similar work is required that may disturb roots of existing to remain trees over six (6) inches in diameter measured three (3) feet above finish grade.
  - 2. Pruning is required on branches more than two (2) inches in diameter for existing to remain trees over six (6) inches in diameter measured three (3) feet above finish grade.
  - 3. Damage to existing to remain tree(s) has occurred during construction to any part of the tree.
  - 4. Construction is required within ten (10) horizontal feet of a tree and/or shrub to remain, with a trunk diameter over six (6) inches in diameter measured three (3) feet above finish grade.

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- C. Certified Arborist Over-sight: Certified Arborist shall perform site inspections, provide over-sight and written summary of visit to Owner's Representative prior to demolition and construction work within the dripline of existing to remain trees with a trunk diameter over six (6) inches in diameter measured three (3) feet above finish grade and provide routine maintenance as required to maintain healthy, viable trees throughout the construction process. Certified Arborist shall provide over-site for recommended pruning for branches two (2) inches and larger in size for existing to remain trees.
- D. Contractor shall be liable for the loss in value due to damaged trees and for repair costs resulting as determined by the Client. Due to the irreplaceable nature of many existing trees and vegetation, the liability to the General Contractor shall be set at \$1,500.00 minimum per tree. The Trunk Formula method for Northern California established by the International Society of Arboriculture will be used to compute the actual value. Other vegetation lost due to construction activity and/or neglect shall be replaced by General Contractor in kind with similar size, potted plant stock to match existing prior to construction.

#### 1.5 PROJECT CONDITIONS

- A. The following practices are prohibited within protection zones:
  - 1. Storage of construction materials, debris, or excavated material.
  - 2. Parking vehicles or equipment.
  - 3. Foot traffic.
  - 4. Erection of sheds or structures.
  - 5. Impoundment of water.
  - 6. Excavation or other digging unless otherwise indicated.
  - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

#### 1.6 DEFINITIONS

- A. Caliper: Caliper on young trees is taken six (6) inches above the soil level and measured by a diameter across the tree trunk. For a tree exceeding a four (4) inch caliper, the diameter measurement is then taken at twelve (12) inches above the soil level. For a mature tree, the caliper is taken at chest height, generally 4-1/2 to 5 feet above the soil level. The measurement is taken using a tree caliper, a utensil in the shape of an "F" with an adjustable cross arm to slide and rest up against the trunk to measure the precise distance of the trunk width.
- B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius equal to the diameter of the drip line unless otherwise indicated.

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- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

## PART 2 - PRODUCTS

### 2.1 TREE PROTECTION PROTECTIVE FENCE

- A. Existing vegetation and/or trees to remain on the site shall be protected with a five (5) foot high orange plastic snow fence. Fence shall be mounted on two (2) inch diameter lodge pole posts driven into the ground every six (6) feet to a depth of at least two (2) feet. Fence shall be erected and installed around the perimeter dripline of each shrub, tree or groups of shrubs or trees to remain.
1. Snow Fence: Orange, UV resistance, 3-inch thickness, 60 inches in height, oval mesh, extruded thermal plastic polymer, Tenax or equal, fence fabric.
  2. Lodgepole: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated Douglas Fir or lodgepole pine, free of knots, holes, cross grain, and other defects, two (2) inches in diameter by length required, and pointed at one end.
  3. Signage: Each tree fence shall have a prominently displayed 8.5 inch x 11 inch sign stating "Warning – Protection Zone".
- B. During planting and irrigation operations, protective fencing is not required beneath existing to remain trees and shrubs that fall within the newly landscaped and/or irrigation area.

### 2.2 TOPSOIL

- A. Natural or cultivated top layer of the soil profile or manufactured topsoil; 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 one (1) inch in diameter; and free of weeds, roots, and toxic and other non-soil materials.

### 2.3 ORGANIC MULCH

- A. Refer to specification section 32 90 00 "Planting" and match organic mulch material to use in non-bio-retention planting areas.
- B. If specification section 32 90 00 "Planting" is not issued as part of this project, provide the following mulch for non-bio-retention planting areas:
1. Mulch for non-bio-retention planting areas: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of untreated recycled wood chips from Wheeler Zamaroni Landscape Supply.
    - a. Address: 3500 Petaluma Hill Rd, Santa Rosa, CA 95404
    - b. Phone: (707) 543-8400
    - c. Website: <https://wzsupply.com/>
    - d. Email: [sales@wzsupply.com](mailto:sales@wzsupply.com)

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. Prior to demolition and construction, Certified Arborist shall review existing to remain trees and vegetation and prepare a written report(s) as required for the protection, treatment and maintenance of existing trees and vegetation throughout the phases of the Project.
- C. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

- A. Inspections: Engage a qualified arborist to direct plant protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain, to over-see removal and re-installation of existing plant material and to prepare inspection reports.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Tie a 1-inch blue-vinyl tape around each tree trunk at 54 inches above the ground.
- C. 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.
- D. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas if indicated within Drawings.
  - 1. Apply 3-inch minimum thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.

3.3 PROTECTIVE FENCE INSTALLATION

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin. Install fencing in a manner that will prevent people from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
  - 1. Plastic Protection Zone Fencing: Neatly install protection zone plastic fabric by securing to posts with plastic bands or steel wires, a minimum of two per post, additionally if required to withstand typical construction activity.
  - 2. Posts: Set or drive posts into ground at least two (2) feet without concrete footings and no more than six (6) feet on center spacing. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Owner's Representative.

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3. Access Gates: Install as necessary; adjust to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
  - B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Owner's Representative. Install one sign spaced approximately every 50 feet on protection-zone fencing, but no fewer than two signs with each facing a different direction.
  - C. Maintain protection zones free of weeds and trash.
  - D. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by the Owner's Representative.
  - E. Maintain protection-zone fencing and signage in good condition as acceptable to Owner's Representative and remove when construction operations are complete and equipment has been removed from the site.
    1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
    2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.
    3. Temporary access is permitted for landscape irrigation and planting operations.
- 3.4 ARBORIST SUPERVISION
- A. For construction within ten (10) horizontal feet of a tree and/or shrub to remain, with a trunk diameter of twelve (12) inches or larger measured three (3) feet above original finish grade, Contractor shall retain the services of a reputable Arborist certified by the International Society of Arboriculture (ISA) to review the tree(s) and/or shrubs(s), the work to be performed and provide written recommendations to minimize the impact on existing trees and/or shrubs to remain. Submit recommendations to Owner's Representative for review.
  - B. Contractor shall implement Arborist recommendations.
  - C. Contractor shall consult Arborist for further recommendations if tree(s) and/or shrub(s) appear in failing health until final completion and acceptance of landscape work.
- 3.5 EXCAVATION
- A. General: Excavation and trenching shall be performed at a minimum, in accordance with these specifications and per Drawings and Details and in accordance with recommendations from project Arborist retained by Contractor.
  - B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.

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- C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.
- D. 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.

### 3.6 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
  - 1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
- C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with topsoil

### 3.7 ROOT PRUNING

- A. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:
  - 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
  - 2. Cut Ends: Coat cut ends of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist.
  - 3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
  - 4. Cover exposed roots with burlap and water regularly.
  - 5. Backfill as soon as possible.
- B. Root Pruning at Edge of Protection Zone: Prune roots flush with the edge of the protection zone, by cleanly cutting all roots to the depth of the required excavation.

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- C. Root Pruning within Protection Zone: Avoid cutting trenches within shrub and/or tree protection zone. If trenching is unavoidable, cut trenches with an air spade tool to expose roots without cutting them. Roots encountered smaller than two (2) inches in diameter may be cut, not torn for removal. Cleanly cut roots as close as possible to excavation. Roots larger than two (2) inches in diameter shall remain.

### 3.8 CANOPY PRUNING

- A. General Pruning Procedures:
  - 1. Prune trees according to ANSI A300 (Part 1).
  - 2. Cut branches with sharp pruning instruments; do not break or chop.
  - 3. Do not apply pruning paint to wounds.
- B. Pruning Goals (Prune as follows and under the direction of Certified Arborist):
  - 1. Prune trees to remain to compensate for root loss caused by construction damage. Provide subsequent maintenance during landscape irrigation and planting maintenance period and until "final completion" as recommended by Certified Arborist.
  - 2. Prune to remove dead wood, promote proper structure, thin and open canopy, and for general health for the specific tree species.
  - 3. Prune for clearance from structures, pathways and driveways and streets and for a balanced canopy.
- C. Shrubs, Vines, and Ground Covers:
  - 1. Prune, thin, and shape shrubs according to standard horticultural practices.
  - 2. Prune to remove injured or dead branches from shrubs.
  - 3. Cleaning: Chip removed branches and dispose of off-site.

### 3.9 IRRIGATION

- A. Irrigate existing vegetation and/or trees to remain and those relocated during hot and/or dry periods and as required to maintain material in a healthy, vigorous condition.

### 3.10 REMOVE AND RE-INSTALL EXISTING TREES

- A. Plant material noted on Drawing to be transplanted shall be carefully removed from planting area and planted in new location indicated on Planting Plan. Removal shall consist of digging around the dripline of each plant to be transplanted and to the depth where roots are present. Plant and rootball shall be carefully moved to new planting pit.
- B. Re-install transplanted plant material to location indicated on Drawing as follows:
  - 1. Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation. Excavate approximately planting pit sizes twice the width of the planting pot and equal to the depth of the planting pot.
  - 2. Carefully install root ball without damaging root ball or plant.

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3. Set rootball onto compacted native soil so the rootball sits one (1) inch above adjacent finish grade.
4. Amend backfill soil per tree planting detail and landscape planting specifications.
5. Place planting soil around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil.
6. Stake tree(s) per tree planting detail.

### 3.11 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by the Owner's Representative.
  1. Submit details of proposed root cutting and tree and shrub repairs.
  2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
  3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
  4. Perform repairs within 24 hours.
  5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by the Owner's Representative.
- B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the maintenance period or are damaged during construction operations that the Owner's Representative determines are incapable of restoring to normal growth pattern.
  1. Provide new trees of same size and species as those being replaced for each tree that measures three (3) inches or smaller in caliper size.
  2. Provide new trees of 48" box size and species as those being replaced for each tree that measures greater than three (3) inches. In addition, the liability to the General Contractor shall be set at \$1,500.00 minimum per tree. The Trunk Formula method for Northern California established by the International Society of Arboriculture must be used to compute the actual value.
  3. Plant and maintain new trees as specified in Section 32 90 00 "Planting."
- C. Soil Aeration: Where directed by the Owner's Representative, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill two (2) inch diameter holes a minimum of 12 inches (300 mm) deep at 24 inches o.c. Backfill holes with an equal mix of augured soil and sand.

### 3.12 REMOVAL OF EXISTING TREES:

- A. Contractor shall remove and demolish from the site trees and vegetation indicated on the Drawings. Additional trees and vegetation conflicting with work require written approval by Owner or Architect.

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- B. Tree removal shall include branches, leaves, roots, stumps and stump grindings to a minimum depth of 18" below proposed subgrade. Exact depth shall be determined in accordance with and as required for building and hardscape work included under this contract.
- C. Contractor shall fill depressions caused by tree removal with topsoil or site soil.
- D. Properly dispose of any vegetation debris in a legal and acceptable manner off project/site property.

3.13 MAINTENANCE OF EXISTING SHRUBS AND/OR TREES DURING CONSTRUCTION

- A. Irrigate existing shrubs and/or trees to remain and those relocated during hot and/or dry periods and as required to maintain material in a healthy, vigorous condition.
- B. Do not store equipment, materials or vehicles beneath existing to remain trees.
- C. Contractor shall exercise caution when working around tree canopies to ensure branches are not torn or broken, bark is not damaged and canopy remains intact.
- D. Protect tree and/or shrub root systems from damage caused by runoff or spillage of noxious materials while mixing, placing or storing construction materials. Protect root system from ponding, eroding or excessive wetting caused by dewatering operations.
- E. Monitor existing to remain trees and/or shrubs to remain for pests and diseases and signs of distress. Retain the services of a Certified Arborist to review and remedy signs of distress, pests and/or disease.
- F. Maintain protective fencing at original location in vertical, undamaged condition until all contractors and subcontractors are complete.
- G. The project Certified Arborist shall be notified of any damage that occurs to a protected tree during construction and proper treatment shall be administered as recommended by the Certified Arborist.

END OF SECTION 01 56 39

(Revised 4/18/2024)

**OWNER-FURNISHED PRODUCTS**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions; and
- C. Materials and Equipment.

**1.02 SECTION INCLUDES**

- A. Requirements for the following:
  - (1) Installing Owner-furnished materials and equipment.
  - (2) Providing necessary utilities, connections and rough-ins.

**1.03 DEFINITIONS**

- A. Owner: District, who is providing/furnishing materials and equipment.
- B. Installing Contactor: Contractor, who is installing the materials and equipment furnished by the Owner.

**1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Receive, store and handle products in accordance with the manufacturer's instructions.
- B. Protect equipment items as required to prevent damage during storage and construction.

**PART 2 – PRODUCTS**

**2.01 GENERAL PRODUCT REQUIREMENTS**

- A. Installing Contractor's Responsibilities:
  - (1) Verify mounting and utility requirements for Owner-furnished materials and equipment items.
  - (2) Provide mounting and utility rough in for all items where required.

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- (a) Rough in locations, sizes, capacities, and similar type items shall be as indicated and required by product manufacturer.

B. Owner and Installing Contractor(s) Responsibilities:

- (1) Owner-Furnished/Contractor Installed ("OFCI"): Furnished by the Owner; installed by the Installing Contractor.
  - (a) General: Owner and Installing Contractor(s) will coordinate deliveries of materials and equipment to coincide with the construction schedule.
  - (b) Owner will furnish specified materials and equipment delivered to the site. Owner/vendor's representative shall be present on Site at the time of delivery to comply with the contract requirements and Specifications Section 01 43 00, Materials and Equipment, Article 1.04.
  - (c) The Owner furnishing specified materials and equipment is responsible to provide manufacturer guarantees as required by the Contract to the Installing Contractor.
  - (d) The Installing Contractor shall:
    - 1) Review, verify and accept the approved manufacturer's submittal/Shop Drawings for all materials and equipment required to be installed by the Installer Contractor and furnished by the Owner. Any discrepancies, including but not limited to possible space conflicts, should be brought to the attention of the Project Manager and/or Program Manager, if applicable.
    - 2) Coordinate timely delivery. Installing Contractor shall receive materials and equipment at Site when delivered and give written receipt at time of delivery, noting visible defects or omissions; if such declaration is not given, the Installing Contractor shall assume responsibility for such defects and omissions.
    - 3) Store materials and equipment until ready for installation and protect from loss and damage. Installing Contractor is responsible for providing adequate storage space.
    - 4) Coordinate with other bid package contractors and field measurement to ensure complete installation.
    - 5) Uncrate, assemble, and set in place.
    - 6) Provide adequate supports.
    - 7) Install materials and equipment in accordance with manufacturer's recommendations, instructions, and

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Shop Drawings, supply labor and material required, and make mechanical, plumbing, and electrical connections required to operate equipment.

- 8) Be certified by equipment manufacturer for installation of the specific equipment supplied by the Owner.
- 9) Provide anchorage and/or bracing as required for seismic restraint per Title 24, UBC Standard 27-11 and all other applicable codes.
- 10) Provide the contract-required warranty and guarantee for all work, materials and equipment, and installation upon its completion and acceptance by the District. Guarantee includes all costs associated with the removal, shipping to and from the Site, and re-installation of any equipment found to be defective.

C. Compatibility with Space and Service Requirements:

- (1) Equipment items shall be compatible with space limitations indicated and as shown on the Contract Documents and specified in other sections of the Specifications.
- (2) Modifications to equipment items required to conform to space limitations specified for rough in shall not cause additional cost to the District.

D. Manufacturer's printed descriptions, specifications, and instructions shall govern the Work unless specifically indicated or specified otherwise.

**2.02 FURNISHED MATERIALS AND EQUIPMENT**

- A. All furnished materials and equipment are indicated or scheduled on the Contract Documents.

**PART 3 – EXECUTION**

**3.01 INSTALLATION**

- A. Install equipment items in accordance with the manufacturer's instructions.
- B. Set equipment items securely in place, rigidly or flexibly mounted in accordance with manufacturers' directions.
- C. Make electrical and mechanical connections as indicated and required.
- D. Touch-up and restore damaged or defaced finishes to the Owner's satisfaction.

**3.02 CLEANING AND PROTECTION**

- A. Repair or replace items not acceptable to the Architect or Owner.

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- B. Upon completion of installation, clean equipment items in accordance with manufacturer's recommendations, and protect from damage until final acceptance of the Work by the Owner.

END OF DOCUMENT

**PRODUCT DELIVERY, STORAGE AND HANDLING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Site Access, Conditions and Requirements;
- B. Special Conditions.

**1.02 PRODUCTS**

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

**1.03 TRANSPORTATION AND HANDLING**

- A. Contractor shall transport and handle Products in accordance with manufacturer's instructions.
- B. Contractor shall promptly inspect shipments to confirm that Products comply with requirements, quantities are correct, and products are undamaged.
- C. Contractor shall provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

**1.04 STORAGE AND PROTECTION**

- A. 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.
- B. For exterior storage of fabricated Products, Contractor shall place on sloped supports, above ground.
- C. Contractor shall provide off-site storage and protection when Site does not permit on-site storage or protection.

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- D. Contractor shall cover products subject to deterioration with impervious sheet covering and provide ventilation to avoid condensation.
- E. Contractor shall store loose granular materials on solid flat surfaces in a well-drained area and prevent mixing with foreign matter.
- F. Contractor shall provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- G. 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.

**PART 2 – PRODUCTS Not Used.**

**PART 3 - EXECUTION Not Used.**

END OF DOCUMENT

**FIELD ENGINEERING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Site Investigation, and Soils Investigation Report;
- B. Special Conditions;
- C. Site-Visit Certification.

**1.02 REQUIREMENTS INCLUDED:**

- A. Contractor shall provide and pay for field engineering services by a California-registered engineer, required for the project, including, without limitations:
  - (1) Survey work required in execution of the Project.
  - (2) Civil or other professional engineering services specified, or required to execute Contractor's construction methods.

**1.03 QUALIFICATIONS OF SURVEYOR OR ENGINEERS:**

Contractor shall only use a qualified licensed engineer or registered land surveyor, to whom District makes no objection.

**1.04 SURVEY REFERENCE POINTS:**

- A. Existing basic horizontal and vertical control points for the Project are those designated on the Drawings.
- B. Contractor shall locate and protect control points prior to starting Site Work and preserve all permanent reference points during construction. In addition Contractor shall:
  - (1) Make no changes or relocation without prior written notice to District and Architect.
  - (2) Report to District and Architect when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
  - (3) Require surveyor to replace Project control points based on original survey control that may be lost or destroyed.



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**1.05 RECORDS:**

Contractor shall maintain a complete, accurate log of all control and survey work as it progresses.

**1.06 SUBMITTALS:**

- A. Contractor shall submit name and address of Surveyor and Professional Engineer to District and Architect prior to its/their work on the Project.
- B. On request of District and Architect, Contractor shall submit documentation to verify accuracy of field engineering work, at no additional cost to the District.
- C. Contractor shall submit a certificate signed by registered engineer or surveyor certifying that elevations and locations of improvements are in conformance or nonconformance with Contract Documents.

**PART 2 – PRODUCTS Not Used.**

**PART 3 - EXECUTION**

**3.01 COMPLIANCE WITH LAWS:**

Contractor is responsible for meeting all applicable codes, OSHA, safety and shoring requirements.

**3.02 NONCONFORMING WORK:**

Contractor is responsible for any re-surveying required by correction of nonconforming work.

END OF DOCUMENT

**CUTTING AND PATCHING**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Inspector, Inspections, and Tests, Integration of Work, Nonconforming Work, and Correction of Work, and Uncovering Work;
- B. Special Conditions;
- C. Hazardous Materials Procedures and Requirements;
- D. Hazardous Materials Certification;
- E. Lead-Based Paint Certification;
- F. Imported Materials Certification.

**1.02 CUTTING AND PATCHING:**

- A. Contractor shall be responsible for all cutting, fitting, and patching, including associated excavation and backfill, required to complete the Work or to:
  - (1) Make several parts fit together properly.
  - (2) Uncover portions of Work to provide for installation of ill-timed Work.
  - (3) Remove and replace defective Work.
  - (4) Remove and replace Work not conforming to requirements of Contract Documents.
  - (5) Remove Samples of installed Work as specified for testing.
  - (6) Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.
  - (7) Attaching new materials to existing remodeling areas – including painting (or other finishes) to match existing conditions.
- B. In addition to Contract requirements, upon written instructions from the 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.

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- C. 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.

**1.03 SUBMITTALS:**

- A. Prior to any cutting or alterations that may affect the structural safety of Project, or work of others, and well in advance of executing such cutting or alterations, 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, including the following:
- (1) The work of the District or other trades.
  - (2) Structural value or integrity of any element of Project.
  - (3) Integrity or effectiveness of weather-exposed or weather-resistant elements or systems.
  - (4) Efficiency, operational life, maintenance or safety of operational elements.
  - (5) Visual qualities of sight-exposed elements.
- B. Contractor's Request shall also include:
- (1) Identification of Project.
  - (2) Description of affected Work.
  - (3) Necessity for cutting, alteration, or excavations.
  - (4) Effects of Work on District, other trades, or structural or weatherproof integrity of Project.
  - (5) Description of proposed Work:
    - (a) Scope of cutting, patching, alteration, or excavation.
    - (b) Trades that will execute Work.
    - (c) Products proposed to be used.
    - (d) Extent of refinishing to be done.
  - (6) Alternates to cutting and patching.
  - (7) Cost proposal, when applicable.
  - (8) The scheduled date the Contractor intends to perform the Work and the duration of time to complete the Work.

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- (9) Written permission of District or other District contractor(s) whose work will be affected.

**1.04 QUALITY ASSURANCE:**

- A. 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.
- B. Contractor shall ensure that cutting, fitting, and patching shall successfully duplicate undisturbed adjacent profiles, materials, textures, finishes, 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.

**1.05 PAYMENT FOR COSTS:**

- A. Cost caused by ill-timed or defective Work or Work not conforming to Contract Documents, including costs for additional services of the District, its consultants, including but not limited to the Construction Manager, the Architect, the Project Inspector(s), Engineers, and Agents, will be paid by Contractor and/or deducted from the Contract by the District.
- B. District shall only pay for cost of Work if it is part of the original 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. Contractor shall provide written cost proposals prior to proceeding with cutting and patching.

**PART 2 - PRODUCTS**

**2.01 MATERIALS:**

- A. 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 first recommend a product of a manufacturer or appropriate trade association for approval by the District.
- B. Materials to be cut and patched include those damaged by the performance of the Work.

**PART 3 – EXECUTION**

**3.01 INSPECTION:**

- A. 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.

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- B. 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.

**3.02 PREPARATION:**

- A. 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.
- B. Contractor shall provide devices and methods to protect other portions of Project from damage.
- C. 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.

**3.03 ERECTION, INSTALLATION AND APPLICATION:**

- A. With respect to performance, Contractor shall:
  - (1) Execute fitting and adjustment of products to provide finished installation to comply with and match specified tolerances and finishes.
  - (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) Execute cutting, demolition excavating, and backfilling by methods that will prevent damage to other Work and damage from settlement.
- B. Contractor shall employ original installer or fabricator to perform cutting and patching for:
  - (1) Weather-exposed surfaces and moisture-resistant elements such as roofing, sheet metal, sealants, waterproofing, and other trades.
  - (2) Sight-exposed finished surfaces.
- C. Contractor shall 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.
- D. Contractor 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.
- E. Contractor shall restore Work which has been cut or removed. Contractor shall install new products to provide completed Work in accordance with

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requirements of the Contract Documents and as required to match surrounding areas and surfaces.

- F. Contractor shall refinish all continuous surfaces to nearest intersection as necessary to match the existing finish to any new finish.

END OF DOCUMENT

**ALTERATION PROJECT PROCEDURES**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Integration of Work, Purchase of Materials and Equipment, Uncovering of Work and Non-conforming Work and Correction of Work and Trenches;
- B. Special Conditions.

**PART 2 - PRODUCTS**

**2.01 PRODUCTS FOR PATCHING AND EXTENDING WORK:**

- A. New Materials: As specified in the Contract Documents including, without limitation, in the Specifications, Contractor shall match existing products, conditions, and work for patching and extending work.
- B. Type and Quality of Existing Products: Contractor shall determine by inspection, by testing products where necessary, by referring to existing conditions and to the Work as a standard.

**PART 3 - EXECUTION**

**3.01 EXAMINATION:**

- A. Contractor shall verify that demolition is complete and that areas are ready for installation of new Work.
- B. By beginning restoration Work, Contractor acknowledges and accepts the existing conditions.

**3.02 PREPARATION:**

- A. Contractor shall cut, move, or remove items as necessary for access to alterations and renovation Work. Contractor shall replace and restore these at completion.
- B. Contractor shall remove unsuitable material not as salvage unless otherwise indicated in the Contract Documents. Unsuitable material may include, without limitation, rotted wood, corroded metals, and deteriorated masonry and concrete. Contractor shall replace materials as specified for finished Work.

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- C. Contractor shall remove debris and abandoned items from all areas of the Site and from concealed spaces.
- D. Contractor shall prepare surface and remove surface finishes to provide for proper installation of new Work and finishes.
- E. Contractor shall close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity. Contractor shall insulate ductwork and piping to prevent condensation in exposed areas. Contractor shall insulate building cavities for thermal and/or acoustical protection, as detailed.

**3.03 INSTALLATION:**

- A. Contractor shall coordinate Work of all alternations and renovations to expedite completion and to accommodate District occupancy.
- B. Designated Areas and Finishes: Contractor shall complete all installations in all respects, including operational, mechanical work and electrical work.
- C. Contractor shall remove, cut, and patch Work in a manner to minimize damage and to provide a means of restoring Products and finishes to original or specified condition.
- D. Contractor shall refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat and square or straight transition to adjacent finishes.
- E. Contractor shall install products as specified in the Contract Documents, including without limitation, the Specifications.

**3.04 TRANSITIONS:**

- A. Where new Work abuts or aligns with existing, Contractor shall perform a smooth and even transition. Patched Work must match existing adjacent work in texture and appearance.
- B. When finished surfaces are cut so that a smooth transition with new Work is not possible, Contractor shall terminate existing surface along a straight line at a natural line of division and make a recommendation for resolution to the District and the Architect for review and approval.

**3.05 ADJUSTMENTS:**

- A. Where removal of partitions or walls results in adjacent spaces becoming one, Contractor shall rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
- B. Where a change of plane of 1/4 inch or more occurs, Contractor shall submit a recommendation for providing a smooth transition to the District and the Architect for review and approval.



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- C. Contractor shall trim and seal existing wood doors and shall trim and paint metal doors as necessary to clear new floor finish and refinish trim as required.
- D. Contractor shall fit Work at penetrations of surfaces.

**3.06 REPAIR OF DAMAGED SURFACES:**

- A. Contractor shall patch or replace portions of existing surfaces, which are damaged, lifted, discolored, or showing other imperfections, in the area where the Work is performed.
- B. Contractor shall repair substrate prior to patching finish.

**3.07 CULTIVATED AREAS AND OTHER SURFACE IMPROVEMENTS:**

- A. Cultivated or planted areas and other surface improvements which are damaged by actions of the Contractor shall be restored by Contractor to their original condition or better, where indicated.
- B. Contractor shall protect and replace, if damaged, all existing guard posts, barricades, and fences.
- C. Contractor shall give special attention to avoid damaging or killing trees, bushes and/or shrubs on the Premises and/or identified in the Contract Documents, including without limitation, the Drawings.

**3.08 FINISHES:**

- A. Contractor shall finish surfaces as specified in the Contract Documents, including without limitations, the provisions of all Divisions of the Specifications.
- B. Contractor shall finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, Contractor shall refinish entire surface to nearest intersections.

**3.09 CLEANING:**

- A. Contractor shall continually clean the Site and the Premises as indicated in the Contract Documents, including without limitation, the provisions in the General Conditions and the Specifications regarding cleaning.

END OF DOCUMENT

**CONTRACT CLOSEOUT AND FINAL CLEANING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Completion of Work;
- B. Special Conditions;
- C. Temporary Facilities and Controls.

**1.02 CLOSEOUT PROCEDURES**

Contractor shall comply with all closeout provisions as indicated in the General Conditions.

**1.03 FINAL CLEANING**

- A. Contractor shall execute final cleaning prior to final inspection.
- B. Contractor shall clean interior and exterior glass and all surfaces exposed to view; remove temporary labels, tape, stains, and foreign substances, polish transparent and glossy surfaces, wax and polish new vinyl floor surfaces, vacuum carpeted and soft surfaces.
- C. Contractor shall clean equipment and fixtures to a sanitary condition.
- D. Contractor shall replace filters of operating equipment.
- E. Contractor shall clean debris from roofs, gutters, down spouts, and drainage systems.
- F. Contractor shall clean Site, sweep paved areas, and rake clean landscaped surfaces.
- G. Contractor shall remove waste and surplus materials, rubbish, and construction facilities from the Site and surrounding areas.

**1.04 ADJUSTING**

Contractor shall adjust operating products and equipment to ensure smooth and unhindered operation.

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**1.05 RECORD DOCUMENTS AND SHOP DRAWINGS**

- A. Contractor shall legibly mark each item to record actual construction, including:
  - (1) Measured depths of foundation in relation to finish floor datum.
  - (2) Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permit surface improvements.
  - (3) Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
  - (4) Field changes of dimension and detail.
  - (5) Details not on original Contract Drawings
  - (6) Changes made by modification(s).
  - (7) References to related Shop Drawings and modifications.
- B. Contractor will provide one set of Record Drawings to District.
- C. Contractor shall submit all required documents to District and/or Architect prior to or with its final Application for Payment.

**1.06 INSTRUCTION OF DISTRICT PERSONNEL**

- A. Before final inspection, at agreed upon times, Contractor shall instruct District's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. For equipment requiring seasonal operation, Contractor shall perform instructions for other seasons within six months or by the change of season.
- C. 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.
- D. Contractor shall prepare and insert additional data in Operation and Maintenance Manual when the need for such data becomes apparent during instruction.
- E. Contractor shall review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

**1.07 SPARE PARTS AND MAINTENANCE MATERIALS**

- A. Contractor shall provide products, spare parts, maintenance, and extra materials in quantities specified in the Specifications and in Manufacturer's recommendations.

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- B. Contractor shall provide District with all required Operation and Maintenance Data at one time. Partial or piecemeal submissions of Operation and Maintenance Data will not be accepted.

**PART 2 – PRODUCTS Not Used.**

**PART 3 – EXECUTION Not Used.**

END OF DOCUMENT

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**OPERATION AND MAINTENANCE DATA**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Completion of the Work;
- B. Special Conditions.

**1.02 QUALITY ASSURANCE:**

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

**1.03 FORMAT:**

- A. Contractor shall prepare data in the form of an instructional manual entitled "OPERATIONS AND MAINTENANCE MANUAL & INSTRUCTIONS" ("Manual").
- B. 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.
- C. 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.
- D. Contractor shall arrange content by systems process flow under section numbers and sequence of Table of Contents of the Contract Documents.
- E. Contractor shall provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- F. Text: The content shall include Manufacturer's printed data, or typewritten data on 24 pound paper.
- G. Drawings: Contractor shall provide with reinforced punched binder tab and shall bind in with text; folding larger drawings to size of text pages.

**1.04 CONTENTS, EACH VOLUME:**

- A. 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.

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- B. 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.
- C. Product Data: Contractor shall mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- D. 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.
- E. Text: 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.
- F. Warranties and Bonds: Contractor shall bind in one copy of each.

**1.05 MANUAL FOR MATERIALS AND FINISHES:**

- A. 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.
- B. 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.
- C. 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.
- D. Additional Requirements: Contractor shall include all additional requirements as specified in the Specifications.
- E. Contractor shall provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

**1.06 MANUAL FOR EQUIPMENT AND SYSTEMS:**

- A. 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.
- B. Panelboard Circuit Directories: Contractor shall provide electrical service characteristics, controls, and communications.

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- C. Contractor shall include color coded wiring diagrams as installed.
- D. 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.
- E. Maintenance Requirements: Contractor shall include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- F. Contractor shall provide servicing and lubrication schedule, and list of lubricants required.
- G. Contractor shall include manufacturer's printed operation and maintenance instructions.
- H. Contractor shall include sequence of operation by controls manufacturer.
- I. Contractor shall provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- J. Contractor shall provide control diagrams by controls manufacturer as installed.
- K. Contractor shall provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- L. Contractor shall provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- M. Contractor shall provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- N. Additional Requirements: Contractor shall include all additional requirements as specified in Specification(s).
- O. Contractor shall provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

**1.07 SUBMITTAL:**

- A. Contractor shall submit to the District for review two (2) copies of preliminary draft or proposed formats and outlines of the contents of the Manual within thirty (30) days of Contractor's start of Work.
- B. 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.

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- C. Contractor shall submit two (2) copies of a complete Manual in final form prior to final Application for Payment. Copy will be returned with Architect/Engineer comments. Contractor must revise the content of the Manual as required by District prior to District's approval of Contractor's final Application for Payment.
- D. Contractor must submit two (2) copies of revised Manual in final form within ten (10) days after final inspection.

**PART 2 – PRODUCTS Not Used.**

**PART 3 – EXECUTION Not Used.**

END OF DOCUMENT



**WARRANTIES**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Warranty/Guarantee Information;
- B. Special Conditions.

**1.02 FORMAT**

- A. Binders: Contractor shall use commercial quality, 8-1/2 by 11 inch, three-side rings, with durable plastic covers; two inch maximum ring size.
- B. Cover: Contractor shall identify each binder with typed or printed title "WARRANTIES" and shall list title of Project.
- C. Table of Contents: Contractor shall provide 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.
- D. 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).

**1.03 PREPARATION:**

- A. 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 blank until the date of completion is determined.
- B. Contractor shall verify that documents are in proper form, contain full information, and are notarized, when required.
- C. Contractor shall co-execute submittals when required.
- D. Contractor shall retain warranties until time specified for submittal.

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**1.04 TIME OF SUBMITTALS:**

- A. 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.
- B. Contractor shall submit for District approval all warranties and related documents within ten (10) days after date of completion. Contractor must revise the warranties as required by the District prior to District's approval of Contractor's final Application for Payment.
- C. For items of work delayed beyond date of completion, Contractor shall provide an updated submittal within ten (10) days after acceptance, listing the date of acceptance as start of warranty period.

**PART 2 - PRODUCTS Not Used.**

**PART 3 – EXECUTION Not Used.**

END OF DOCUMENT

**RECORD DOCUMENTS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Documents on Work;
- B. Special Conditions.

**PART 2 - RECORD DRAWINGS**

**2.01 GENERAL:**

- A. As indicated in the Contract Documents, the District will provide Contractor with one set of reproducible, full size original Contract Drawings (mylars).
- B. Contractor shall maintain at each Project Site one set of marked-up plans and shall transfer all changes and information to those marked-up plans, 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 Drawings ("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.
- C. Label and date each Record Drawing "RECORD DOCUMENT" in legibly printed letters.
- D. All deviations in construction, including but not limited to pipe and conduit locations and deviations caused by without limitation Change Orders, Construction Claim Directives, RFI's, and Addenda, shall be accurately and legibly recorded by Contractor.
- E. 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.

**2.02 RECORD DRAWING INFORMATION:**

- A. Contractor shall record the following information:
  - (1) Locations of Work buried under or outside each building, including, without limitation, all utilities, plumbing and electrical lines, and conduits.

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- (2) Actual numbering of each electrical circuit to match panel schedule.
- (3) Locations of significant Work concealed inside each building whose general locations are changed from those shown on the Contract Drawings.
- (4) Locations of all items, not necessarily concealed, which vary from the Contract Documents.
- (5) Installed location of all cathodic protection anodes.
- (6) Deviations from the sizes, locations, and other features of installations shown in the Contract Documents.
- (7) Locations of underground work, points of connection with existing utilities, changes in direction, valves, manholes, catch basins, capped stubouts, invert elevations, etc.
- (8) Sufficient information to locate Work concealed in each building with reasonable ease and accuracy.

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.

- B. Contractor shall provide additional drawings as necessary for clarification.
- C. Contractor shall provide reproducible record drawings, made from final Shop Drawings marked "No Exceptions Taken" or "Approved as Noted."
- D. After review and approval of the marked-up specifications by the Project Inspector, Contractor shall provide electronic copies of the drawings (in PDF format) with one file with all of the sheets and one set of individual sheet files at the conclusion of the Project.

**PART 3 - RECORD SPECIFICATIONS**

**3.01 GENERAL:**

- A. Contractor shall mark each section legibly to record manufacturer, trade name, catalog number, and supplier of each Product and item of equipment actually installed.
- B. After review and approval of the marked-up specifications by the Project Inspector, Contractor shall provide one electronic copy of the specifications (in PDF format) at the conclusion of the Project.

**PART 4 - MAINTENANCE OF RECORD DOCUMENTS**

**4.01 GENERAL**

- A. Contractor shall store Record Documents apart from documents used for construction as follows:

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- (1) Provide files and racks for storage of Record Documents.
- (2) Maintain Record Documents in a clean, dry, legible condition and in good order.

B. Contractor shall not use Record Documents for construction purposes.

**PART 5 – PRODUCTS Not Used.**

END OF DOCUMENT

## GENERAL COMMISSIONING

### SECTION 01 91 00 GENERAL COMMISSIONING

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- B. This section includes general and specific requirements that apply to the Commissioning Process (Cx) without regard to specific systems, assemblies, or components.
- C. Related Sections. Specific commissioning-related sections that may contain additional requirements specifying the relationship of general work provisions in conjunction with commissioning are:
  - 1. Division 23 Heating, Ventilating, and Air Conditioning (HVAC)
  - 2. Division 26 Electrical
- D. Additional documentation may be included by reference for information only.

##### 1.2 SYSTEMS TO BE COMMISSIONED

- A. The following is an overview list of the major building systems that will be commissioned in this project:
  - 1. Mechanical Systems
    - a. Split System Air Conditioning Units
    - b. Exhaust Fans
    - c. HVAC distribution (Ductwork)
    - d. Building Automation Control System (BAS)
    - e. Associated operational components installed within the above systems
  - 2. Electrical Systems
    - a. Lighting Control System
    - b. Associated operational components installed within the above systems

##### 1.3 ABBREVIATIONS / DEFINITIONS

- A. Abbreviations
  - 1. A/E: Architect / Engineer
  - 2. BoD: Basis of Design Documentation
  - 3. CC: Controls Contractor (Subcontractor)
  - 4. CM: Construction Manager
  - 5. Cx: Commissioning
  - 6. Cx Plan: Commissioning Plan
  - 7. CxM: CM/GC's Commissioning Manager

## GENERAL COMMISSIONING

8. CxP: Commissioning Provider or Commissioning Authority (Commissioning Authority often referred to as CxA; for purpose of this document, referred to as CxP)
9. CxS: Commissioning Specialist
10. EC: Electrical Contractor (Subcontractor)
11. EE: Electrical Engineer
12. EOR: Engineer of Record
13. FAT: Functional Acceptance Test
14. FWT: Factory Witness Test
15. GC: General Contractor (Prime)
16. MC: Mechanical Contractor (Subcontractor)
17. ME: Mechanical Engineer
18. OPR: Owner's Project Requirements
19. OR: Owner's Representative
20. PC: Plumbing Contractor (Subcontractor)
21. PFC: Pre-Functional Checklist
22. PM: Project Manager
23. PMS: Project Management Software
24. RE: Resident Engineer
25. Subs: Subcontractors to the General Contractor (Subcontractors)
26. TAB: Testing, Adjusting, and Balancing Contractor (Subcontractor)

### B. Definitions

1. Acceptance Phase: The phase of construction after startup and initial checkout when functional acceptance tests, O&M documentation review and training occurs.
2. BoD: Basis of Design. A document produced by the design team that records concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements (OPR) and to satisfy applicable regulatory requirements, standards, and guidelines. The basis of design describes space use, redundancy, diversity, space zoning, occupancy, operations and space requirements. The document includes both narrative descriptions and lists of individual items that support the design process.
3. CxP: Commissioning Provider. An entity who leads, plans, schedules and coordinates the Cx team to implement the Cx process.
4. Commissioning: The basic purpose of building Cx is to provide documented confirmation that building systems function in compliance with criteria set forth in the project documents to satisfy the Owner's operational needs. The CM/GC shall be responsible for participation in the commissioning process as outlined below, and in references and attachments throughout the contract documents. Commissioning procedures will be written and coordinated by the Commissioning Provider (CxP).
5. Cx Plan: A living document that outlines the organization, schedule, allocation of resources, and documentation requirements (guidelines) of the Cx process.
6. CxS: An individual who works on a project to conduct commissioning on a specific technical area or system. Specialists shall be designated to commission systems for which specialized technical certification or licenses are required.

### GENERAL COMMISSIONING

7. Final Commissioning Report: Includes the overall final Cx documents, prepared by the CxP, which details the actual Cx procedures performed, inspection and testing results, and the final version of the issues list indicating that all issues discovered through the Cx process have been verified as resolved or accepted. The report also includes key items for the maintenance staff such as fan and pump curves for the equipment furnished, marked with design and actual duty points.
8. Functional Acceptance Test (FAT): Functional Acceptance Testing is the process of verifying that a material, product, assembly, or system is properly installed and operates in accordance with design and manufacturer's specifications. Test includes operational and performance tests.
9. Integrated Testing: The goal of integrated testing is to verify that fire protection and life safety systems operate as designed and as required by codes and standards. Mechanical and electrical systems with interconnections to fire protection and/or fire alarm systems will be included in the testing.
10. Observation Issues Log (Deficiencies List): Includes a list of noted issues discovered as a result of the Cx process. This list also includes the current disposition of issues, and the date of final resolution as confirmed by the CxP. Issues are defined as those issues where products, execution or performance do not satisfy the specifications and/or the design intent.
11. Operational Test: Operational Testing is the process of verifying that a material, product, assembly, or system meets defined sequence of operation criteria. The methods and conditions under which operation is verified are described in one or more test protocols.
12. Owner Contracted Tests: Tests paid for by the Owner outside the GC's contract and for which the CxP does not oversee. These tests will not be repeated during functional tests if properly documented. E.G. Fire Marshall Demonstration tests etc.
13. Owner's Project Requirements (OPR): A written document that details the requirements of a project and the expectations of how it will be used and operated. This includes project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. (The term Project Intent or Design Intent is used by some Owners for their Commissioning Process Owner's Project Requirements.)
14. Performance Test: Performance Testing is the process of verifying that a material, product, assembly, or system meets defined performance criteria. The methods and conditions under which performance is verified are described in one or more test protocols.
15. Pre-Functional Checklists (PFC): Checklists are prepared by the CxP and completed by the installing Subcontractors. Checklist shall be by system and/or equipment for verification of system set points, operating strategies, required component testing, correct rotation, and damper positions prior to functional test. They include system specific tests such as pipe system pressure tests, chemical cleaning and flushing, duct leakage tests, mechanical system test and balance, and electrical equipment testing. These checklists shall verify that all systems and equipment are ready for continuous operation and final testing. This document shall incorporate manufacturers' start-up plan and system operational



## GENERAL COMMISSIONING

checkout. Requires final sign-off by the CM/GC prior to continuing with the Cx process. They must be completed before FATs commence.

16. Project Management Software: Computer Software to manage documents associated with the construction of the building. Access to the software is generally through the internet. Construction plans and specifications, submittals, information requests, clarifications, change orders, commissioning documents, O&M manuals, and closeout documents should be located here for access by all personnel associated with the project. Management of the PMS can be by the Owner, Architect, or CM/GC.
17. CFR/O&M: A living document assembled by the CxP with support from the commissioning team to document current facilities requirements and operations & maintenance plans that contain the information necessary to operate the building efficiently. This document included setpoints and schedules, maintenance requirements, continuous commissioning requirements, and systems narrative describing the commissioned systems with any seasonal or change adjustments needed for unusual situations.
18. Training Plan: A CxP written document that details the expectations, schedule, duration and deliverables of Commissioning Process activities related to training of project operating and maintenance personnel, users, and occupants.

### 1.4 THE COMMISSIONING TEAM

- A. Overview: The Cx Team will consist of all members needed to execute the approved Cx program. This includes at a minimum the CxP, the Owner's staff, the CM/GC and its Subcontractors, the architect, the mechanical engineer, and the electrical engineer.
- B. Members Appointed by CM/GC: Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the Cx process through coordinated action. These shall consist of, but not be limited to, representatives of CM/GC, including project superintendent and Subcontractors, installers, suppliers, and specialists deemed appropriate by the CxP. E.G TAB and DDC controls specialist.

### 1.5 SUBMITTALS

- A. Submittals to CxP
  1. All Contract Documents and associated documentation including changes to the drawings Architectural Supplemental Instructions, Request for Information, Change Requests, and Change Orders.
  2. Copies or access to all submittals made to A/E required by Contract Documents for Cx Divisions. Includes all transmittals, product data, shop drawings, coordination drawings, test reports, field reports, factory reports, installation instructions, training documentation, warranty forms, manufacturer start-up reports, certificates from manufacturer, close out documentation, information for Material Completion, as-built information, and operating and maintenance manuals.
  3. All submittals to and from the CxP will be electronic.

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4. Organize submittals into logical groupings, by specification Sections and Divisions.
5. Product Data: If submittals to A/E do not include the following, submit copies of information as soon as possible.
  - a. Manufacturer's product data, cut sheets, and shop drawings.
  - b. Manufacturer's installation instructions.
  - c. Startup, operating, and troubleshooting procedures.
  - d. Fan and pump curves (marked with design and actual duty points).
  - e. Factory test reports.
  - f. Warranty information.
6. Startup Plans, Procedures, and Reports.

## PART 2 PRODUCTS

### 2.1 TEST EQUIPMENT

- A. All standard testing equipment required to perform Subcontractor's pre-commissioning checklists, startup, and functional acceptance tests (FAT), shall be provided by the division Subcontractor for the equipment being tested.
- B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, to be provided according to these contract documents, shall be included in the base bid price to the CM/GC.
- C. All testing equipment shall be of sufficient quality and calibrated accuracy to test and/or measure system performance with the tolerances indicated in the specifications.

## PART 3 EXECUTION

### 3.1 OVERVIEW OF THE DESIGN PHASE COMMISSIONING PROCESS

- A. Work with the Design Team to finalize system and equipment basis of design, per space use.
- B. Work with the Design Team to define system and equipment operating and performance characteristics.
- C. Work with the Design Team to define system and equipment acceptance criteria including agreed tolerances for pass fail criteria.
- D. Conduct a focused review of the design prior to construction documents completion, including system schematic single-line diagrams, mechanical schedules, systems sequence of operations, and equipment integration & interdependency plan.
- E. Conduct a focused review of the construction documents.

## GENERAL COMMISSIONING

### 3.2 OVERVIEW OF THE CONSTRUCTION PHASE COMMISSIONING PROCESS

- A. As soon as mobilization has occurred to the project site, the CxP will conduct a pre-installation Cx "kick-off" meeting with the CM/GC and Subcontractors. The CxP will explain the Cx process in detail and identify specific Cx-related responsibilities of the CM/GC and Subcontractors.
- B. Ongoing Cx status meetings will be scheduled to occur during the construction phase to monitor progress and to help facilitate the Cx process. CM/GC and Subcontractor representatives will be required to attend these meetings (normally tagged onto general progress site meetings).
- C. Once the CM/GC has provided the CxP with written verification indicating Subcontractor's pre-functional checklists have been completed, the CxP will conduct an on-site installation inspection of the specific systems and equipment.
- D. Verify the execution of Cx process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxP will report the failure in the issues and resolutions log.
- E. CxP will review preliminary TAB reports. Spot-check and witness the final TAB process. Approximately 10-15% of the TAB report will be randomly selected and verified by the CxP.
- F. Review DDC Point to Point Reports. Spot-check and/or witness the DDC Point by Point checks. Approximately 20-30% of the DDC points of the terminal units will be randomly selected and verified by the CxP.
- G. Upon confirmation of system readiness, the CxP will schedule with the CM/GC and Subcontractors to perform operational and performance tests to verify functional compliance with the specifications and design intent documents. The CxP will oversee the process and will provide the format and documentation for these tests.
- H. Issues noted during these tests will be documented on the issues and resolutions log. When easily corrected, issues will be resolved at the time of discovery. All other issues will be resolved by the responsible CM/GC and Subcontractor at a later time. All issues will be noted by the CxP as either resolved or pending resolution. When resolved, CM/GC and Subcontractor shall return communications to the CxP for "re-check".
- I. The construction phase Cx process will be complete when all noted issues have been corrected, proven to comply with the contract specifications or otherwise resolved to the satisfaction of the Owner.

### 3.3 COMMISSIONING PLAN

## GENERAL COMMISSIONING

- A. The Cx process is intended to enhance the quality of system start-up and aid in the orderly transfer of systems to the Owner's staff prior to beneficial occupancy. This process includes design review, submittal review, installation inspections, functional and operational testing, training evaluation, O&M manual review, and final documentation. The Commissioning Plan is intended to describe the details of the Cx process.
- B. The Commissioning Plan, prepared by the CxP, will:
  - 1. Include site specific descriptions and information.
  - 2. Identify Cx team roles, responsibilities, and deliverables.
  - 3. Define systems to be commissioned.
  - 4. List Cx-related specification sections for reference.
- C. CM/GC is responsible for compliance with the Commissioning Plan.
- D. Commissioning Scope. The scope of Cx is to verify building systems' performance and operation per the contract documents. Cx of this project is intended to:
  - 1. Verify through inspections that equipment and systems have been installed in accordance with the contract documents and manufacturer's written installation instructions.
  - 2. Inspect and verify that equipment has been installed and placed into operation with manufacturer's oversight and approval.
  - 3. Evaluate the results of operational and performance tests for each system and piece of equipment per acceptance criteria as defined in the contract documents.
  - 4. Review Subcontractor as-built/as-installed shop drawings, schematics, one-line diagrams, etc.
  - 5. Review O&M manuals.
  - 6. Inspect and verify the performance of each piece of equipment and its system, as described in the project documents.
  - 7. Test the interrelationship of systems and equipment to verify integrated performance and sequence of operation.
  - 8. Review Subcontractor training of the Owner personnel in the proper operation of equipment and systems. Evaluate training program and make recommendations to the Owner for approval or retraining requirements.
  - 9. Identify, document, and report, for tracking and correction, all issues of the work versus contract documents and performance requirements as it pertains to specific system commissioning.
  - 10. Make a recommendation to the Owner as to whether the systems should be accepted based on the results of the tests compared with the contract documents.

### 3.4 OWNER'S RESPONSIBILITIES

- A. Ensure the participation of Owner's chosen representatives as required to complete the Cx process.
- B. Provide the OPR documentation to the CxP, A/E, and GM/GC for information and use.

### GENERAL COMMISSIONING

- C. Assign O&M personnel and schedule them with the CxP to participate in Cx team activities.
- D. Ensure an on-line Project Management Software with a folder for commissioning documentation is specified and access is granted to all commissioning team members. Encourage reduced use of paper-based documentation.
- E. Will review, direct, and approve commissioning related tasks in relation to the requirements of the contract documents.
- F. Will provide direction to the Project Team for Cx issue resolution.
- G. Will review and comment on the submitted Commissioning Plan.
- H. Will review technical submittals and issue comments to the Architect / Engineer and/or approve.
- I. Will be invited for startup of equipment / systems to be commissioned, as appropriate.
- J. Ensure O&M personnel are available for scheduled training sessions.
- K. Will review and approve the Operation and Maintenance Documents.
- L. Attend Cx meetings as required to facilitate the Cx process.

### 3.5 ARCHITECT / ENGINEER'S RESPONSIBILITIES

- A. Review the Cx documentation and provide comments as necessary to the CxP and the Owner.
- B. Provide the Basis of Design documentation to the Owner.
- C. The architect shall ensure the participation of necessary representatives from the design team as required to complete the Cx process. Design team members will be expected to provide prompt replies to Cx review reports.
- D. Copies of all submittals, RFI's and ASI's pertaining to equipment to be commissioned shall be transmitted in parallel to the CxP for review and comment. Comments will be coordinated with the Design team prior to return to the GM/GC.
- E. Will review and approve the technical submittals, reviewing and incorporating all received review comments from the commissioning team as required. Will issue the Electrical Coordination sturdy report for field verification by specialists.
- F. Will perform equipment and system design verification walks prior to Construction Complete and report issues to the Architect for distribution to the Commissioning Team.

### GENERAL COMMISSIONING

- G. Will develop the design and specification sequence of operations and Fire Life Safety cause and effect matrix.
- H. Participate in determination of final controls system input/output points list and sequences of operation as required to complete functional test procedures with the Owner's representative, CxP, and controls Subcontractor.
- I. Attend Cx meetings as required to facilitate the Cx process.
- J. Will assist in resolution of commissioning related issues.
- K. Will review and approve the preliminary & final TAB reports and Functional Acceptance Test records.
- L. Will review and approve the Operation & Maintenance Documents.

### 3.6 COMMISSIONING PROVIDER'S RESPONSIBILITIES

- A. Organize and lead the Cx team.
- B. Coordinate Cx meetings as necessary to facilitate the Cx process, assist the CM/GC in maintaining the project Cx schedule, and resolve identified issues. Provide meeting notes to Cx team for review and comment.
- C. Review OPR and BoD as related to the equipment and systems being commissioned.
- D. Provide and implement Cx Plan with list of commissioned equipment and systems.
- E. Review Cx-related specifications, submittals, and construction documents related to equipment and systems to be commissioned. Communicate noted issues and concerns to the A/E, Owner and/or Owner's representative.
- F. Review and approve training curriculum as developed by the Subcontractor(s). Will observe and report regarding the adequacy of training.
- G. Develop detailed and specific operational and performance procedures for the functional acceptance test plans for equipment and systems to be commissioned.
- H. Review TAB specifications, TAB plan and balancing reports. Provide comments to A/E and Owner.
- I. Review and comment on the mechanical flushing and chemical cleaning procedures and methods.
- J. Review DDC specifications, DDC points list, plan and reports. All written sequences will be functionally tested and demonstrated to the CxP by the controls Subcontractor.
- K. Perform regular and key site inspections and verify Subcontractor readiness for the operational and functional testing process. Document issues for future resolution.

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- L. Verify the execution of Cx process activities using random sampling, where appropriate. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, FAT and Integrated tests, and test reports to verify compliance with the OPR.
- M. Prepare and maintain the Cx observation issues log.
- N. Prepare and maintain completed construction equipment list matrix.
- O. Will assist the CM/GC with scheduling and tracking statuses of commissioning activities. Will review master schedule to identify that sufficient commissioning activities are incorporated, and durations are adequate to fully commissioning the project. Will monitor and coordinate with CM/GC regularly on TAB and DDC progress leading up to Cx FATs, in an effort to assist in maintaining schedule for final testing activities.
- P. Will witness hydronic and non-hydronic pipe system flushing and cleaning activities, when possible.
- Q. Will witness Subcontractor-performed systems, assemblies, equipment, and component startup, when possible.
- R. Will provide Pre-Functional Checklists (PFCs) for completion, submission, and execution by the CM/GC and their Subcontractors.
- S. Verify all documentation from the Subcontractor's pre-functional test forms: building flush-out verification, pressure tests, pipework flushing and chemical cleaning, testing and balancing data, pre-functional checklist, installation checklist, operational checklist, functional acceptance testing, Cx issues list, and any other forms used to document the commissioning process has been uploaded into the Project Management Software's commissioning module.
- T. Will lead and execute the Functional Acceptance Tests and Integrated Systems Testing per the CxP provided FAT procedures for the equipment and systems to be commissioned with Subcontractor/vendor support where needed. Functional Acceptance Testing will not commence until the systems are construction complete, the system documentation has been submitted, the control program has been loaded and de-bugged, and the TAB report has been submitted to the Engineer of Record for approval.
- U. Will coordinate with Owner's O&M staff to witness FATs, as appropriate.
- V. Review the closeout documentation with the mechanical and electrical engineers and prepare the agenda of items to be clarified or tested to complete the commissioning process for the Owner's acceptance of the systems.
- W. When all items of commissioning have been successfully completed, recommend acceptance to the Owner.

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- X. Provide the Owner with a final Cx report to document the Cx process and to verify that the Cx process has been completed. Report shall be provided in the Owner's required format for the Owner's project record.
- Y. Compile test data, inspection reports, and certificates; include them in the current facilities requirements and operations & maintenance plan (CFR/O&M) when manual is required.

### 3.7 CM/GC AND CONSTRUCTORS' RESPONSIBILITIES

- A. CM/GC, all Subcontractors, and all specialist contractors shall assign representatives with expertise and authority to act on its behalf and shall ensure that they are familiar with all requirements noted in this section. All parties shall execute all Cx responsibilities assigned to them in the contract documents. CM/GC, all Subcontractors, and all specialist contractors must schedule time for, participate in, and perform Cx process activities including, but not limited to, the following:
  - 1. In each purchase order or subcontract written, include requirements for submittal data, Cx documentation, O&M data and training.
  - 2. Attend Cx meetings, to include a Cx scoping kick off meeting and other meetings, as required to facilitate the Cx process.
  - 3. Review the Cx Plan, Cx milestone schedule, and functional test procedures. Provide the input required to develop final test plans and procedures.
  - 4. Integrate and coordinate Cx process, Cx milestones and testing activities with construction schedule with assistance from the CxP. The schedule is to identify, among other milestones, the completion of all Subcontractor pre-commissioning checklists, preliminary TAB report, DDC points verification, system startup, operational and functional acceptance testing, initiation and completion of the performance period indicated in the specification, and training for the systems specified. The performance period is to be coordinated with any required building purge or occupancy move-in schedules required by the Owner. The initial schedule shall identify the pertinent Cx milestones as outlined above.
  - 5. Notify CxP of all activities defined in Contract Documents that require CxP attendance.
  - 6. CM/GC, all Subcontractors, and all specialist contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures. A Controls Sequence meeting will be organized early in the project prior to rough-in completion of MEP equipment.
  - 7. Upload to the Project Management Software normal cut sheets, shop drawings, RFIs, ASIs, and approved change orders and equipment submittals of commissioned equipment. Notify by email their availability to the commissioning team.
  - 8. Coordinate installation of mechanical and electrical systems and equipment with equipment suppliers, mechanical, controls, and electrical Subcontractors. Verify that coordination, installation, quality control, and final specialist testing have been completed such that installed systems and equipment comply with construction documents.



### GENERAL COMMISSIONING

9. Will confirm availability and provision of qualified personnel, tools, equipment, ladders and lifts to support the commissioning process.
10. Will provide the Owner, A/E, and CxP written email notification that individual onsite commissioning activities are planned to take place. The Owner, A/E, and CxP require seven (7) days' notice of all commissioning related witnessing activities.
11. Provide assistance to the CxP, as necessary, in preparing the specific functional acceptance test procedures as specified herein. The CM/GC, all Subcontractors, and all specialist contractors shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
12. Review and accept construction pre-functional checklists provided by the CxP or Subcontractors.
13. Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and complete the construction pre-functional checklists for all commissioned equipment.
14. Provide skilled technicians to execute starting of equipment, and to execute the functional acceptance tests, as required by the CxP, typically following the manufacturers' approved procedures. The CxP shall develop the test procedures and orchestrate the execution of the functional testing procedures with assistance from the Subcontractors and vendors. These procedures shall be reviewed and approved by the design team, the CM/GC, and the Owner prior to execution. Ensure that skilled technicians are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving. The Cx procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the CxP or Owner.
15. Follow proper LOTO (Lock Out Tag Out) procedures and confirm all Safety Trips are operational prior to initial energization.
16. Schedule and execute installation, pre-commissioning, testing, and commissioning of the control system such that systems are operable and checked out prior to commencement of the test and balance activities.
17. Participate in fine-tuning or troubleshooting of system performance if either of these measures becomes necessary.
18. Participate in an integrated whole building test under emergency power. This test is initiated by disconnecting the utility power to the building (or by simulation), and it will involve multiple disciplines. All Subcontractors shall participate in the FATs as required for operation of the inter-related systems on emergency power.
19. Retain all documentation from the Subcontractors and upload into the Project Management Software's commissioning module, including manufacturers' information and cut sheets, installation checklists, test sheets, pre-functional checklists, system readiness checklists, manufacturers' startup forms, flush-out verification, pressure tests, electrical tests, coordination study and safety trip settings, testing and balancing data (TAB), Functional Acceptance Tests (FAT), recorded performance data, record of equipment operational settings and any other reports (in electronic format) used to document the commissioning process.

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20. Evaluate performance issues identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend any corrective action.
  21. Notify the CxP and CxM as soon as possible of any issues identified during construction that may affect the construction schedule, Cx process, or final system performance.
  22. Correct issues (differences between specified and observed performance) as interpreted by the CxP, CM/GC and A/E and retest the equipment.
  23. Address current A/E punch list and CxP observation issues log items, prior to start of the functional testing. DDC Points list and sufficient programming to allow Air and Water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air- or water-related systems.
  24. Cooperate with the CxP for resolution of issues recorded in the Cx observation issues log.
  25. Provide complete O&M manuals according to the contract documents, including clarifying and updating the original sequences of operation to as-built conditions. Upload electronic copies of O&M manuals into the Project Management Software. O&M's will be issued in sufficient time for them to be reviewed, approved, and used during owner staff training.
  26. Will coordinate with CxP to collate final commissioning documentation, in electronic format (pdf files) for issue to the Owner's O&M staff and A/E design team for approval and inclusion in the Final Commissioning Report.
  27. Complete and/or verify that the Subcontractors complete the Cx process test procedures.
  28. CM/GC and Subcontractors shall comply with all training requirements as noted in the specifications and shall coordinate training with the CxP.
    - a. CxP Training plan and Subcontractor agendas must be submitted to the Owner for approval at least two weeks in advance of the scheduled trainings. Training shall not be performed until the Cx functional acceptance test process is 100% complete and the training plan and agenda have been approved by the Owner and CxP.
    - b. Provide training using expert qualified personnel.
  29. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
  30. Obtain agreements from manufacturers and vendors for the equipment warranties to start when equipment is accepted by the Owner.
  31. Execute seasonal or deferred functional acceptance testing, witnessed by the CxP, according to the specifications.
  32. Make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.
  33. Specific detailed responsibilities associated with Subcontractors, specialist contractors; i.e. mechanical, electrical, controls, flushing and TAB Subcontractors, are detailed in Part 3, "Execution" of this section.
- B. CxM; The CM/GC will have a person designated as their commissioning manager who will be responsible for day-to-day oversight of the CM/GC and Subcontractors commissioning requirements.

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1. The CxM will hold regular meetings with CM/GC and Subcontractors to continuously refine the project schedule for commissioning activities and publish metrics showing current progress towards final completion.
  2. The CxM or CM/GC field superintendent witnesses all tests for building systems, mechanical and electrical and verifies they are performing within design parameters.
  3. It is required that the CxM sign off all Pre-Functional Checklist commissioning forms on behalf of the CM/GC as required for all equipment.
  4. The CxM must meet on a regular basis with Subcontractors as required to verify that identified deficiencies are repaired.
  5. The CxM must meet on a regular basis with CxP and Design consultants to update as to actual site conditions.
- C. HVAC Mechanical Subcontractor. The Cx responsibilities of the HVAC Mechanical Subcontractor(s) in addition to those listed in 3.8.A are:
1. Test Plans:
    - a. Where duct leakage testing is required, submit a Duct Leakage Test Plan to the A/E and CxP two weeks in advance of conducting any duct leakage tests.
      - 1) Floor plan drawings showing the duct section to be tested.
      - 2) The total duct square footage for the duct section to be tested. Provide supporting calculation showing how the square footage was calculated.
      - 3) The duct pressure class and the SMACNA duct "leakage" class per the SMACNA Duct Leakage Test Manual.
      - 4) The intended test static pressure and the corresponding allowable leakage rate (cfm) per the SMACNA Duct Leakage Test Manual.
      - 5) Test fan orifice certificate of calibration sheet and chart showing the orifice pressure drop and airflow (cfm).
    - b. Submit a Hydronic Pipe Hydrostatic Pressure Test Plan to the A/E and CxP for all applicable systems two weeks in advance of conducting any required tests.
    - c. Submit a Hydronic, Flush, clean and Treat Plan to the A/E and CxP for all applicable systems two weeks in advance of filling, flushing, and cleaning any hydronic systems.
      - 1) The intended minimum durations for all pipe flushing and cleaning, and the associated cleaning agents and corrosion inhibitors to be used.
      - 2) An outline of the chemical treatment and water analysis testing to be performed after flushing and cleaning, including any additional chemicals and biocides to be added as part of the final water treatment, the water chemistry analysis and corrosion testing to be conducted, and the intended final water chemistry limits / ranges (including steel, iron and copper levels) to be achieved in order to meet the specifications and any specific manufacturer requirements.
      - 3) The Plan shall indicate the timing for submitting the Water Treatment Analysis Reports for review by the Engineer of Record, Owner and CxP.

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- d. Submit a Flush and clean Plan to the A/E and CxP for all applicable non-hydronic systems two weeks in advance of flushing and cleaning.
  - 1) The intended minimum durations for all pipe flushing and cleaning, and methodology.
2. Pre-Acceptance Checklists
  - a. Division 23 contractor(s) will document installation, pressure testing, inspection, and startup of their systems, equipment, and components.
  - b. The following documents will be uploaded by the Subcontractor to the commissioning folder in the Project's document management website for inclusion into the CFR/O&M:
    - 1) As-built plans and Final Test Records
    - 2) Pressure Test Documentation. If not a whole system test, then include marked up plan views of the section(s) tested.
    - 3) Manufacturer installation and startup checklists
    - 4) Variable Frequency Drive startup/programming reports
    - 5) Flushing and Chemical Treatment reports
    - 6) Combustion efficiency reports
    - 7) As-built valve charts
    - 8) DDC final SOO and point to point checklists
    - 9) Test and Balance reports. Fan and pump curves shall be marked with design and actual duty points, balance sheet shall include actual flows, volumes, and pressures expressed as a percentage (%) against design values.
    - 10) Chiller and fan operational noise level reports.
    - 11) AHJ progress and final inspections
3. Functional Acceptance of HVAC
  - a. Functional Acceptance of HVAC will be based upon the operational and performance tests of the systems, equipment, and components by the CxP and final AHJ inspection approval of systems.
  - b. HVAC Subcontractor(s) to have a qualified person on call during FAT to help troubleshoot issues as needed.
  - c. HVAC Subcontractor(s) to have qualified person(s) on call during Integrated Systems Testing for demonstration of emergency power systems.
  - d. Operate equipment and systems as required for operational and functional acceptance testing. Dry Mechanical Subcontractor to uncover all fire and/or smoke dampers for CxP testing and AHJ acceptance inspection. The Mechanical Subcontractor shall have ladder and any necessary tools for opening access doors to fire and/or smoke dampers for visual inspection.
4. Perform start-up and testing of mechanical equipment and systems and document as required with start-up reports and completion of Subcontractor's pre-commissioning checklists submitted to the CxP.
5. Perform and record manufacturers' recommended equipment maintenance as a minimum during the period between delivery, installation, start-up, and Owner Acceptance.
6. Provide complete operation and maintenance information, single line schematics and as-built drawings to the CM/GC for verification, organization, and distribution.

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- D. Controls Subcontractor. The Cx responsibilities of the controls Subcontractor(s) in addition to those listed in 3.8.A are:
1. Complete Subcontractor pre-functional checklist and other supporting documentation as required demonstrating completion of control system installation, point-to-point verification (including sensor calibration), controller communication, start-up and testing, and to the Commissioning folder in the Project Management Software.
  2. Participate in pre-functional testing of mechanical equipment. Place specific systems as directed by Cx Team into test modes for pre-commissioning and startup.
  3. Assist and cooperate with the TAB Subcontractor in the following manner:
    - a. Meet with the TAB Subcontractor minimum 4 weeks prior to beginning TAB and review the TAB plan to determine the capabilities of the control system operational modes toward completing TAB.
    - b. Provide a qualified technician to operate the controls to assist the TAB Subcontractor in performing TAB or provide sufficient training for the TAB Technician to operate the mechanical systems without assistance.
    - c. Provide (loan) any necessary control interface tool to the TAB Technician to allow them to make temporary equipment adjustments.
  4. Assist and cooperate with the CxP in the following manner:
    - a. Provide a skilled technician to execute and assist in performance of the functional acceptance testing procedures of the controls system. This will require dedicated support during testing. Assist in the functional testing of all equipment specified and written sequence of operations in this section.
    - b. Provide and set up control system trend logs and metering for the points as directed by the CxP. Trended points include those required for M&V.
    - c. Final graphics to be complete, reviewed, and ready for loading prior to functional testing.
  5. Participate in fine-tuning or troubleshooting P&ID control loops of system sequence of operation performance if either of these measures becomes necessary.
  6. Provide the CxP and CM/GC with final documentation for all installed conditions, including as-built drawings and final detailed narrative sequences of operation and a final as-built control programming record as determined during the Cx process.
- E. TAB Subcontractor. The Cx responsibilities of the TAB Subcontractor(s) in addition to those listed in 3.8.A are:
1. Test Plan:
    - a. Provide a TAB Plan that outlines the TAB procedures and approach for each system type that satisfies the requirements of NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems Section 7.3 (Preliminary TAB Procedures) and/or AABC National Standards Section 20.4 (Procedures).
      - 1) TAB Plan shall also include the associated forms and drawings to be used in the TAB work, and the forms shall be pre-filled with all available project, site, and design parameters.

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- 2) The TAB Plan shall include any TAB qualification certificates and TAB instrument calibration certificates.
    - 3) The TAB Subcontractor shall submit the TAB Plan and certificates to the A/E and CxP for review two (2) weeks minimum prior to the start of balancing, in addition to any other submittal requirements per the specifications. Electronic files are acceptable.
  2. Coordinate balancing activities with those of the mechanical and controls Subcontractors. Document through pre-balancing checklists; that coordination, installation, flushing process, quality control, and final Subcontractor testing have been completed to allow proper balancing work to be performed. Upload completed checklists to the commissioning folder in the Project Management Software.
  3. Notify the CM/GC, CxP, and A/E within 24 hours of any system installation or performance issues that may compromise the ability of the system to be balanced or operate at design capacities.
  4. Participate in start-up and testing as required by the CM/GC and Subcontractors.
  5. Return all control points to automatic or as found values at the end of each day unless specific permission is obtained in writing from the CM/GC, Mechanical and Control Subcontractors.
  6. Provide preliminary TAB report, indicating all actual field values recorded and a percentage (%) against design values, to the CM/GC, CxP, and Engineer, prior to initiation of operational and functional testing, and highlighting any variations in actual volumes and static pressures -5% or +10% from design parameters. A preliminary TAB report shall be submitted within seven (7) working days after completion of the balancing work. If job conditions require the TAB work be divided by logical systems, the preliminary TAB report will be submitted in logical sections within seven (7) working days after completion of the balancing work on each system. Mark and permanently record all field regulating devices in the final balanced position (or minimum outside air for AHU dampers), for readily identifiable resetting mode if needed. Include marked-up plans showing openings with corresponding numbering from the report.
  7. Record design and actual duty points of all fans and pump on manufacturers performance curves for CxP & ME review and approval. Include in preliminary TAB report.
  8. Provide a separate submittal record of DDC values and setpoints determined during the TAB of the systems for use by the DDC Subcontractor to "lock in" the numbers and update their as-built drawings.
  9. Coordinate with CxP and demonstrate a 10 – 15% verification of selected systems balance sheet readings, to be identified by the CxP.
  10. Assist during the operational and functional testing as required.
  11. Participate in fine-tuning or troubleshooting of system performance if either of these measures becomes necessary.
- F. Electrical Subcontractor. The Cx responsibilities of the electrical Subcontractor(s) in addition to those listed in 3.8.A are (all references apply to commissioned equipment only):
1. Pre-Acceptance Checklists

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- a. Division 26 contractor(s) will document installation, component testing, inspection, and startup of their systems, equipment, and components.
- b. The following documents will be uploaded by the Subcontractor to the commissioning folder in the Project's document management website for inclusion into the CFR/O&M:
  - 1) As-built plans
  - 2) Circuit Breaker test reports
  - 3) Manufacturer installation and startup checklists
  - 4) Variable Frequency Drive startup/programming reports
  - 5) Breaker Coordination Study
  - 6) Complete and document the discrimination trip settings in conjunction with the Electrical Engineer of all breakers, fuses and safety trips prior to the commissioning functional acceptance testing
  - 7) Cabling test reports
  - 8) Programmed sequences of operation
  - 9) Lighting and emergency light level test records
  - 10) Generator noise transmission decibel levels
  - 11) Fire Alarm decibel levels and cause and effect matrix
  - 12) AHJ progress and final inspections
2. Functional Acceptance of Electrical Systems
  - a. Functional Acceptance of Electrical Systems will be based upon the operational and performance tests of the systems, equipment, and components by the CxP and final AHJ inspection approval of systems.
  - b. Electrical Subcontractor to have sufficient fuel levels and a qualified person(s) available during integrated systems testing for demonstration of emergency power systems.
  - c. Operate equipment and systems as required for functional acceptance testing. Provide and set up electrical system trend logs for the points as directed by the CxP (power monitoring and lighting controls).
3. Perform start-up and testing of electrical equipment and systems and document as required with start-up reports and completion of Subcontractor's pre-commissioning checklists submitted to the CxP.
4. Provide complete operation and maintenance information, as-built distribution board charts and as-built drawings to the CM/GC for verification, organization and distribution.

### 3.8 NOTIFICATION OF SYSTEM COMPLETION AND REQUEST FOR FINAL SYSTEM AND EQUIPMENT START-UP AND CX VERIFICATION

- A. Two weeks prior to the beginning of start-up or test activities, the CM/GC shall provide a detailed look-ahead schedule. This schedule shall be reviewed and updated weekly for the Cx Team progress meetings and shall provide information to include date, time, beginning location, and anticipated duration of each start-up or test activity. CM/GC shall notify the CxP in writing at least 72 hours of any changes to this schedule. The CxP will witness the equipment start-up by the manufacturer's representative per the specifications.

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- B. When systems are ready for operational and performance verification testing, Subcontractor will verify all pre-functional testing documents have been uploaded and then shall notify the CxP, in writing, at least 72 hours in advance.
- C. Should the verification test for systems and equipment reveal that the equipment is not performing as specified or control operation is not acceptable; the Subcontractor may be entitled to one re-inspection of any failed item at no additional cost.
- D. The Subcontractor shall be liable for costs incurred by the engineers of record, CxP, the Owner staff and others if the second system or equipment verification test does not meet specification or design intent.

### 3.9 PRE-FUNCTIONAL CHECKLISTS

- A. Pre-functional checking includes verification of proper installation and start-up for each piece of equipment and system. Pre-functional checking is required to establish that the equipment and systems are installed and operational so the functional acceptance testing can proceed without unnecessary delays. Pre-functional checklists and start-up testing must be completed prior to functional testing of equipment and systems.
- B. Pre-functional checklists are provided by the CxP and performed/completed by the Subcontractors. If a Subcontractor prefers to utilize their own pre-functional checklists (for internal QA/QC or compulsory reasons), the CxP can assist by reviewing the forms. The forms at a minimum must include the following:
  - 1. Design and submittal data verification.
  - 2. Installation verification.
  - 3. Operational verification.
  - 4. Functional verification.
  - 5. Signoff by CxM and Subcontractor.
- C. The CxP will verify that the Subcontractor has completed the PFCs and will sample the installation to check readiness for Functional Acceptance Testing. Each PFC must be signed by Subcontractor attesting to the equipment or system's readiness for Functional Acceptance Testing.
- D. PFCs will be completed for all commissioned equipment and systems. Sampling is not acceptable.
- E. Manufacturer's start-up documentation will be included as part of the pre-functional checking.
- F. The Subcontractor individuals that sign the PFCs and checklists must have direct knowledge and have witnessed that the line-item task on the pre-functional checklist was actually performed. It is not acceptable for supervisors to fill out these forms unless they have actually observed the installation and witnessed the tests.
- G. Subcontractor PFCs, that match the rigor, clarity and intent of all the commissioning specifications, may be substituted for CxP forms if approved by CxP.



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### 3.10 VERIFICATION OF OPERATION and PERFORMANCE

- A. Functional Acceptance Testing is the dynamic testing of material, equipment and systems to demonstrate performance and operation in accordance with commissioning objectives.
- B. Verification of operation and performance will take place after formal notice from the Subcontractor that the pre-commissioning checklists have been signed-off.
- C. Each functional acceptance test will be performed under conditions that simulate actual conditions as close as practically possible. The CM/GC and Subcontractor will provide all necessary materials and system modifications to produce the necessary flows, pressures, temperatures necessary to execute the test according to the specified conditions. At completion of the test, the CM/GC and Subcontractor will return all affected building equipment and systems to their normal pre-test condition.
- D. The CxP will direct, witness and document the functional testing. Performance demonstration will be done by the systems and equipment trade representatives and shall be witnessed by the CxP.
- E. Verification will include demonstration of performance listed in the functional test plan test script data sheets. This may involve trend logging and analysis.
- F. The specified, submitted and other data will be entered on the equipment test script data sheets prior to the verification.
- G. The witnessed performance data will be added to the test script data sheet at the time of verification.
- H. Notify the CxP and CM/GC as soon as possible of any issues identified during construction that may affect the Cx process or final system performance.
- I. Process the CxP's observation issues list to the appropriate parties for timely resolution and notify the CxP for recheck.

### 3.11 TRAINING OF THE OWNER'S STAFF

#### A. General

- 1. The Owner's personnel shall be given comprehensive training in the understanding of the systems and the operation, maintenance, and repair of each major piece of equipment and system per the CxP and Owner's FM team approved agenda and curriculum.
- 2. Training session agendas will be provided to the CxP one week prior to the scheduled date of training.
- 3. The CM/GC, in cooperation with the CxP, will be responsible for scheduling the training. Classroom training session(s) may be provided as part of the training requirements.
- 4. The CM/GC or their Subcontractor representative shall conduct all sessions and shall add to each session any special information relating to the details of

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- installation of the equipment as it might impact the operation, maintenance, and repair.
5. Training shall occur after functional acceptance testing is complete, unless approved otherwise by the Owner's representative.
  6. Training shall include:
    - a. Subcontractor overview of systems' normal and emergency operations. The CxP will assist as needed.
    - b. Reference to installation, O&M instruction material included in the O&M manuals.
    - c. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions.
    - d. Discussion of relevant health and safety issues and concerns.
    - e. Discussion of warranties and guarantees.
    - f. Common troubleshooting problems and solutions.
    - g. Explanatory information included in the O&M manuals and the location of all plans and manuals in the facility.
    - h. Discussion of any peculiarities of equipment installation or operation.
    - i. Hands-on training shall include start-up, operation in all modes possible, including manual, shutdown and any emergency procedures and preventative maintenance for all pieces of equipment.
    - j. The Subcontractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not controlled by the central control system. The CxP will assist as needed.

### 3.12 COMMISSIONING ACCEPTANCE CRITERIA

- A. The project acceptance criteria will be developed from the plans, specifications, and equipment manufacturer's operating criteria. The CM/GC and Subcontractors are responsible for meeting contractual requirements found in the plans and specifications. The GM/GC is reminded of their responsibility for furnishing a working system. All items in the issues and resolutions log need to be corrected per the plans and specifications.

### 3.13 REPORT REQUIREMENTS

- A. The CxP will submit a final report to the Owner which includes a statement that the project meets the Owner's design intent and includes a narrative of the results of the completed inspections, operational and functional testing. The final report will also include an outline of the issues and resolutions log and dates identifying items were found and dates those items were corrected. All open items will be identified in the report. The CFR/O&M will include the final report along with technical data from the equipment as well as all test results and completed FAT test scripts, manufacturer's start-up sheets, and testing, adjusting, & balancing (TAB) reports when possible. The CxP will upload the report into the Project Management Software.

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- B. At the conclusion of the commissioning process and after the final summary has been completed, the CxP will formally recommend system and equipment performance acceptance to the design engineer and the Owner's Representative.
- C. The Final Commissioning Report will include:
  - 1. Executive Summary
  - 2. Commissioning Plan
  - 3. Design Reviews
  - 4. Submittal Reviews
  - 5. Commissioning Meeting Minutes
  - 6. Site Observation Reports
  - 7. Observation Log
  - 8. Training Records
  - 9. O&M and As-built Reviews
- D. The Current Facilities Requirements and Operations & Maintenance (CFR/O&M) report will include:
  - 1. Executive Summary
  - 2. Owner's Project Requirements
  - 3. Basis of Design
  - 4. Pre-Functional Checklists
  - 5. Start-up Forms, Pressure Tests
  - 6. Test, Adjust, and Balance (TAB) Report
  - 7. Functional Acceptance Tests
  - 8. Re-Commissioning Forms (blank, for future use by operations staff)
  - 9. Trend Reviews
  - 10. As-built Control Drawings and Sequences of Operation, including set points and schedules (as-built programming)

END OF SECTION 01 91 00

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SECTION 02 41 00 - SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes the Following:

1. Work required to demolish, modify, salvage, relocate, and dispose existing structures, pavements, utilities, fencing, and miscellaneous items as required for the construction of the improvements as shown on the Drawings and as specified.
2. Protect all on-site personnel and the public at all areas of demolition.
3. Complete erosion and dust control measures as specified in Section 31 25 13.
4. Protect, support, and maintain adjoining structure, utilities, site work facilities, and miscellaneous items surrounding the demolition work from damage or harmful effects.
5. In accordance with all applicable state and local laws, properly dispose of all hazardous materials as required, obtain EPA generator number from the OWNER, and prepare safety plans.

B. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 01 11 00 – Summary of Work

1.2 SELECTIVE SITE DEMOLITION WORK

A. Selective demolition work includes, but is not limited to:

1. General site work: Asphalt and concrete paving and slabs, fencing, storm drainage structures, sidewalks, curbs, gutters, concrete walls and slabs, signs, bollards, utilities, irrigation systems, and landscaping. Demolition of existing site work structures that conflict with the new Work shown on the Drawings.
2. Partial demolition of pavements to allow new work to connect, for conduit penetrations, or otherwise modify existing structures.

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1.3 PROTECTION

- A. Maintain free and safe passage for all on-site personnel at all times.
- B. Prevent movement or settlement of structures or surrounding areas to demolition work. Provide bracing, shoring, and debris barriers as required and assume responsibility for the safety and support of affected structures.
- C. Protect existing finishes, equipment, and adjacent work which remains from damage. Cut finish surfaces such as masonry, tile, plaster, wood, gypsum wallboard, concrete, or metals by methods which will terminate or join work in a straight line at an appropriate point of division.
- D. Protect existing vegetation, landscaping and irrigation systems to remain.
- E. Cease operations and notify the ENGINEER immediately if the safety of any structure or utility appears to be endangered. Take additional precautions to properly support such structure(s) and do not resume demolition operations until safety is restored.
- F. Utility locations shown on the Drawings are approximate and may vary from where they are shown. The CONTRACTOR shall contact Underground Service Alert (800-642-2444) and obtain field marking to determine the exact locations of utilities owned by agencies. Record, preserve and protect the field markings.
- G. Blasting and the use of explosives shall not be permitted for any demolition work.
- H. Promptly repair any damage caused to facilities or landscaping by demolition operations as directed by the ENGINEER and at no additional cost to the OWNER. The minimum quality of repair shall be equal to that which existed prior to the start of the CONTRACTOR's work.

1.4 SCHEDULING

- A. Schedule all demolition work to meet the requirements of Section 01 32 13 and minimize disruption to the work of OWNER staff and the public. Exercise due concern and procedures for maintaining plant operation and diligently direct all activities towards maintaining continuous operation of the existing plant and minimizing operation inconvenience.

1.5 CONDITION OF STRUCTURES

- A. Conditions existing at the structures and areas to be demolished at the time of the bid period shall be maintained by the OWNER insofar as practical. Minor variations in

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small piping, electrical equipment, and miscellaneous materials shall be expected by the CONTRACTOR and this work shall be completed at no additional cost to the OWNER.

1.6 DISPOSAL OF MATERIAL REMOVED BY DEMOLITION WORK

- A. All materials removed by demolition work shall become the property of the CONTRACTOR as soon as actual demolition is initiated. The CONTRACTOR shall remove demolition materials as soon as possible but in no case shall store materials removed by demolition on the project site longer than 5 working days. Demolition materials other than concrete and soil shall be properly contained in covered waste disposal bins. Concrete and soil shall be tightly stockpiled until removal.

1.7 SUBMITTALS

- A. All submittals shall be in accordance with Section 01 33 00.
- B. Submit letters to the ENGINEER showing proposed start and finish dates, times, and detailed descriptions of demolition work a minimum of 14 days in advance of such work. See also Section 01 33 00.

PART 2 - PRODUCTS

2.1 PATCHING MATERIALS

- A. See Sections 32 12 16 and 32 13 13 for patching materials.

PART 3 - EXECUTION

3.1 SEQUENCE OF WORK

- A. The sequence of demolition and the modifications of existing facilities shall be in accordance with Section 01 33 00.
- B. The CONTRACTOR shall mark all facility components to be demolished in advance of demolition to permit ENGINEER review. The purpose of this requirement is to provide an opportunity to avoid unnecessary or erroneous demolition. The CONTRACTOR remains responsible for demolition as shown and specified in the Contract Documents.
- C. The CONTRACTOR shall schedule a meeting and meet with the ENGINEER at the site of the proposed demolition in advance of the start of demolition. CONTRACTOR

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shall ensure that subcontractors are present if necessary or requested by the ENGINEER.

3.2 REMOVAL OF STRUCTURES

- A. CONTRACTOR shall remove all components of structures shown or required to be removed.

3.3 REMOVAL AND ABANDONMENT OF BURIED PIPING

- A. Unless specifically noted on the Drawings to be abandoned-in-place, all abandoned buried piping shall be excavated and removed from the site.
- B. Piping specifically noted to be abandoned-in-place shall have each open end filled with concrete grout to a minimum distance of 5 feet or 5 pipe diameters, whichever is greater, unless otherwise specified or shown.

3.4 DEMOLITION OF AND ADJOINING TO ARCHITECTURAL FINISHES

- A. Demolition of finishes where adjoining finishes are to remain shall be carefully completed. Such special finishes include terrazzo, tile, stone, concrete, plaster, wood paneling, metal paneling, and drywall. Cuts shall be even, straight, and parallel to surrounding building lines. Over cuts shall not be permitted unless approved by the ENGINEER.

3.5 CLEAN-UP

- A. The CONTRACTOR shall remove from the site all debris resulting from the demolition operations as it accumulates and at least 2 times a week. Upon completion of the immediate demolition work, the CONTRACTOR shall thoroughly clean each area, including dusting, vacuuming, sweeping, and window cleaning.

END OF SECTION

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SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Demolition and removal of selected portions of building or structure.
  - 2. Demolition and removal of selected site elements.

1.02 MATERIALS OWNERSHIP

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

1.03 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for dust control and , for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
  - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
  - 3. Coordination for shutoff, capping, and continuation of utility services.
  - 4. Use of elevator and stairs.
  - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

1.04 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- D. Storage or sale of removed items or materials on-site is not permitted.

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- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.05 WARRANTY

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

1.06 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

3.03 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

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2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  4. Cover and protect furniture, furnishings, and equipment that have not been removed.
  5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.
- 3.04 SELECTIVE DEMOLITION, GENERAL
- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
  3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  5. Maintain fire watch during and after flame-cutting operations.
  6. Maintain adequate ventilation when using cutting torches.
  7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  10. Dispose of demolished items and materials promptly.

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3.05 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.

3.06 CLEANING

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

END OF SECTION

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SECTION 03 30 53 - MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture.

1.03 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. Comply with ACI 301.
- C. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 - PRODUCTS

2.01 FORMWORK

- A. Furnish formwork and formwork accessories according to ACI 301.
- B. Acceptable Materials:
  - 1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. APA HDO (high-density overlay).
    - b. APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
    - c. APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
    - d. APA Plyform Class I, B-B or better; mill oiled and edge sealed.

2.02 STEEL REINFORCEMENT

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

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- B. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.
- D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

2.03 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout Project:
  - 1. Portland Cement: ASTM C 150, Type I .
- B. Normal-Weight Aggregate: ASTM C 33, graded, 1-1/2-inch nominal maximum aggregate size.
- C. Water: ASTM C 94/C 94M.

2.04 ADMIXTURES

- A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.05 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.

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- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.06 MISCELLANEOUS MATERIALS

- A. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
  - 2. Form release agent for form liners shall be acceptable to form liner manufacturer.

2.07 CONCRETE MIXTURES

- A. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:
  - 1. Minimum Compressive Strength: coordinate with AOR/MOR & EEOR.
  - 2. Maximum Water-Cementitious Materials Ratio: 0.50.
  - 3. Slump Limit: 4 inches, plus or minus 1 inch.

2.08 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
  - 1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 EMBEDDED ITEMS

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

3.02 STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

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3.03 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Contraction Joints in Slabs-on-Grade: Form weakened-plane grooved or sawed contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness.
- C. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

3.04 CONCRETE PLACEMENT

- A. Comply with ACI 301 for placing concrete.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
- C. Do not add water to concrete during delivery, at Project site, or during placement.
- D. Consolidate concrete with mechanical vibrating equipment.

3.05 FINISHING UNFORMED SURFACES

- A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scream surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.
  - 1. Do not further disturb surfaces before starting finishing operations.
- C. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish.
- D. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces.

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3.06 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.07 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Tests: Perform according to ACI 301.
  - 1. Testing Frequency: One composite sample shall be obtained for each day's pour of each concrete mix exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
  - 2. Testing Frequency: One composite sample shall be obtained for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.

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3.08 REPAIRS

- A. Remove and replace concrete that does not comply with requirements in this Section.

END OF SECTION

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SECTION 06 10 00 ROUGH CARPENTRY

PART I – GENERAL

1.1 Description Of Work

A. Work Included:

1. Wood framing and sheathing systems.
2. Wood furring, blocking and nailers.
3. Backing for wall mounted equipment, railings, toilet partitions, toilet accessories, etc.
4. Rough hardware, including tie-downs, post caps, etc.
5. Acoustical sealant, where indicated, at wood plates and plywood.
6. Prefabricated wood products

1.2 Applicable Standards (latest editions apply)

A. AITC- American Institute of Timber Construction Standards

1. 110 – Standard Appearance Grades for Structural Glued Laminated Timber.
2. 111 – Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection.
3. 113 – Standard for Dimensions of Glued Laminated Structural Members.
4. 115 – Standard for Fabricated Structural Timber
5. 103 – Standard for Structural Glued Laminated Timber

B. ANSI- American National Standards Institute

1. ANSI/AITC A190.1 Structural Glued Laminated Timber
2. ANSI/ASME B18.2.1 Square and Hex Bolts and Screws (Inch Series)
3. ANSI/ASME B18.6.1 Wood Screws (Inch Series)

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- C. APA- American Plywood Association Product Standard PS 1.
- D. ASTM- American Society for Testing and Materials: D05055-90, Establishing and monitoring Structural Capacities of Prefabricated Wood I Joists.
- E. AWWPA- American Wood Preservers Association Standard, U1
- F. ICC- International Code Council, Inc.
  - 1. CBC- California Building Code, 2022 Edition
- H. FS- Federal Specifications
- I. TPI- Truss Plate Institute: Design Specification for Metal Plate Connected Wood Trusses.
- J. WCLIB- West Coast Lumber Inspection Bureau, Grading Rule No. 17

1.3 Submittals

- A. Shop drawings of glued laminated beams plus AITC or equal certificate of conformance with product standard ANSI/AITC 190.1
- B. Shop drawings of prefabricated wood I joists including:
  - 1. Plan layout of members and bridging, design loads and installation instructions.
  - 2. Details of member connections, stiffeners, blocking and web openings.
  - 3. Structural calculations stamped and signed by California Registered Civil Engineer.
- C. Product information for rough hardware.

1.4 Store lumber and plywood off ground in manner to ensure proper ventilation and protection from weather; and to prevent damage by either decay or insects. Store plywood under cover and cover lumber as required to avoid twisting and warping.

1.5 Coordinate work of this Section with work by others. Check lines and levels indicated on such other work as has been completed, before commencing work of this Section. Report discrepancies in writing to the Owner for correction and adjustment, or in the event of failure to do so, correct errors without additional cost to the Owner.

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- 1.6 Install temporary bracing as required. Make proper provision to take care of stresses resulting from construction loads, whenever piles of materials, erection equipment or other loads are carried by frame during its erection.

PART II – PRODUCTS

- 2.1 Wood: Materials shall conform to grades and grading rules as hereinafter specified. Each piece of lumber and plywood shall be grade-stamped or certified by a competent agency approved by the Owner.

A. Plywood:

1. Roof Sheathing: Structural 1, 15/32" APA Rated, 24/0, Exposure I; 5 ply, min.
2. Wall Sheathing: Structural 1, 15/32" APA C-C, Interior with exterior glue; 5 ply, min.
3. Floor Sheathing: Structural 1, 3/4" APA Rated 48/24 Exposure 1; 5 ply, min.

B. Framing Lumber: Douglas Fir – Larch conforming to "WCLIB Standard Grading and Dressing Rules No. 17" as follows:

1. Structural Light Framing: 2" to 4" thick 2" to 6" wide D.F. No. 1
2. Structural Joists & Planks: 2" to 4" thick, 6" and wider D.F. No. 1 or better
3. Beams & Stringers: 5" and thicker, Rectangular width more than 2" greater than thickness D.F. No. 1, free of heart centers
4. Posts & Timbers: 5" x 5" and larger, width not more than 2" greater than thickness D.F. No. 1 free of heart centers
5. Sills: Pressure treated D.F. No. 1, Stamped in compliance with CBC 2303.1.9, Ammoniacal Copper Quat (ACQ), Copper Boron Azole (CBA) or Borate Treated AWP Standard C2, minimum 4/10" penetration, incised

C. Glued Laminated Timber

1. Lumber; Douglas Fir (Laminating Grades), Grade Combination No. A ( $F_B = 2,400$  psi) graded in accordance with the Standard Grading and Dressing Rules of WCLIB.
2. Glues: Exterior type adhesive conforming to ASTM D2559, resin adhesive of phenol, or melamine base applied in accordance with the manufacturer's recommendation.

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3. Fabrication shall comply with the Standards established by the American Institute of Timber Construction, (AITC 103, 110, 113, 115 and ANSI / A190.1)
  4. Provide extra length of at least six (6) inches at each end for field trim of all members, or verify field dimensions prior to fabrication of members to ensure proper fit.
  5. Glu-lam beam fabrication shall be continuously inspected by a DSA certified inspector per 1705A.5.4 of the CBC, where required.
- D. Prefabricated Wood I-joists: Red-I Joist by RedBuilt or an approved equal manufacturer. Fabrication of I-joists to take place under the supervision of an independent inspection agency.
1. Flanges: Continuous Laminated Veneer Lumber (LVL) proof loaded per ANSI A-190.1, moisture content not to exceed 15 percent;  $F_t = 2000$  psi,  $E = 2.0 \times 10^6$  psi.
  2. Webs: CD Structural I plywood with exterior glue, grade marked by APA, in accordance with Product Standard PS1-09 or other recognized equal which complies with APA standards as substantiated by performance verification data and verified by an independent testing agency.
  3. Adhesive: adhesives shall comply with ASTM D2559
  4. Metal Bridging: Metal bridging shall be 20 gauge "TB-tension bridging" (nail type) as manufactured by Simpson Strong-Tie, or approved equal.
- E. Laminated Veneer Lumber (LVL): "Microlam" as manufactured by Weyerhaeuser Co. or approved equal.
- F. Parallel Strand Lumber (PSL): "Parallam" as manufactures by Weyerhaeuser Co. or approved equal.
- G. Additional Grading Requirements
1. In order to qualify as "structural lumber", each piece including plywood, shall be marked with the grade of the lumber by some competent and reliable organization whose regular business is to establish lumber grades and whose trade-mark shall also appear on each piece; except that, a certificate from such an organization may be accepted in lieu of such grade and trade-marks. All plywood must be grade stamped on each piece with the APA trade-mark.
  2. There shall be no boxed heart in any framing lumber 4" and larger in the least dimension.

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2.2 Preservative Treatment

- A. Use waterborne preservatives complying with AWWPA Standard U-1, Use Category 2.
- B. All preservative treated lumber shall be retreated where cut on site.

2.3 Rough Hardware

Nails, bolts, nuts, washers, lag bolts, screws, anchor and other fastenings as shown or as required for complete installation. Galvanized or cadmium-plate for exterior work. Comply with the following specifications:

- A. Wire Nails: Common. Plywood nails are acceptable at diaphragms and walls. Provide minimum penetration as required for common nails.
- B. Bolts, Nuts, ASTM A307, (upset threads are prohibited)
- C. Lag Screws and Lag Bolts: ANSI/ASME B18.2.1.
- D. Wood Screws: ANSI/ASME B18.6.1.
- E. Framing Clips, Boots, Hangers, hold-downs etc.: by Simpson Strong Tie or approved equal.

- 2.4 Glue: AFG – 01 approved. PL Premium" polyurethane construction adhesive by Chem Pex, Inc., or equal.

PART III – EXECUTION

3.1 General Framing

- A. Joists, rafters and beams shall be cut as required to provide a full even and horizontal seating on the support, unless otherwise shown. Do not overcut.
- B. Notches and bored holes in joists and beams shall be limited as shown on the drawings.

3.2 Framing For Pipes

- A. Frame members for passage of pipes and ducts to avoid cutting structural members. Do not cut, notch or bore framing members for passage of pipes or conduits without architect's authorization.

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- B. Pipes 1" diameter or less may pass through a neatly bored hole in the center of the plates. Hole location is subject to the Architect's acceptance.
- 3.3 Fire stops: Provide 2" nominal fire stops in conformance with Section 708.2 of the CBC.
- 3.4 Blocking: Provide solid blocking in all walls for wall mounted items.
- 3.5 Furring: Provide furring, stripping, blocking, backing and grounds where indicated or where necessary to support, or to furnish suitable spacings for finish materials and accessories.
- 3.6 Nailing:
- A. All nailing shall conform to CBC Table 2304.10.2, except where more stringent requirements are shown on drawings.
  - B. Penetration of nails or spikes into piece receiving point shall be not less than 1/2 length of nail or spike, except, that 16 penny nails may be used to connect pieces of 2" thickness.
  - C. Drive nails and spikes no closer together than 2/3 their length nor closer to edge of member than 1/2 their length, except when detailed otherwise.
  - D. Place nails without splitting wood. Pre-drill holes whenever nailing tends to split wood or plywood. Replace split members.
  - E. Use of machine nailing is subject to a satisfactory job site demonstration. Authorization is subject to continued satisfactory performance. If nail heads penetrate the outer ply of plywood more than would be normal for a hand hammer or if the minimum allowable edge distances are not maintained the performance will be deemed unsatisfactory.
- 3.7 Bolts and Lag Screws:
- A. Provide bolts and lag screws, bearing on wood, with malleable iron or steel plate washers of sizes indicated under heads and nuts. All nuts and screws shall be tightened when placed and re-tightened at completion of the job or immediately prior to closing with finish construction. Nuts shall be secured against loosening.
  - B. Except where otherwise indicated on the details, bore holes for bolts with a bit 1/32" to 1/16" larger than nominal diameter as the bolt.
  - C. Bore lag screw holes the same diameter and depth as shank, continue hole to depth equal to length of lag screw and with a diameter equal to 40% to 70% of the diameter of the shank.

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- D. Screw all lag screws; do not drive into place. Embed threaded portion of lag screws in each timber a minimum of seven (7) times their shank diameter.
- 3.8 Preservative Treatment: Treat all framing in direct contact with concrete or masonry construction with wood preservative, as follows:
- A. Wood bucks and nailing blocks: Dip in preservative 15 minutes prior to incorporation in concrete.
  - B. All treated lumber shall be marked or branded.
- 3.9 Glue Plywood Floor Sheathing to supporting members
- 3.10 Prefabricated Wood: Install prefabricated wood products in accordance with the recommendations of the manufacturer. All trusses and I-joists must be securely braced during erection and after permanent installation. Erection bracing shall hold trusses and I-joists straight and plumb and in safe condition until decking and permanent bracing has been fastened forming a structurally sound framing system. All erection and permanent bracing shall be installed and all trusses permanently fastened before application of any loads. Do not impose construction loads which cause stresses beyond design limits. Materials used in bracing are to be furnished by the erection contractor.
- 3.11 Removal Of Debris: Remove all wood, including form lumber, chips, shavings and sawdust in or on the ground from the area under the floor. No wood shall be buried in any fill.

END OF SECTION



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SECTION 07 56 00 - FLUID-APPLIED ROOFING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. PMMA-based, fluid-applied roofing membrane system.
- B. Related Sections:
  - 1. Division 01 sustainable design requirements Section(s) for supplementary sustainable design criteria.

1.02 PREINSTALLATION MEETINGS

- A. Preinstallation Roofing Conference: Conduct conference at Project site.
  - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
  - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
  - 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review substrate requirements for conditions and finishes, including flatness.
  - 5. Review structural loading limitations of roof deck during and after roofing.
  - 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
  - 7. Review governing regulations and requirements for insurance and certificates if applicable.
  - 8. Review temporary protection requirements for roofing during and after installation.
  - 9. Review roof observation and repair procedures after roofing installation.

1.03 ACTION SUBMITTALS

- A. Product Data: For each membrane system component.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

1.04 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:

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- 1. Documentation for roof coatings, indicating VOC content.
- B. Field quality-control reports and manufacturer's final roof inspection report.
- 1.05 CLOSEOUT SUBMITTALS
  - A. Maintenance Data: For roofing system to include in maintenance manuals.
- 1.06 QUALITY ASSURANCE
  - A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's roofing system and that is eligible to receive manufacturer's special warranty.
- 1.07 DELIVERY, STORAGE, AND HANDLING
  - A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
  - B. Handle and store roofing materials, and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.
- 1.08 PROJECT CONDITIONS
  - A. Environmental Limitations: Apply roofing within the range of ambient and substrate temperatures recommended by roofing system manufacturer. Do not apply roofing to a damp or wet substrate or when temperature is below 0 deg F.
    - 1. Do not apply roofing in snow, rain, fog, or mist.

PART 2 - PRODUCTS

- 2.01 SUSTAINABLE DESIGN CRITERIA
  - A. Sustainable Design Criteria: Comply with indicated criteria for the following product categories:
    - 1. Roof Coatings:
      - a. VOC content limits for field applications.
- 2.02 PERFORMANCE REQUIREMENTS
  - A. General Performance: Installed roofing and base flashings are to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings are to remain watertight.

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- B. Material Compatibility: Roofing materials are to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- C. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

## 2.03 ROOFING MEMBRANE

- A. Fluid-Applied Roofing Membrane: Flexible, PMMA-based resin combined with a thixotropic agent for use in combination with non-woven, needle-punched polyester fabric reinforcement to form a monolithic, reinforced roofing membrane.
  - 1. Roofing Systems: Subject to compliance with requirements, roofing systems that may be incorporated into the Work include, but are not limited to the following:
    - a. Kemper System; 2K FR.

## 2.04 ACCESSORY MATERIALS

- A. Accessory materials recommended by roofing manufacturer for intended use and compatible with roofing membrane.
  - 1. Liquid-type accessory materials are to comply with VOC limits of authorities having jurisdiction.
- B. Reinforcing Fabric: Manufacturer's recommended, spun-bonded polyester fabric.
- C. Anti-Skid Granule Walkway Surfacing: Manufacturer's standard ceramic granules suitable for broadcast into a PMMA-based resin wear layer.
- D. Color Topcoat: A pigmented, PMMA-based resin for used to provide a color finish for both field and flashing membranes.
  - 1. Color: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
  - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof drain bodies are securely clamped in place.
  - 2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.02 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions.
- B. Mask off adjoining surfaces not receiving roofing to prevent spillage from affecting other construction.

3.03 INSTALLATION OF ROOFING MEMBRANE

- A. Apply primer, at manufacturer's recommended rate, over prepared substrates and allow to dry.
- B. Apply fluid-applied roofing membrane according to manufacturer's written instructions.
- C. Start application with manufacturer's authorized representative present.
- D. Reinforced Membrane: Apply roofing membrane to area to receive roofing. Spread a layer of fluid-applied PMMA; embed reinforcing fabric, overlapping sheets 2 inches; spread another layer of fluid-applied PMMA to form a uniform, reinforced, seamless membrane, 90 mils thick minimum.

3.04 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

3.05 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

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1SECTION 08 71 00 GATE HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes items known commercially as finish or door hardware that are required for swing gate, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.
- B. Related Sections: The following sections are noted as containing requirements that relate to this Section, but may not be limited to this listing.

1.03 REFERENCES

- A. 2022 California Building Code, CCR Title 24, Part 2
- B. BHMA - Builders' Hardware Manufacturers Association
- C. DHI - Door and Hardware Institute
- D. NFPA - National Fire Protection Association.
  - 1. NFPA 80 - Fire Doors and Other Opening Protectives
  - 2. NFPA 105 - Smoke and Draft Control Door Assemblies
- E. UL - Underwriters Laboratories.
  - 1. UL 10C - Fire Tests of Door Assemblies
  - 2. UL 305 - Panic Hardware
- F. WHI - Warnock Hersey Incorporated
- G. SDI - Steel Door Institute

1.04 SUBMITTALS & SUBSTITUTIONS

- A. General: Submit in accordance with Conditions of the Contract and Division 01 Specification sections.

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- B. Submit product data (catalog cuts) including manufacturers' technical product information for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
- C. Submit electronic PDF copies of schedule organized vertically into "Hardware Sets" with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:
1. Include a Cover Sheet with:
    - a. Job Name, location, telephone number.
    - b. Architects name, location and telephone number.
    - c. Contractors name, location, telephone number and job number.
    - d. Suppliers name, location, telephone number and job number.
    - e. Hardware consultant's name, location and telephone number.
  2. Job Index information included:
    - a. Numerical door number index including; door number, hardware heading number and page number.
    - b. Complete keying information (referred to DHI hand-book "Keying Systems and Nomenclature"). Provision should be made in the schedule to provide keying information when available; if it is not available at the time the preliminary schedule is submitted.
    - c. Manufacturers' names and abbreviations for all materials.
    - d. Explanation of abbreviations, symbols, and codes used in the schedule.
    - e. Mounting locations for hardware.
    - f. Clarification statements or questions.
    - g. Catalog cuts and manufacturer's technical data and instructions.
  3. Vertical schedule format sample:

Heading Number 1 (Hardware group or set number - HW Group #1)				
(a) 1 Single - Door #101 - Corridor 101 to Exterior			(b) 90°	(c) RH
(d) 3'-0" x 7'-0" x 1-3/4" - Wood Door x Hollow Metal Frame - 20 Minute				
(e) 1.	(f) 3 ea	(g) Hinges - (h) 5BB1 4.5 x 4.5 NRP TMS	(i) 1/2	(j) 630
2.	1 ea	Lockset - ND80P6D x RHO x RH x 10-025 x JTMS	626	(k) IVE SCH
3.	1 ea	Closer - 4040XP x EDA x TBSRT	689	LCN

- a) Single or pair of doors with opening number and location.
- b) Degree of opening.
- c) Hand of door(s).
- d) Door/frame dimensions and material; Label requirements, if any.

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- e) Hardware item line # (Optional).
  - f) Quantity.
  - g) Product description.
  - h) Product part number.
  - i) Fastenings and other pertinent information.
  - j) Hardware finish codes per ANSI/BHMA A156.18.
  - k) Manufacturer abbreviation.
- D. Make substitution requests in accordance with Division 01. Substitution requests must be made prior to bid date. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.
- E. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.
- F. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- G. Furnish as-built/as-installed schedule with close-out documents, including keying schedule and transcript, wiring/riser diagrams, manufacturers' installation and adjustment and maintenance information.
- H. Fire Door Assembly Testing: Submit a written record of each fire door assembly to the Owner to be made available to the Authority Having Jurisdiction (AHJ) for future building inspections.
- I. LEED Certification Points: Submit information and certifications necessary to achieve maximum points for LEED certification; coordinate and cooperate with Owner and Architect in providing information necessary for required LEED rating.
- 1.05 QUALITY ASSURANCE
- A. Obtain each type of hardware (latch and lock sets, hinges, closers, exit devices, etc.) from a single manufacturer.
- B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.
1. Responsible for detailing, scheduling and ordering of finish hardware.

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2. Meet with Owner to finalize keying requirements and to obtain final instructions in writing. To maintain the integrity of patented key systems provide a letter of authorization from the specified manufacturer indicating that supplier has authorization to purchase the key system directly from the manufacturer.
  3. Stock parts for products supplied and are capable of repairing and replacing hardware items found defective within warranty periods.
- C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.
- D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.
1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".
- E. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.
- F. Product packaging to be labelled in compliance with CA Prop 65, Safe Drinking Water and Toxic Enforcement Act of 1986.
- 1.06 DELIVERY, STORAGE AND HANDLING
- A. Coordinate delivery of packaged hardware items to the appropriate locations (shop or field) for installation.
- B. Hardware items shall be individually packaged in manufacturers' original containers, complete with proper fasteners. Clearly mark packages on outside to indicate contents and locations in hardware schedule and in work.
- C. Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc.
- D. Contractor to inventory door hardware jointly with representatives of hardware supplier and hardware installer until each all are satisfied that count is correct.
- 1.07 WARRANTY
- A. Provide warranties of respective manufacturers' regular terms of sale from day of final acceptance as follows:

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1. Locksets: Ten (10) years.
2. Exit devices: Three (3) years.
3. Closers: Thirty (30) years.
4. All other hardware: Two (2) years.

1.08 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.

1.09 PRE-INSTALLATION CONFERENCE

- A. Convene a pre-installation conference at least one week prior to beginning work of this section.
- B. Attendance: Architect, Construction Manager, Contractor, Security Contractor, Hardware Supplier, Installer, Key Owner's Personnel, and Project Inspector.
- C. Agenda: Review hardware schedule, products, installation procedures and coordination required with related work. Review Owner's keying standards.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

<u>Item</u>	<u>Manufacturer</u>	<u>Acceptable Substitutes</u>
Hinges	Ives	Hager, Stanley, McKinney
Locks, Latches & Cylinders	Schlage	None – District Standard
Exit Devices	Von Duprin	None – District Standard
Closers	LCN	None – District Standard
Push, Pulls & Protection Plates	Ives	Trimco, BBW, DCI
Flush Bolts	Ives	Trimco, BBW, DCI
Coordinators	Ives	Trimco, BBW, DCI
Door Stops	Ives	Trimco, BBW, DCI
Overhead Stops	Glynn-Johnson	Or Approved Equal
Thresholds	Zero	Pemko, National Guard
Seals & Bottoms	Zero	Pemko, National Guard

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2.02 MATERIALS

A. Hinges:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Hinges shall be sized in accordance with the following:
  - a. Height:
    - 1) Doors up to 42" wide: 4-1/2 inches.
    - 2) Doors 43" to 48" wide: 5 inches.
  - b. Width: Sufficient to clear frame and trim when door swings 180 degrees.
  - c. Number of Hinges: Provide 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.
3. Exterior out-swinging hinges shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.
4. Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.

B. Continuous Hinges:

1. Provide aluminum geared continuous hinges fabricated from 6063-T6 aluminum conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
3. Provide continuous hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
4. Provide continuous hinges 1" shorter in length than nominal height of door, unless otherwise noted, with symmetrical hole pattern.
5. Install continuous hinges with fasteners supplied by manufacturer.

C. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Rhodes" lever design.

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3 hour fire doors.
2. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:
  - a. Abusive locked lever torque – minimum 3,100 inch-pounds without gaining access.
  - b. Offset lever pull – minimum 1,600 foot pounds without gaining access.
  - c. Vertical lever impact – minimum 100 impacts without gaining access.
  - d. Cycle Test – tested to minimum 16 million cycles with no visible lever sag; without the use of performance aids such as set screws or spacers.
3. Cylinders: Refer to "KEYING" article, herein.
4. Provide locks with standard 2-3/4" backset, unless noted otherwise, with 1/2" latch throw. Provide proper latch throw for UL listing at pairs.

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5. Provide locksets with separate solid steel anti-rotation thru-bolts, and no exposed screws.
  6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
  7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
  8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
  9. Provide levers with vandal resistant technology as scheduled for use at abusive applications.
- D. Exit devices: Von Duprin as scheduled.
1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
  2. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 standards.
  3. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
  4. Provide exit devices cut to door width and height. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
  5. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
  6. Provide flush end caps for exit devices.
  7. Exit devices shall comply with CBC Section 11B-404.2.7 and shall be mounted between 34" and 44" above the finished floor surface.
  8. Provide exit devices UL certified to meet 5 lbs. maximum unlatching force requirements according to the CBC Section 11B-309.4.
  9. Cylinders: Refer to "KEYING" article, herein.
  10. Provide cylinder dogging as specified at non fire-rated openings. Provide cylinder dogging indicators (CDSI) for visible indication of dogging status as specified.
  11. Removable Mullions: Provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
  12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
  13. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
  14. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
  15. Provide exit devices with manufacturer's approved strikes.
  16. Panic hardware shall not be provided with "Night Latch" (NL) function for any accessible doors or gates unless the following conditions are met per DSA

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Interpretation 10-08 DSA/AC. Such conditions must be clearly demonstrated and indicated in the specification:

- a. Panic hardware contains a "dogging" feature and during the time the facility is open the panic hardware shall be "dogged".
- b. The act of "dogging" a door in the open position shall only be performed by employees as a part of their job function (non-public use).

E. Closers: LCN as scheduled.

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Provide certificate by independent testing laboratory that door closers have completed over 10,000,000 cycles and can still meet ANSI/BHMA A156.4 standards.
4. Cylinder Body: 1-1/2" diameter with 3/4" diameter double heat-treated pinion journal.
5. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120° F to -30° F.
6. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
7. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
8. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
9. Pressure Relief Valve (PRV) Technology: Not permitted.
10. Provide door closers powder coated to match balance of door hardware. Powder coating finish shall be certified to exceed 100 hours salt spray testing as described in ANSI/BHMA A156.4 and ASTM B117.
11. Provide special rust inhibitor (SRI) in highly corrosive areas, and where noted in hardware sets.
12. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

F. Low Energy Auto Operators

1. Electro-Hydraulic Automatic Operators - LCN 4600 Series.
  - a. Requirements:
    - 1) Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
    - 2) Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.

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- 3) Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door.
- 4) Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
- 5) Provide drop plates, brackets, or adapters for arms as required for details.
- 6) Provide hard-wired actuator switches for operation as specified.
- 7) Provide weather-resistant actuators at exterior applications.
- 8) Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
  - a) Actuator to comply with CBC 11B-404.3.5 Controls.
- 9) Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2. Accessories

- a. Signage: As required by cited BHMA standard for type of door and its operation.
  - 1) Provide sign materials with instructions for field application when operators are installed.
- b. Operator controls
  - 1) Vertical, Full Length Switches (Actuators): LCN 8310-836T wall-mounted, door-control switch plate for operation by touch. Install a wall push plate actuator on each side of each automatic swinging entrance door.
  - 2) Provide each actuator with a decal to be applied adjacent to the actuator instructing the user as to the operation and function of the door.
  - 3) Automatic flush bolts shall be of the low operating force design.
  - 4) Provide top bolt only model for interior doors where applicable and as permitted by testing procedures.
  - 5) Provide dust proof strikes at openings using bottom bolts.
  - 6) Manual flush bolts shall only be permitted on storage or mechanical openings, as scheduled.

G. Door Stops:

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1. Unless otherwise noted in hardware sets, provide floor type with appropriate fasteners. Where floor type cannot be used, provide overhead type.
2. Do not install floor stops more than four (4) inches from the face of the wall or partition (CBC Section 11B-307).
3. Provide backing plate at wall framing behind wall type.
4. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions. Stop-only function shall be provided at fire-rated openings.

H. Protection Plates:

1. Provide kick, mop, and/or armor plates minimum of 0.050" thick, with four beveled edges. Furnish with sheet metal or wood screws, finished to match plates.
2. Kick plates shall be sized 10" high and 2" less door width (LDW) at single doors and 10" high and 1" LDW at pairs or doors.
3. Provide mop and armor plates with sizes as scheduled in hardware sets.

I. Thresholds: As scheduled and per details.

1. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope. Thresholds shall comply with CBC Section 11B-404.2.5.
2. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Division 07 "Thermal and Moisture Protection".
3. Use 1/4" fasteners, red-head flat-head sleeve anchors (SS/FHSL).

J. Seals: Provide silicone gasket at all rated and exterior doors.

1. Smoke & Draft Control Doors: Provide UL10C Classified gasketing that complies with NFPA 80 & NFPA 252 for use on "S" labeled Positive Pressure door assemblies.

K. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.

2.03 KEYING

- A. Furnish a proprietary Schlage Primus masterkey system as directed by the District. Initiate and coordinate the Primus Letter of Authorization face sheet with the District. Verify Primus keyway with the District locksmith prior to ordering.
- B. All permanent Schlage Primus interchangeable cores and keys shall be furnished by the Contractor and delivered to the District 60 days prior to substantial completion. District shall key all permanent cores and return to Contractor for final installation.
- C. A detailed keying schedule is to be prepared by the District and/or architect in consultation with a representative of Allegion or an Authorized Key Center. Each keyed

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cylinder on every keyed lock is to be listed separately showing the door #, key group (in BHMA terminology), cylinder type, finish and location on the door.

- D. Furnish all cylinders in Schlage Primus Full Size Interchangeable Core (FSIC). Pack change keys independently (PKI).
- E. Furnish construction keying for doors requiring locking during construction.
- F. Furnish all keys with visual key control.
  - 1. Stamp key "Do Not Duplicate".
  - 2. Stamp (BHMA) key symbol on key.
  - 3. Stamp unique owner identifier from the key bow.
- G. Furnish all cylinders with visual key control.
  - 1. Stamp (BHMA) key symbol on side of cylinder (CKC).
- H. Furnish mechanical keys as follows:
  - 1. Furnish 2 cut change keys for each different change key code.
  - 2. Furnish 1 uncut key blank for each change key code.
  - 3. Furnish 6 cut masterkeys for each different masterkey set.
  - 4. Furnish 3 uncut key blanks for each masterkey set.
  - 5. Furnish 2 cut control keys cut to the top masterkey for permanent I/C cylinders.
  - 6. Furnish 1 cut control key cut to each SKD combination.
- I. Furnish Schlage Padlocks and the cylinders to tie them into the masterkey system for gates, storage boxes, utility valve security, roof hatches and roll-up doors keyed as directed in the keying schedule.
  - 1. Furnish KS43F3200 padlock for use with FSIC Schlage cylinders. 20-740 (Primus core) with above.
- J. Furnish one Schlage cabinet lock for each cabinet door or drawer so designated on the drawings or keying schedule to match the masterkey system.
  - 1. Furnish CL777R for use with FSIC Schlage cylinders.

## 2.04 FINISHES

- A. Generally to be satin chrome US26D (626 on bronze and 652 on steel) unless otherwise noted.
- B. Furnish push plates, pull plates and kick or armor plates in satin stainless steel US32D (630) unless otherwise noted.
- C. Door closers shall be powder-coated to match other hardware, unless otherwise noted.

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- D. Aluminum items to be finished anodized aluminum except thresholds which can be furnished as standard mill finish.

2.05 FASTENERS

- A. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.
- B. Screws for butt hinges shall be flathead, countersunk, full-thread type.
- C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.
- D. Provide expansion anchors for attaching hardware items to concrete or masonry.
- E. All exposed fasteners shall have a phillips head.
- F. Finish of exposed screws to match surface finish of hardware or other adjacent work.
- G. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.
- B. Beginning of installation means acceptance of existing conditions.
- C. Fire-Rated Door Assembly Inspection: Upon completion of the installation, all fire door assemblies shall be inspected to confirm proper operation of the closing device and latching device and that only the manufacturer's furnished fasteners are used for installation and that it meets all criteria of a fire door assembly per NFPA 80 (Standard for Fire Doors and Other Opening Protectives) 2016 Edition. A written record shall be maintained and transmitted to the Owner to be made available to the Authority Having Jurisdiction (AHJ). The inspection of the swinging fire doors shall be performed by a certified FDAI (Fire Door Assembly Inspector) with knowledge and understanding of the operating components of the type of door being subjected to the inspection. The record shall list each fire door assembly throughout the project and include each door number, an itemized list of hardware set components at each door opening, and each door location in the facility.

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3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.
- B. Use the templates provided by hardware item manufacturer.
- C. Mounting heights for hardware shall be as recommended by DHI. Operating hardware shall be located between 34" and 44" above finish floor to comply with CBC Section 11B-404.2.7.
- D. Door Closers:
  - 1. Place door closers inside building, stairs, rooms, etc. Closers shall be installed to permit doors to swing 180 degrees or maximum allowable by conditions.
  - 2. Maximum effort to operate closers shall not exceed 5 lbs., such pull or push effort being applied at right angles to hinged doors.
  - 3. When fire doors are required, the maximum effort to operate the closer may be increased but shall not exceed 15 lbs. when specifically approved by fire marshal.
  - 4. All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.
  - 5. Compensating devices or automatic door operators may be utilized to meet the above standards.
  - 6. Per CBC Section 11B-404.2.8.1, doors shall take minimum of 5 seconds to move from an open position of 90 degrees to 12 degrees to the latch jamb.
- E. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- G. Set thresholds for exterior doors in full bed of butyl-rubber sealant.
- H. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.

3.03 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Clean adjacent surface soiled by hardware installation.

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- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy, return to that work area and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.
- E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor accompanied by the Architectural Hardware Consultant, shall return to the project and re-adjust every item of hardware to restore proper functions of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.04 HARDWARE LOCATIONS

- A. Conform to CCR, Title 24, Part 2; and ADAAG; and the drawings for access-compliant positioning requirements for the disabled.

3.05 FIELD QUALITY CONTROL

- A. Contractor is responsible for providing the services of an Architectural Hardware Consultant (AHC) or a proprietary product technician to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturers' instructions and as specified herein.

3.06 HARDWARE SCHEDULE

- A. The items listed in the following schedule shall conform to the requirements of the foregoing specifications.
- B. While the hardware schedule is intended to cover all doors, and other movable parts of the building, and establish type and standard of quality, the contractor is responsible for examining the Plans and Specifications and furnishing proper hardware for all openings whether listed or not. If there are any omissions in hardware groups in regard to regular doors they shall be called to the attention of the Architect prior to bid opening for instruction; otherwise, list will be considered Complete. No extras will be allowed for omissions.
- C. The Door Schedule on the Drawings indicates which hardware set is used with each door.

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**REFER TO DRAWINGS- SHEET A1.10, FOR HARDWARE GROUP INFORMATION.**

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SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Interior gypsum board.

1.02 ACTION SUBMITTALS

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

1.03 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.04 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. American Gypsum.
  - 2. CertainTeed Corp.
  - 3. Georgia-Pacific Gypsum LLC.
  - 4. Continental Building Products.

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5. National Gypsum Company.
6. PABCO Gypsum.
7. USG Corporation.

2.02 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C1396/C1396M.
  1. Thickness: 5/8 inch.
  2. Long Edges: Tapered.

2.03 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.
  1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.

2.04 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
  1. Interior Gypsum Board: Paper or self-adhering glass mesh.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
  1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
  2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
  4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.

2.05 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
  1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

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PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

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- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### 3.03 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Single-Layer Application:
  - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) or horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
  - 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
  - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

### 3.04 INSTALLATION OF TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

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- B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

3.05 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 4: Surfaces scheduled for light-textured finishes, wallcoverings, paints and panel surfaces that will be exposed to view, unless otherwise indicated .
    - a. Primer and its application to surfaces are specified in other Division 09 Sections.

3.06 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or blotchy surface contamination and discoloration.

END OF SECTION



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SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Surface preparation and the application of paint systems on interior substrates.
- B. Related Sections:
  - 1. Division 01 sustainable design requirements Section(s) for supplementary sustainable design criteria.

1.02 DEFINITIONS

- A. Sheen Levels:
  - 1. Flat: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
  - 2. Eggshell: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
  - 3. Satin: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
  - 4. Semi-Gloss: 35 to 70 units at 60 degrees, according to ASTM D523.
  - 5. Gloss: 70 units and greater at 60 degrees, according to ASTM D523.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include preparation requirements and application instructions.
  - 2. Indicate VOC content.

1.04 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Documentation for paints and coatings, indicating VOC content.
  - 2. Documentation for paints and coatings, indicating compliance with emissions testing or certification.

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PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in other Part 3 articles for the paint category indicated.
- B. Source Limitations: Obtain products for each coating system from single source from single manufacturer.

2.02 SUSTAINABLE DESIGN CRITERIA

- A. Sustainable Design Criteria: Comply with indicated criteria for the following product categories:
  - 1. Paints and Coatings:
    - a. VOC content limits for field applications.
    - b. VOC emissions testing or certification for field applications within the weatherproofing system.

2.03 PAINT PRODUCTS, GENERAL

- A. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. Colors: As indicated in a color schedule on drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

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- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- B. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

3.03 INSTALLATION

- A. Apply paints according to manufacturer's written instructions.
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

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3.04 CLEANING AND PROTECTION

- A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.05 INTERIOR PAINTING SCHEDULE

- A. Gypsum Board; Acrylic Latex: Provide one of the following systems:
  - 1. Benjamin Moore:
    - a. Primer: Ultra Spec 500 Interior Latex Primer.
    - b. Intermediate Coat: Same as top coat.
    - c. Top Coat: Ultra Spec 500 Interior.
    - d. Sheen:
      - 1) Walls: Eggshell, unless indicated otherwise.
      - 2) Ceilings: Flat, unless indicated otherwise.
  - 2. Sherwin Williams:
    - a. Primer: ProMar 200 Zero VOC Interior Latex Primer B28 Series.
    - b. Intermediate Coat: Same as top coat.
    - c. Top Coat: ProMar 200 Zero VOC Interior Latex.
    - d. Sheen:
      - 1) Walls: Eggshell, unless indicated otherwise.
      - 2) Ceilings: Flat, unless indicated otherwise.
  - 3. PPG:
    - a. Primer: Speedhide ZERO VOC Interior Latex Primer.
    - b. Intermediate Coat: Same as top coat.
    - c. Top Coat: Speedhide ZERO VOC Interior Latex.
    - d. Sheen:
      - 1) Walls: Eggshell, unless indicated otherwise.
      - 2) Ceilings: Flat, unless indicated otherwise.

END OF SECTION

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SECTION 22 05 10  
PLUMBING GENERAL PROVISIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. References.
- B. Description of Work.
- C. Drawings and Specifications.
- D. Industry Standards and Codes.
- E. Site Examination.
- F. Permits, Fees and Utility Connections.
- G. Coordination of Work.
- H. Progress of Work.
- I. Submittals
- J. Operation and Maintenance Manuals.
- K. Project Record Documents.
- L. Warranty.
- M. Quality and Care
- N. Access Doors.
- O. Starting Equipment and Systems.

1.02 RELATED SECTIONS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.

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1.03 REFERENCES

- A. ANSI - American National Standards Institute.
- B. ASTM - American Society for Testing Materials.
- C. CEC - California Electric Code.
- D. NEMA - National Electric Manufacturers' Association.
- E. NFPA - National Fire Protection Association.
- F. OSHA - Occupational Safety and Health Act.
- G. UL - Underwriters' Laboratories.
- H. See detailed References that are listed in individual sections.

1.04 DESCRIPTION OF WORK

- A. The work included in this division of the specifications consists of furnishing labor, tools, equipment, supplies and materials, unless otherwise specified, and in performing operations necessary for the installation of the complete Plumbing System as required by these specifications or shown on the Drawings, subject to the terms and conditions of the Contract Agreement.
- B. The work shall also include the completion of details of plumbing work not mentioned or shown which are necessary for the successful operation of mechanical systems described on the drawings or required by these specifications. Furnish and install any incidental work not shown or specified which is required to provide a complete and operational system.

1.05 DRAWINGS AND SPECIFICATIONS

- A. Drawings are schematic and diagrammatic. Drawings indicate the general arrangement of equipment, piping, and other plumbing work. Use judgement and care to install mechanical work to fit the job conditions within the building construction and finishes, and to function properly.
- B. The Contractor shall investigate the building conditions affecting the Work and shall arrange his work accordingly providing offsets, fittings, valves and accessories to fit the actual job conditions. The Contractor shall be responsible to field measure and confirm new and existing mechanical systems locations with respect to other architectural, structural, and electrical work, existing and new. Do not scale distances off of the mechanical drawings. Use actual building dimensions.

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- C. The drawings and specifications are complimentary each to the other. What is required by one shall be as binding as if called for by both.
- D. Examine all drawings and specifications prior to bidding the Work. Report any discrepancies to the Engineer.

1.06 INDUSTRY STANDARDS AND CODES

- A. The Mechanical Contractor shall comply with the latest provisions of all codes, regulations, laws and ordinances applicable to the work involved. This does not relieve the Contractor from furnishing and installing work shown or specified which may exceed the requirements of such codes, regulations laws and ordinances.
- B. All materials, products, devices, fixtures forms or types of construction included in this project shall meet or exceed the published requirements of the publications listed below. These publications form a part of this specification.
  - 1. California Building Code, 2022.
  - 2. California Mechanical Code, 2022.
  - 3. California Plumbing Code, 2022.
  - 4. California Electrical Code, 2022.
  - 5. National Fire Protection Association.
  - 6. California Fire Code, 2022.
  - 7. California State Fire Marshal.
  - 8. Occupational Safety and Health Administration, including CAL-OSHA.
  - 9. California Energy Code, 2022.
  - 10. California Green Building Standards Code, 2022.
  - 11. State of California Code of Regulations, Title 24.
  - 12. Other applicable state laws.
- C. Nothing in the Drawings or Specifications shall be construed to permit work that does not conform these codes. When Contract Documents differ from governing codes, furnish and install to the higher standard required at no extra charge. The Contract Documents are not intended to repeat the code requirements except where necessary for clarity.

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- D. No material or product installed as a part of the Work shall contain asbestos in any form.
- E. Domestic water piping and components shall be provided and installed in accordance with California AB 1953 Legislation (effective January 1, 2010), which limits the allowable lead content in certain domestic water system components.

#### 1.07 SITE EXAMINATION

- A. Contractor shall examine the site, verify dimensions and locations with Drawings, check utility connection locations, and familiarize himself with the existing conditions and limitations. No extras will be allowed because of the Contractor's misunderstanding of the amount of work involved or his lack of knowledge of any site condition which may affect his work. Any apparent variance of the drawings or specifications from the existing conditions at the site shall be called to the attention of the Engineer immediately.

#### 1.08 PERMITS, FEES AND UTILITY SERVICES

- A. Contractor shall pay for and obtain all permits and service required in the installation of this work.
- B. Contractor shall arrange for all required inspections and will secure approvals from authorities having jurisdiction.

#### 1.09 COORDINATION OF WORK

- A. It is recognized that the contract documents are diagrammatic in showing certain physical relationships which must be established within the mechanical work, and in its interface with other work and that such establishment is the exclusive responsibility of the contractor.
- B. The Contractor shall give careful consideration to the work of the General, Electrical and other contractors on the job and shall organize his work so that it will not interfere with the work of other trades. He shall consult the drawings and specifications for work of other trades for correcting information, and the pertinent drawings for details and dimensions.
- C. Arrange plumbing work in a neat, well-organized manner with the piping and similar services running parallel and/or perpendicular to primary lines of the building construction. Locate operating and control equipment properly to provide easy access, and arrange entire mechanical work with adequate access for operation and maintenance.



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- D. Verify the location of all equipment, plumbing devices, etc. and if interference develops, the Owner/Engineer's decision will be final and no additional compensation will be allowed for the moving of misplaced air devices or equipment.

#### 1.10 PROGRESS OF WORK

- A. This Contractor shall organize his work so that the progress of the mechanical work will conform to the progress of the other trades, and shall complete the entire installation as soon as the conditions of the building will permit. Any cost resulting from defective or ill timed work performed under this section shall be borne by this Contractor.

#### 1.11 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS

- A. Plumbing systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.
- B. Plumbing systems and equipment shall include, but are not limited to, all piping, water heaters, expansion tanks, air compressors, vacuum pumps, electrical and control panels, conduits and other components.
- C. For all non-standard installations not detailed in one of the approved systems, the Contractor shall provide details of supports, anchorages and restraints, including attachments to building structure, with supporting calculations all stamped and signed by a licensed professional structural engineer registered in the state in which the Work is performed.

#### 1.12 SUBMITTALS

- A. See Section 013300 - Submittals, for additional submittal procedures.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project.
- D. Organize submittals in sequence according to Specification Section. Submit in bound document with tabs identifying each Specification Section. Provide a Table of Contents identifying the Specifications Sections being submitted and the contents within each tabbed section. Prepare Submittals in multiple volumes if required. Provide a complete Submittal package at one time. Do not submit individual Sections piecemeal.

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- E. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- F. Furnish, upon request, installation instructions for all equipment and materials to Inspector of Record prior to installation.
- G. Maintain a copy of the fire penetration installation instructions on site for use by the Inspector of Record.

### 1.13 SUBSTITUTION PROCEDURES

- A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
- B. LP Consulting Engineers, Inc. will consider requests for substitutions only within 7 days after date of Agreement.
- C. Substitutions may be considered when a product becomes unavailable through no fault of the .
- D. Failure by the Contractor to order materials or equipment in a timely manner will not constitute justification for a substitution.
- E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- F. A request for substitution constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
  - 2. Will provide the same warranty for the substitution as for the specified product.
  - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
  - 5. Will reimburse Owner and LP Consulting Engineers, Inc. for review or redesign services associated with reapproval by authorities including obtaining reapproval by authorities.

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- G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- H. If excessive review, as judged by the Engineer, is required caused by complicated, numerous or repetitive requests, Contractor shall reimburse Engineer and its Consultants for such review at their standard billing rates.
- I. Substitution Submittal Procedure:
  - 1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
  - 2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
  - 3. The LP Consulting Engineers, Inc. will notify in writing of decision to accept or reject request.
  - 4. Present each substitution individually. If a proposed substitute is not found to be acceptable, then the specified item shall be supplied.

#### 1.14 OPERATION AND MAINTENANCE MANUALS

- A. See Div. 01 for Closeout Submittals for Operation and Maintenance Manual requirements.
- B. Provide operating and maintenance instructions, diagrams and parts lists for all components of all mechanical systems and each piece of equipment furnished under these specifications.
- C. Operating and maintenance instructions shall be furnished for the following equipment and systems:
  - 1. Plumbing Systems.
  - 2. Medical Gas Equipment, Piping and Alarm Systems.
  - 3. Piping Systems.
  - 4. Temperature Controls Systems.
  - 5. Testing, Adjusting, and Balancing Reports.
- D. Provide manufacturer's model number, design data, capacities, etc. for each piece of plumbing equipment furnished as a part of the Work.

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- E. The operating instructions shall include procedures for starting, stopping and emergency manual operation for all equipment and systems.
- F. Provide maintenance instructions of each item of individual equipment including applicable maintenance data as recommended by the manufacturer, including frequency of lubrication, lubricants, inspections required, adjustment procedures, belt and pulley sizes, etc.
- G. Provide manufacturer's parts bulletins with part numbers for each item of equipment included in the Work. Parts bulletins shall be specific to the equipment provided. Extraneous information that does not apply to the equipment provided shall be eliminated from the literature.
- H. Include copies of test reports (startup, check, etc.) and inspections performed for each piece of equipment provided in the Work.
- I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- J. Provide supplier and manufacturer contacts, telephone numbers and addresses in the front portion of the operation and maintenance manual.

#### 1.15 PROJECT RECORD DOCUMENTS

- A. See Div. 01 - Closeout Procedures.
- B. Provide red-lined drawings accurately showing location of equipment and devices and size and routing of piping. Include notes explaining installed condition for complete understanding.

#### 1.16 QUALITY ASSURANCE

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from LP Consulting Engineers, Inc. before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.

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- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

#### 1.17 PROJECT CONDITIONS

- A. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

#### 1.18 WARRANTY

- A. See Div. 01 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.

### PART 2 PRODUCTS

#### 2.01 QUALITY AND CARE

- A. All materials shall be new and in perfect condition when installed unless specifically indicated otherwise. Materials shall be tested within the Continental United States by an independent, nationally recognized testing agency and shall be listed in accordance with testing agency requirements. When not otherwise specified, all material shall conform to applicable National Standards (ANSI).
- B. All capacities, sizes and efficiency ratings shown on the drawing are minimum. Gas meter and gas pressure reducing valve capacities are maximum allowable.
- C. Each category of material or equipment shall be of the same brand or manufacturer throughout the Work wherever possible.
- D. The quality of materials and equipment to be provided is defined by the brand names, manufacturers, model and catalog numbers listed on the Drawings and in the Specifications. Contractor shall provide each item listed, of the quality specified, or equal.
- E. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.

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- F. Inspect and report concealed damage to carrier within their required time period.
- G. Store materials in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect from dirt, water, construction debris, and traffic.
- H. Equipment which has been damaged, exposed to weather or is, in the opinion of the Engineer or Owner, otherwise unsuitable because of improper fabrication, storage or installation shall be removed and replaced by this Contractor at his expense.

## 2.02 ACCESS DOORS

- A. Coordinate access door requirements with Div. 08. The more stringent requirements shall govern.
- B. Provide access doors where access through floors, walls or ceilings is required to access plumbing equipment and plumbing devices or other systems requiring access for maintenance, test or observation.
  - 1. Access doors requiring hand access or access for observation only shall be 14"x14" minimum usable opening.
  - 2. Access doors where entrance of a service person may be required shall be 24"x30" minimum usable opening.
- C. Established standard: Milcor of types listed below. Other acceptable manufacturers: CESCO, J.L. Industries, Karp, Larsen's, or equal. Comply with the following:
  - 1. Form doors and frames of welded, ground smooth steel construction, 14 gauge for doors, 16 gauge for frames. Provide prime coat finish except for stainless steel type.
  - 2. Concealed hinges to allow 175 degree opening.
  - 3. Locks: flush, screw driver operated cam lock(s).
  - 4. Provide anchoring devices suitable for the construction into which the doors are framed.
- D. Application (as applicable):
  - 1. In gypsum drywall walls and ceilings: Type DW.
  - 2. In ceramic tile walls: Type MS (stainless steel).

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3. In fire rated walls: Type Fire Rated (rating as required for wall or ceiling), self closing, 250 F in 30 min. temperature rating.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

##### A. Access Doors

1. Coordinate the exact location of access doors to provide proper access to the item concealed. Obtain written approval for access door locations from Architect.
2. Coordinate installation of access doors with the trades performing the construction assemblies into which the access doors are placed.
3. Install all access doors neatly and securely, to open and close completely, and to operate freely and without binding. Install rated doors in accordance with their listing requirements.
4. Test operate all doors and make all adjustments required for satisfactory operation. Replace all damaged materials.
5. Install in accordance with manufacturer's instructions.

#### 3.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with the requirements within this section.
- B. Test all piping with no leak or loss in pressure in accordance with the requirements within this section.

#### 3.03 GENERAL TESTING REQUIREMENTS FOR MECHANICAL AND PLUMBING SYSTEMS

- A. Contractor shall assign a responsible person to be an independent representative to witness testing and to sign as witness of times, pressure and losses of testing media for all hydronic, duct and gas piping testing.
  1. Test all piping as noted below with no leak or loss of pressure. Repair or replace defective piping until tests are accomplished successfully.
  2. Submit to the Engineer for review a log of all tests made which shall include time, temperature, pressure, water makeup and other applicable readings, necessary to indicate the systems have been operated and tested in the manner outlined in the construction documents.

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3. After producing the specified test pressure, disconnect the pressurizing source; do not introduce further pressure for the duration of the test period, repair leaky piping and retest. Repeat the procedure until the entire system is proven tight.
- B. Test the following systems with the medium listed to the pressure indicated for the time period listed:
1. Sanitary Sewer, Drain, Vent Piping: Pressure=10 Ft.Hd. / Medium= Water / Duration=4 Hours.
  2. Domestic Water Piping: Pressure=125 Psig / Medium= Water / Duration=4 Hours.
  3. Condensate drains: Pressure=10 Ft.Hd. / Medium=Water / Duration=4 Hours.
  4. Gas Piping: Pressure=60 Psig / Medium=Air and soap / Duration=8 Hours.

### 3.04 CUTTING AND PATCHING

- A. Submit written request in advance of cutting or alteration which affects:
1. Structural integrity of any element of Project.
  2. Integrity of weather exposed or moisture resistant element.
  3. Efficiency, maintenance, or safety of any operational element.
  4. Visual qualities of sight exposed elements.
  5. Work of Owner or separate Contractor.
- B. Execute cutting and patching to complete the work, to uncover work to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit Products together to integrate with other work.
- C. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.



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- E. Restore work with new Products in accordance with requirements of Contract Documents.
- F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Code requirements , to full thickness of the penetrated element.
- H. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

### 3.05 PRIMING AND PAINTING

- A. Apply primer to all exposed ferrous metals that are not factory primed, factory finished, galvanized, stainless steel or anodized. Exposed black steel piping shall be primed and finish painted, including gas piping outdoors.
  - 1. Primer shall be as recommended by the paint manufacturer for each specific application.
  - 2. Acceptable Products include: Fuller O'Brien Blox-Rust Metal All Purpose Primer, equivalent Rust-Oleum product, or equal. See Section 09900 for other acceptable products.
- B. Apply two coats of primer to metal surfaces of items to be insulated or jacketed, except piping, or factory primed or finished.
- C. Preparation:
  - 1. Do not start work until surfaces to be finished are in proper condition to produce finished surfaces of uniform, satisfactory appearance.
  - 2. Stains and Marks: Remove completely, if possible, using materials and methods recommended by coating manufacturer; seal stains and marks which cannot be completely removed using Devco KILSTAIN primers, shellac, or other coating acceptable to paint manufacturer any marks or defects that might bleed through paint finishes.
  - 3. Remove mildew from impervious surfaces by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow substrate to thoroughly dry.
  - 4. Galvanized Surfaces:

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- a. Remove surface contamination and oils by solvent cleaning in accordance with SSPC-SP 1 and allow to dry.
  - b. Apply Devoe MIRROLAC Galvanized Metal Primer in accordance with manufacturer instructions.
5. Uncoated Steel And Iron Surfaces:
- a. Remove grease, rust, scale, and dust from steel and iron surfaces using solvent in accordance with SSPC-SP 1.
  - b. Where heavy coatings of scale or contaminants are evident, hand tool clean in accordance with SSPC-SP 2 or use other approved SSPC SP method as needed.
6. Shop Primed Steel Surfaces: Remove loose primer and dust. Sand and feather edges to smooth surface. Clean areas with solvent and spot prime bare metal surfaces with appropriate Devoe MIRROLAC metal primer or primer recommended by manufacturer.

D. Application:

- 1. Apply each coat to uniform coating thickness in accordance with manufacturer's instructions, not exceeding manufacturer's specified maximum spread rate for indicated surface; thins, brush marks, roller marks, orange-peel, or other application imperfections are not permitted.
- 2. Allow manufacturer's specified drying time, and ensure correct coating adhesion, for each coat before applying next coat.
- 3. Remove dust and other foreign materials from substrate immediately prior to applying each coat.

E. Finish Painting: See Div. 09.

3.06 STARTING EQUIPMENT AND SYSTEMS/COMMISSIONING

- A. Start equipment and systems in accordance with manufacturer's written instructions..
- B. Adjust for proper operation within manufacturer's published tolerances.
- C. Demonstrate proper operation of equipment to Owner's designated representative.
- D. Description:

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1. Comply with all start up of mechanical and electrical equipment systems as required in the various sections and herein.
2. Coordinate all testing and startup procedures with all other trades so that all non-plumbing and non-electrical work is completed and operational so that the specified testing can be performed.

E. Preliminary Work:

1. Prior to the startup, the Contractor shall ensure that the systems are ready to operate, and the following items have been completed and checked including but not limited to:
  - a. Proper motor and fan/pump rotation.
  - b. Flushing and cleaning of the system.
  - c. Wiring
  - d. Auxiliary connections
  - e. Lubrication.
  - f. Venting.
  - g. Controls.
  - h. Installation of filters and strainers.
  - i. Setting of relief and safety valves .
2. All electrical testing must be completed and test results submitted before equipment startup to avoid power interruptions during mechanical equipment startup and testing.
3. The Contractor shall submit at least 30 days in advance a schedule listing the date of completion of his work as it will be ready for equipment startup of Electrical/Plumbing equipment. This schedule shall include work on a system by system, floor by floor basis.
4. Two weeks prior to the startup of any major equipment, the Contractor shall certify in writing that the systems will be complete and ready for startup. Completeness shall not only include physical installation of individual pieces of equipment, but all related elements of other crafts to make all equipment operate as a system.

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- a. The startup checklist will cover all related crafts, e.g., controls, electrical, plumbing, and a clean environment for equipment startup.
  - 5. The Contractor shall schedule a tour with the Owner's representative and the Engineer to review startup conditions prior to equipment startup. This tour shall take place during the associated Engineer's regularly scheduled visit. This tour does not relieve the Contractor of any responsibilities to properly start equipment. The Engineer will issue a notice of deficiencies that will be required to be corrected prior to equipment startup. The Contractor will be required to reschedule a back check with the Engineer prior to attempting an equipment startup.
  - 6. Equipment of systems should not be started until systems and associated subsystems are completed. Verify that other continuing work could not possibly damage completed systems if they are in operation. Furnish signed off prestartup check sheet.
- F. Startup and Commissioning:
- 1. System Startup and Operation:
    - a. The Contractor shall provide all labor, materials and services necessary for the initial startup and operation of all systems and equipment furnished and installed under this section.
    - b. The Contractor and the factory representative shall check all equipment during initial startup to insure correct rotation, proper lubrication, adequate fluids or air flows, nonoverloading electrical characteristics, proper alignment and vibration isolation. Systems shall be checked for water flows throughout without blockages. Plumbing systems shall be checked for proper connections and positions, nonexcessive electrical characteristics and minimal vibration. Other miscellaneous equipment shall be started and operated as described above as applicable. Manufacturer's representative shall submit a preliminary written copy of equipment startup check sheet prior to leaving job site.
    - c. After initial startup and operation of systems, the Contractor shall submit a report, showing proper operation before commencement of the final "Operation Test".
    - d. During initial operation of the system and until substantial completion, qualified personnel shall be provided and designated for maintaining the equipment and systems in good running order. Items such as strainers, cleanouts, packing replacement, and other consumables

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shall be provided without cost to the Owner. Failure of equipment during this period due to lack of proper supervision is the responsibility of the Contractor and continued failures shall be grounds for the Owner to provide such services with back charges to the Contractor. Submit written schedule of completed maintenance to the Engineer.

G. System Acceptance:

1. General: The system installation shall be complete and tested for proper operation prior to acceptance testing "Operation Test" for the Owners authorized representative. A letter shall be submitted to the Engineer requesting system acceptance. This letter shall certify that all controls are installed and the software programs have been completely exercised for proper equipment operation. Acceptance testing shall commence at a mutually agreeable time within ten (10) calendar days of request. When the field test procedures have been demonstrated to the Owner's representative and pass, the system will be accepted. The warranty period may begin at this time.

H. Operation Test:

1. Provide all labor, equipment, and materials required to perform test.
2. The test shall occur after all major equipment startup and balance services have been performed as specified. The purpose is to demonstrate that individual pieces of equipment and all related elements operate as one complete system and not to identify incomplete or defective work.
3. All equipment is to be run in an automatic operating position and exercised for 72 hours to verify that they perform in accordance with the specified sequence of operation and designed operation logic.
4. The Engineer's representative shall be notified and may be present for the initiation of the test.
5. A log shall be prepared by the Contractor, to be submitted to the Engineer, of all tests including, but not limited to: time, temperatures, pressures, and other readings to prove all equipment is operating as specified.
6. All temperatures, pressures, status indication, etc., shall be verified by at least one other means of measurement or visual verification of condition.
7. Change set points and simulate conditions as directed to demonstrate:
  - a. Ability to control to new set point.

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- b. Interface between systems, fire alarm/fire sprinkler systems.
  - c. Proper sequence and operation.
  - d. Equipment safety systems and all automatic changeover/backup systems and alarms are functioning or will function.
8. If unsatisfactory performance or a system failure is experienced for any reason, the test shall be repeated until 72 hour consecutive hours are achieved. The Engineer's representative shall make all final decisions of a satisfactory test.

END OF SECTION 22 05 10

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SECTION 22 05 23  
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Applications.
- B. Angle valves.
- C. Ball valves.
- D. Butterfly valves.
- E. Check valves.
- F. Gate valves.
- G. Globe valves.
- H. Lubricated plug valves.

1.02 RELATED REQUIREMENTS

- A. Div. 08 - Access Doors and Panels.
- B. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
- C. Section 22 07 19 - Plumbing Piping Insulation.
- D. Section 22 10 05 - Plumbing Piping.

1.03 ABBREVIATIONS AND ACRONYMS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Non-rising stem.
- E. OS&Y: Outside screw and yoke.
- F. PTFE: Polytetrafluoroethylene.
- G. RS: Rising stem.
- H. SWP: Steam working pressure.

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- I. TFE: Tetrafluoroethylene.
- J. WOG: Water, oil, and gas.

#### 1.04 REFERENCE STANDARDS

- A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch 2013 (Reaffirmed 2018).
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2020.
- C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard 2020.
- D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves 2022.
- E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
- F. ASME B16.34 - Valves — Flanged, Threaded, and Welding End 2020.
- G. ASME B31.9 - Building Services Piping 2020.
- H. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2023.
- I. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2022.
- J. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings 2004 (Reapproved 2019).
- K. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings 2015 (Reapproved 2021).
- L. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.
- M. AWWA C606 - Grooved and Shouldered Joints 2022.
- N. MSS SP-45 - Drain and Bypass Connections 2020.
- O. MSS SP-67 - Butterfly Valves 2022.
- P. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends 2011.
- Q. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends 2018.



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- R. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service 2010a.
- S. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends 2011.
- T. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves 2019.
- U. MSS SP-85 - Gray Iron Globe and Angle Valves, Flanged and Threaded Ends 2011.
- V. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .
- W. MSS SP-125 - Check Valves: Gray Iron and Ductile Iron, In-Line, Spring-Loaded, Center-Guided 2018.
- X. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- Y. NSF 372 - Drinking Water System Components - Lead Content 2022.

#### 1.05 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.
- D. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.

#### 1.06 QUALITY ASSURANCE

- A. Manufacturer:
  - 1. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

### PART 2 PRODUCTS

#### 2.01 APPLICATIONS

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- A. Provide the following valves for the applications if not indicated on drawings:
1. Shutoff: Ball, butterfly, gate or plug.
  2. Throttling: Provide globe, angle, ball, or butterfly.
  3. Swing Check (Pump Outlet):
    - a. 2 inch and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
    - b. 2-1/2 inch and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.
    - c. 2-1/2 inch and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.
- C. Required Valve End Connections for Non-Wafer Types:
1. Steel Pipe:
    - a. 2 inch and Smaller: Threaded ends.
    - b. 2-1/2 inch to 4 inch: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
    - c. Grooved-End Steel Piping: Grooved.
  2. Copper Tube:
    - a. 2 inch and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
    - b. 2-1/2 inch to 4 inch: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
- D. Domestic, Hot and Cold Water Valves:
1. All sizes:
    - a. Bronze and Brass: Provide with solder-joint or threaded ends.
    - b. Bronze Angle: Class 125, bronze disc.

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- c. Ball: Two piece, full port, brass with brass trim.
- d. Bronze Swing Check: Class 125, bronze disc.
- e. Bronze Gate: Class 125, NRS.

E. Gas Valves:

- 1. All sizes:
  - a. Bronze: Provide with threaded ends.
  - b. Ball: One piece, full port, bronze with bronze trim.
  - c. Lubricated Plug: Class 125, regular gland.

## 2.02 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:
  - 1. Gear Actuator: Quarter-turn valves 8 inch and larger.
  - 2. Handwheel: Valves other than quarter-turn types.
  - 3. Hand Lever: Quarter-turn valves 6 inch and smaller except plug valves.
  - 4. Wrench: Plug valves with square heads.
- D. Insulated Piping Valves: With 2 inch stem extensions and the following features:
  - 1. Gate Valves: Rising stem.
  - 2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
  - 3. Butterfly Valves: Extended neck.
  - 4. Memory Stops: Fully adjustable after insulation is installed.
- E. Valve-End Connections:
  - 1. Threaded End Valves: ASME B1.20.1.

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2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
3. Pipe Flanges and Flanged Fittings 1/2 inch through 24 inch: ASME B16.5.
4. Solder Joint Connections: ASME B16.18.
5. Grooved End Connections: AWWA C606.

F. General ASME Compliance:

1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
2. Solder-joint Connections: ASME B16.18.
3. Building Services Piping Valves: ASME B31.9.

G. Potable Water Use:

1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.03 BRONZE, ANGLE VALVES

A. Class 125; CWP Rating: 200 psi:

1. Comply with MSS SP-80, Type 1.
2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
3. End Connections: Pipe thread.
4. Stem: Bronze.
5. Disc: Bronze.
6. Packing: Asbestos free.
7. Handwheel: Bronze or aluminum.

2.04 BRASS, BALL VALVES

A. Two Piece, Full Port with Brass Trim and Threaded or Soldered Connections:

1. Comply with MSS SP-110.

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2. Seats: PTFE.
3. Ball: Chrome-plated brass.

## 2.05 BRONZE, BALL VALVES

### A. General:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

### B. Two Piece, Full Port with Bronze Trim:

1. Comply with MSS SP-110.
2. WSP Rating: 150 psi.
3. WOG Rating: 600 psi.
4. Body: Forged bronze or dezincified-brass alloy.
5. Ends Connections: Pipe thread or solder.
6. Seats: PTFE.
7. Stem: Bronze, blowout proof.
8. Ball: Chrome plated brass.

## 2.06 BRONZE, LIFT CHECK VALVES

### A. General:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

### B. Class 125:

1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat and Type 2, Nonmetallic Disc to Metal Seat.
2. CWP Rating: 200 psi.
3. Design: Vertical flow.
4. Body: Comply with ASTM B61 or ASTM B62, bronze.
5. End Connections: Threaded.

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2.07 BRASS, INLINE CHECK VALVES

- A. Class 150:
- B. Maximum Service Temperature: 250 degrees F.
- C. Body: Forged brass.
- D. Disc: Forged brass.
- E. Seal: PTFE, bubble-tight.
- F. End Connections: Press.

2.08 BRASS, HORIZONTAL SWING CHECK VALVES

- A. Class 125, Threaded End Connections:
  - 1. WOG Rating: 200 psi.
  - 2. Body: Forged brass.
  - 3. Disc: Forged brass.
  - 4. Hinge-Pin, Screw, and Cap: Forged brass.

2.09 BRONZE, SWING CHECK VALVES

- A. General:
  - 1. Fabricate from dezincification resistant material.
  - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Class 125:
  - 1. Pressure and Temperature Rating: MSS SP-80, Type 3.
  - 2. Design: Y-pattern, horizontal or vertical flow.
  - 3. WOG Rating: 200 psi.
  - 4. Body: Bronze, ASTM B62.
  - 5. End Connections: Threaded.
  - 6. Disc: Bronze.

2.10 BRONZE, GATE VALVES

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A. General:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. NRS (Non-rising Stem) or OS & Y (Rising Stem):

1. Comply with MSS SP-80, Type I.
2. Class 125: CWP Rating 200 psig.
3. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
4. Ends: Threaded or solder joint joint.
5. Stem: Bronze.
6. Disc: Solid wedge; bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron, bronze, or aluminum.

## 2.11 LUBRICATED PLUG VALVES

A. Regular Gland with Flanged Ends:

1. Comply with MSS SP-78, Type II.
2. Class 125: CWP Rating: 200 psi.
3. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
4. Pattern: Regular or short.
5. Plug: Cast iron or bronze with sealant groove.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.

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- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
- D. Should valve is determined to be defective, replace with new valve.

### 3.02 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- C. Install check valves where necessary to maintain direction of flow as follows:
  - 1. Lift Check: Install with stem plumb and vertical.
  - 2. Swing Check: Install horizontal maintaining hinge pin level.

END OF SECTION 22 05 23



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SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Strut systems for pipe or equipment support.
- B. Beam clamps.
- C. Pipe hangers.
- D. Pipe rollers and roller supports.
- E. Pipe supports, guides, shields, and saddles.
- F. Seismic bracing hardware.
- G. Nonpenetrating rooftop supports for low-slope roofs.
- H. Anchors and fasteners.

1.02 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping 2023.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2022).
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures 1999 (Reapproved 2022).

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- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2023.
- J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.
- K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- N. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

### 1.03 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
- C. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

## PART 2 PRODUCTS

### 2.01 GENERAL REQUIREMENTS

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- A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.
- B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.
- C. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
- D. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
- E. Fire Resistance: Provide hardware rated for 120 minutes resistance unless specifically indicated by the authority having jurisdiction.
- F. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.
  - 1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
  - 2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.
- G. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.

## 2.02 STRUT SYSTEMS FOR PIPE OR EQUIPMENT SUPPORT

- A. Strut Channels:
  - 1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
  - 2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.
- B. Hanger Rods:
  - 1. Threaded zinc-plated steel unless otherwise indicated.
  - 2. Minimum Size, Unless Otherwise Indicated or Required:

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- a. Equipment Supports: 1/2 inch diameter.
- b. Piping up to 4 inch: 3/8 inch diameter.
- c. Piping larger than 4 inch: 1/2 inch diameter.
- d. Trapeze Support for Multiple Pipes: 3/8 inch in length.

C. Channel Nuts:

- 1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring as indicated on drawings.

2.03 BEAM CLAMPS

- A. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
- B. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
- C. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

2.04 PIPE HANGERS

A. J-Hangers, Adjustable:

- 1. MSS SP-58 type 5, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
- 2. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.

B. Swivel Ring Hangers, Adjustable:

- 1. MSS SP-58 type 10, epoxy-painted, zinc-colored.
- 2. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
- 3. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.

C. Clevis Hangers, Adjustable:

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1. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.
2. Felt-Lined: MSS SP-58 type 1, zinc-plated, silicone-free carbon steel.
3. Light-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.
4. Standard-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.

## 2.05 PIPE CLAMPS

### A. Riser Clamps:

1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.

### B. Extension Split Pipe Clamp:

1. MSS SP-58 type 12, hinged split ring and yoke roller hanger with epoxy copper or plain finish.
2. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
3. Provide hanger rod and nuts of the same type and material for a given pipe run.
4. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

### C. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.

### D. Strut Clamps:

1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.
2. Cushioned Pipe or Tubing Strut Clamp: Provide strut clamp with thermoplastic elastomer cushion having dielectric strength of 670 V/mil.

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E. Insulation Coupling:

1. Two bolt-type clamps designed for installation under insulation.
2. Material: Carbon steel with epoxy copper or zinc finish.

2.06 PIPE ROLLERS AND ROLLER SUPPORTS

- A. MSS SP-58 type 43 based on required load, nonconductive and corrosion resistant.
- B. Material: Zinc plated ASTM A36/A36M carbon steel or ASTM A47/A47M malleable iron.

2.07 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES

- A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.
- B. Stanchions:
  1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
  2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
  3. For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.
- C. U-Bolts:
  1. MSS SP-58 type 24, carbon steel u-bolt for pipe support or anchoring.
- D. Pipe Alignment Guides, Galvanized steel:
  1. Pipe Sizes 8 inch and Smaller: Spider or sleeve type.
  2. Pipe Sizes 10 inch and Larger: Roller type.
- E. Pipe Shields for Insulated Piping:
  1. MSS SP-58 type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
  2. General Construction and Requirements:

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- a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
- b. Shields Material: UV-resistant polypropylene with glass fill.
- c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
- d. Service Temperature: Minus 40 to 178 degrees F.
- e. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

F. Pipe Supports:

- 1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
- 2. Liquid Temperatures Up to 122 degrees F:
  - a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.
  - b. Support From Below: MSS SP-58 types 35 through 38.
- 3. Operating Temperatures from 122 to 446 degrees F:
  - a. Overhead Support: MSS SP-58 type 1 or 3 through 12 clamps with appropriate saddle of MSS SP-58 type 40 for insulated pipe.
  - b. Roller Chair: MSS SP-58 types 41 or 43 through 46 roller chair support with appropriate saddle of MSS SP-58 type 39 for insulated pipe.
  - c. Sliding Support: MSS SP-58 types 35 through 38.

G. Pipe Supports, Thermal Insulated:

- 1. General Requirements:
  - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
  - b. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.

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- c. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
  - d. Provide pipe supports for 1/2 to 30 inch iron pipes.
  - e. Insulation inserts to consist of rigid phenolic foam insulation surrounded by 360 degree, PVC jacketing.
2. PVC Jacket:
- a. Pipe insulation protection shields to be provided with ball bearing hinge and locking seam.
  - b. Minimum Service Temperature: Minus 40 degrees F.
  - c. Maximum Service Temperature: 180 degrees F.
  - d. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
  - e. Minimum Thickness: 60 mil, 0.06 inch.

## 2.08 SEISMIC BRACING HARDWARE

### A. Cable Sway Bracing Systems:

- 1. Cable wire hanger with fix and release spring mechanism enclosed using zinc housing with 302 stainless steel components for pipe or equipment suspension to surface-mounted end-fixing fittings.
- 2. Provide cable wire and end-fixing as required to hold minimum weight of 100 lb.

## 2.09 NONPENETRATING ROOFTOP SUPPORTS FOR LOW-SLOPE ROOFS

- A. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
- B. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
- C. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.



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- D. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

## 2.10 ANCHORS AND FASTENERS

- A. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
- B. Concrete: Use preset concrete inserts or expansion anchors.
- C. Solid or Grout-Filled Masonry: Use expansion anchors.
- D. Hollow Masonry: Use toggle bolts.
- E. Hollow Stud Walls: Use toggle bolts.
- F. Steel: Use beam clamps, machine bolts, or welded threaded studs.
- G. Sheet Metal: Use sheet metal screws.
- H. Wood: Use wood screws.
- I. Plastic and lead anchors are not permitted.
- J. Powder-actuated fasteners are not permitted.
- K. Hammer-driven anchors and fasteners are not permitted.
- L. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
- M. Preset Concrete Inserts: Continuous metal strut channel and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
  - 1. Channel Material: Use galvanized steel.
  - 2. Manufacturer: Same as manufacturer of metal strut channel framing system.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.

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- C. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- D. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- H. Equipment Support and Attachment:
  - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
  - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- I. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
- J. Secure fasteners according to manufacturer's recommended torque settings.

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K. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 22 05 29

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SECTION 22 05 53  
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

1.03 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2023.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Heat Transfer Equipment: Nameplates.
- B. Major Control Components: Nameplates.
- C. Piping: Pipe markers.

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- D. Pumps: Nameplates.
- E. Small-sized Equipment: Tags.
- F. Tanks: Nameplates.
- G. Valves: Tags and ceiling tacks where located above lay-in ceiling.
- H. Water Treatment Devices: Nameplates.

## 2.02 MANUFACTURERS

- A. Brady Corp.
- B. Seton Identification Products.

## 2.03 NAMEPLATES

- A. Description: Laminated piece with up to three lines of text.
  - 1. Letter Color: White.
  - 2. Letter Height: 1/4 inch.
  - 3. Background Color: Black.
  - 4. Plastic: Comply with ASTM D709.

## 2.04 TAGS

- A. Flexible: Vinyl with engraved black letters on light contrasting background color with up to three lines of text. Minimum tag size 1-1/2 inch in diameter.
- B. Metal: Brass, 19 gauge 1-1/2 inch in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.

## 2.05 PIPE MARKERS

- A. Comply with ASME A13.1.
- B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Secure to pipe using two (2) bands of adhesive tape with flow arrows supplied by the manufacturer. Install securing bands completely around pipe and overlapped.
- C. Underground Flexible Marker: Bright-colored continuously printed ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

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PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive identification products.

3.02 INSTALLATION

- A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags in clear view and align with axis of piping
- C. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.
- D. Identify domestic hot water heating equipment, including pumps, etc. with plastic nameplates.
- E. Identify valves in main and branch piping with tags.
- F. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- G. Identify all medium pressure gas piping (over 11" W.C. to 5 PSI pressure) with pressure contained within piping system (for example: "MPG 5 PSI")

END OF SECTION 22 05 53

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SECTION 22 07 19  
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible elastomeric cellular insulation.
- B. Piping insulation.
- C. Glass fiber insulation.
- D. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

- A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019, with Editorial Revision (2023).
- D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- E. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation 2017 (Reapproved 2023).
- F. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2023.
- G. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022a.
- H. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing 2022.

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- I. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2023).
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- K. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

#### 1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

#### 1.07 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

### PART 2 PRODUCTS

#### 2.01 REGULATORY REQUIREMENTS



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- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

## 2.02 GLASS FIBER INSULATION

- A. Manufacturers:
1. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
  2. Johns Manville Corporation: [www.jm.com/#sle](http://www.jm.com/#sle).
  3. Knauf Insulation: [www.knaufusa.com](http://www.knaufusa.com).
  4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
1. 'K' value: ASTM C 177, 0.22 to 0.28 at 100 degrees F.
  2. Maximum Service Temperature: 850 degrees F.
  3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm.
- D. Vapor Barrier Lap Adhesive: Compatible with insulation.

## 2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
1. Armacell LLC; AP Armaflex: [www.armacell.us/#sle](http://www.armacell.us/#sle).
  2. K-Flex USA LLC; Insul-Tube: [www.kflexusa.com/#sle](http://www.kflexusa.com/#sle).
  3. Owens Corning Flex Tubing
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 3; use molded tubular material wherever possible and sheet for equipment and other surfaces.
1. 'K' value: ASTM C 177; 0.27 at 75 degrees F.
  2. Minimum Service Temperature: Minus 40 degrees F.

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3. Maximum Service Temperature: 220 degrees F.
  4. Maximum Moisture Absorption - Pipe Insulation: 3.5 percent, by weight, when tested in accordance with ASTM D 1056.
  5. Water Vapor Permeability: 0.20 perm-inches, when tested in accordance with ASTM E 96.
  6. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive:
- D. Insulation Exposed to the Weather: Finish with two coats Armstrong white Armaflex finish. Provide aluminum jacketing.

## 2.04 JACKETING AND ACCESSORIES

- A. PVC Plastic Jacket:
1. Manufacturers:
    - a. Proto Corporation, Proto-Wrap 30 LoSmoke.
    - b. Johns Manville Corporation: [www.jm.com](http://www.jm.com).
  2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
    - a. Minimum Service Temperature: 0 degrees F.
    - b. Maximum Service Temperature: 150 degrees F.
    - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
    - d. Thickness: 10 mil, 0.010 inch.
    - e. Connections: Brush on welding adhesive.
  3. Covering Adhesive Mastic: Compatible with insulation.
- B. Aluminum Jacket:
1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
  2. Thickness: 0.016 inch sheet.

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3. Finish: Embossed.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

#### 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Glass fiber insulated pipes conveying fluids below ambient temperature:
  1. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with molded PVC fitting covers.
- D. Glass fiber insulated pipes conveying fluids above ambient temperature:
  1. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with molded PVC fitting covers.
- E. Inserts and Shields:
  1. Application: Piping 1-1/2 inches diameter or larger.
  2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
  3. Insert Location: Between support shield and piping and under the finish jacket.
  4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
  5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

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- F. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, use a UL rated fire penetration assembly, 3M or equal.
- G. Pipe in Supply Air Plenum or Finished Spaces: Finish with PVC jacket and fitting covers.
- H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.
- I. Exterior Applications (exposed to the weather): Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

### 3.03 SCHEDULES

#### A. Plumbing Systems:

- 1. Domestic Hot and Tempered Water Supply:
  - a. Glass Fiber Insulation:
    - 1) Pipe Size Range: 1-1/2 inch and larger.
      - (a) Thickness: 2 inch.
    - 2) Pipe Size Range: 1 inch and smaller.
      - (a) Thickness: 1-1/2 inch.
- 2. Domestic Cold Water Located in Unheated Areas:
  - a. Glass Fiber Insulation:
    - 1) Pipe Size Range: 1-1/2 inch and larger.
      - (a) Thickness: 1 inch.
    - 2) Pipe Size Range: 1 inch and smaller.
      - (a) Thickness: 3/4 inch.

END OF SECTION 22 07 19

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SECTION 22 10 05  
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary waste piping, buried within 5 feet of building.
- B. Sanitary waste piping, above grade.
- C. Drains.
- D. Domestic water piping, buried within 5 feet of building.
- E. Domestic water piping, above grade.
- F. Storm drainage piping, buried within 5 feet of building.
- G. Storm drainage piping, above grade.
- H. Natural gas piping, buried within 5 feet of building.
- I. Natural gas piping, above grade.
- J. Pipe flanges, unions, and couplings.
- K. Pipe hangers and supports.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.
- C. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
- D. Section 22 07 19 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

- A. ANSI LC 1/CSA 6.26 - Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing 2019.
- B. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems 2015 (Reaffirmed 2020).
- C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.

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- D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
- E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.
- F. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings: DWV 2021.
- G. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings—DWV 2022.
- H. ASME B31.1 - Power Piping 2022.
- I. ASME B31.9 - Building Services Piping 2020.
- J. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers 2023.
- K. ASSE 1003 - Water Pressure Reducing Valves for Potable Water Distribution Systems 2023.
- L. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- M. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings 2021.
- N. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2023a.
- O. ASTM B32 - Standard Specification for Solder Metal 2020.
- P. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes 2020.
- Q. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2022.
- R. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV) 2020.
- S. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.
- T. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.
- U. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings 2020.

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- V. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing 2020.
- W. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- X. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.
- Y. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2018.
- Z. AWWA C550 - Protective Interior Coatings for Valves and Hydrants 2017.
- AA. AWWA C651 - Disinfecting Water Mains 2014, with Addendum (2020).
- BB. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2021.
- CC. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2020.
- DD. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- EE. MSS SP-67 - Butterfly Valves 2022.
- FF. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- GG. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- HH. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- II. NSF 372 - Drinking Water System Components - Lead Content 2022.

1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.

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- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Project Record Documents: Record actual locations of valves.

#### 1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with State of California, standards.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

#### 1.06 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with State of California plumbing code.
- B. Domestic water piping and components shall be provided and installed in accordance with California AB 1953 Legislation (effective January 1, 2010), which limits the allowable lead content in certain domestic water system components.
- C. Conform to applicable code for installation of backflow prevention devices.
- D. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

### PART 2 PRODUCTS

#### 2.01 GENERAL REQUIREMENTS



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- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

## 2.02 SANITARY SEWER PIPING, BURIED

- A. Cast Iron Pipe: CISPI 301, hubless.
  - 1. Fittings: Cast iron.
  - 2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies. Heavy duty, Husky SD4000, .015 inch thick 304 stainless steel shield, 4-band coupling.
- B. PVC Pipe: Schedule 40 Solid Core. ASTM D1785, ASTM D2665.
  - 1. Fittings: PVC.
  - 2. Joints: Solvent welded, with ASTM D2564 solvent cement and ASTM F656 primer.

## 2.03 DRAIN PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
  - 1. Fittings: Cast iron.
  - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.
- B. PVC Pipe: Schedule 40 Solid Core. ASTM D1785, ASTM D2665.
  - 1. Fittings: PVC.
  - 2. Joints: Solvent welded, with ASTM D2564 solvent cement and ASTM F656 primer.
- C. Copper Tube: ASTM B 306, DWV or ASTM B 88 (ASTM B 88M), Type M (C), Drawn (H).
  - 1. Application: Condensate drains inside building (non-acidic).
  - 2. Fittings: ASME B16.29, wrought copper, or ASME B16.23, solvent.
  - 3. Joints: ASTM B32, alloy Sn50 solder.
- D. Steel Pipe: ASTM A53/A53M Schedule 40, galvanized.

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1. Application: Condensate drains outside building (non-acidic).
  2. Threaded Joints: ASME B16.3 malleable iron fittings.
- E. PVC Pipe: ASTM D2665.
1. Application: Condensate drains (acidic).
  2. Fittings: PVC.
  3. Joints: Solvent welded, with ASTM D2564 solvent cement.

#### 2.04 WATER PIPING, BURIED

- A. Copper Pipe: ASTM B 42, hard drawn, Type K.
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
  2. Joints: ASTM B32, alloy Sn95 solder.
  3. Joints: For sizes 2" and larger, AWS A5.8M/A5.8, BCuP copper and silver braze.

#### 2.05 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
1. Fittings: ASME B16.18, cast copper alloy.
  2. Joints: For sizes 1-1/2" and smaller, ASTM B 32, alloy Sn95 solder.
  3. Joints: For sizes 2" and larger, AWS A5.8, BCuP5 silver braze.
- B. Provide full solder cup for all fittings.
- C. Schedule 40 Screwed Brass: Capped or plugged outlets.

#### 2.06 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Storm drainage piping below grade to match sanitary drain piping below grade.

#### 2.07 STORM DRAINAGE PIPING, ABOVE GRADE

- A. Storm drainage piping above grade to match sanitary drain piping above grade.

#### 2.08 NATURAL GAS PIPING, BURIED BEYOND 5 FEET OF BUILDING

- A. Polyethylene Pipe: ASTM D2513, SDR 11.

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1. Fittings: ASTM D2683 or ASTM D2513 socket type.
2. Joints: Fusion welded.

2.09 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASTM A234/A234M, wrought steel welding type.
  2. Joints: ASME B31.1, welded.
  3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.10 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Pipe size 2" and smaller: Malleable iron threaded fittings.
  2. Pipe size 2-1/2" and larger: Steel butt welded fittings.
  3. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
  4. Joints: Threaded or welded to ASME B31.1.
- B. Flexible Gas Piping:
1. Corrugated Stainless Steel Tubing: Comply with ANSI LC 1/CSA 6.26.
  2. Comply with ASTM E84.
  3. Fittings: Provided by piping system manufacturer.

2.11 PIPE FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 2 Inches and Under:
1. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Sizes Over 2 inch:
1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
  2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

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- C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

## 2.12 PIPE HANGERS AND SUPPORTS

- A. See Section 22 05 29 for additional requirements.

## 2.13 GAS PRESSURE REGULATING VALVES

- A. Provide single stage, steel jacketed, corrosion resistant gas pressure regulating valves with atmospheric vent and elevation compensator sized for inlet and outlet pressures , specific gravity and volume indicated on the drawings.
- B. Compliance requirements:
  - 1. Appliance Regulator: ANSI Z21.18/CSA 6.3.
  - 2. Line Pressure Regulator: ANSI Z21.80/CSA 6.22.
- C. For sizes 2" and smaller: threaded ends.
- D. For sizes 2-1/2" and larger: flanged ends.
- E. Provide high and low pressure cutout and internal relief for each regulator.

## 2.14 SEISMIC GAS SHUTOFF VALVES

- A. Manufacturers: Safetquake, Quakemaster or equal.
- B. Valve is fabricated of aluminum, incorporates a stainless steel ball and bubble level, is vertically mounted, has a single step manual reset lever, operates at ambient temperature range of -40 deg F to +150 Deg F, minimum pressure .5 psi and maximum allowable pressure of 60 psi.
- C. Valves actuates within 5 seconds when subjected to a horizontal sinusoidal oscillation having a peak acceleration of anyone of the following: (1) 0.70g and period of 0.13 second, (2) 0.40g and period of 0.20 second, (3) 0.30g and period of 0.40 second, (4) 0.25g and period of 1.00 second.
- D. Meets or exceeds California standard, ANSI (Z21 1995), California Office of State Architect (Label Numbers CA-OSA 19.49 and CA-OSA 27.02, IAPMO, UPC (file 3D94), AGA P-70-2A, U.L. Building and Safety RR 4996.

## 2.15 WATER PRESSURE REDUCING VALVES

- A. 2 inch and Smaller:

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1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.
  2. Pressure Reducing Pilot-Operator:
    - a. Operating Range: 5 to 50 psi.
    - b. Connected into brass or bronze pilot piping and fittings.
    - c. Fixed flow restrictor, pressure gauges, and isolation valves.
- B. 2 inch and Larger:
1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.
  2. Pressure Reducing Pilot-Operator:
    - a. Operating Range: 5 to 50 psi.
    - b. Connected into brass or bronze pilot piping and fittings.
    - c. Fixed flow restrictor, strainer, pressure gauges, and isolation valves.

## 2.16 PRESSURE RELIEF VALVES

- A. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.
- B. Temperature and Pressure:
1. ANSI Z21.22, AGA certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME BPVC-IV certified and labelled.

## 2.17 STRAINERS

- A. Size 2 inch and Smaller:
1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
  2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

## PART 3 EXECUTION

### 3.01 EXAMINATION

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- A. Verify that excavations are to required grade, dry, and not over-excavated.

### 3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

### 3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed.
- I. Provide anodeless transition riser at gas piping transition from below grade to above grade.
- J. All natural gas piping exposed to outdoors shall be primed and painted, color by architect.
- K. All ABS and PVC pipe material exposed to outdoors shall be primed and painted, color by architect.
- L. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.
- M. Install valves with stems upright or horizontal, not inverted. See Section 22 05 23.

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- N. Install water piping to ASME B31.9.
- O. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- P. Sleeve pipes passing through partitions, walls, and floors.
- Q. Pipe Hangers and Supports:
  - 1. Install in accordance with ASME B31.9.
  - 2. Support horizontal piping as indicated.
  - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 4. Place hangers within 12 inches of each horizontal elbow.
  - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 6. Provide copper plated hangers and supports for copper piping.
  - 7. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
  - 8. Support cast iron drainage piping at every joint.

### 3.04 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

### 3.05 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.
- B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

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3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed, and clean.
- B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SCHEDULES

- A. Pipe Hanger Spacing:
  - 1. Metal Piping:
    - a. Pipe Size: 1/2 inch to 1-1/4 inch:
      - 1) Maximum Hanger Spacing: 6.5 ft.
      - 2) Hanger Rod Diameter: 3/8 inches.
    - b. Pipe Size: 1-1/2 inch to 2 inch:
      - 1) Maximum Hanger Spacing: 10 ft.
      - 2) Hanger Rod Diameter: 3/8 inch.
    - c. Pipe Size: 2-1/2 inch to 3 inch:
      - 1) Maximum Hanger Spacing: 10 ft.
      - 2) Hanger Rod Diameter: 1/2 inch.
    - d. Pipe Size: 4 inch to 6 inch:



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- 1) Maximum Hanger Spacing: 10 ft.
- 2) Hanger Rod Diameter: 5/8 inch.

END OF SECTION 22 10 05

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SECTION 22 10 06  
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Floor drains.
- B. Cleanouts.
- C. Water hammer arrestors.
- D. Trap primers.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 22 10 05 - Plumbing Piping.

1.03 REFERENCE STANDARDS

- A. ASME A112.6.3 - Floor Drains 2022.
- B. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance 2011 (Reaffirmed 2016).
- C. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- D. NSF 372 - Drinking Water System Components - Lead Content 2022.
- E. PDI-WH 201 - Water Hammer Arresters 2017.

1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- D. Project Record Documents: Record actual locations of equipment, cleanouts, water hammer arrestors.

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- E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

#### 1.06 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with State of California plumbing code.
- B. Domestic water piping and components shall be provided and installed in accordance with California AB 1953 Legislation (effective January 1, 2010), which limits the allowable lead content in certain domestic water system components.
- C. Conform to applicable code for installation of backflow prevention devices.
- D. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

### PART 2 PRODUCTS

#### 2.01 GENERAL REQUIREMENTS

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

#### 2.02 REFER TO PLUMBING SCHEDULE FOR PLUMBING PIPING SPECIALTIES NOT LISTED HEREIN.

#### 2.03 DRAINS

- A. Manufacturers:
  - 1. Josam Company: [www.josam.com/#sle](http://www.josam.com/#sle).
  - 2. MIFAB, Inc: [www.mifab.com/#sle](http://www.mifab.com/#sle).
  - 3. Jay R. Smith Manufacturing Company.
  - 4. Zurn Industries, LLC: [www.zurn.com/#sle](http://www.zurn.com/#sle).

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B. Downspout Nozzles:

1. Bronze round with straight bottom section. Zurn Z-199.

C. Floor Drain (FD):

1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.
2. Provide accessories suitable for wood raised floor installation.

D. Floor Sink (FS):

1. Lacquered cast iron body with white acid resisting porcelain interior and top complete with aluminum anti-splash bottom dome strainer, square slotted medium duty half grate, anchor and seepage flange.

## 2.04 CLEANOUTS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: [www.jayrsmith.com/#sle](http://www.jayrsmith.com/#sle).
2. Josam Company: [www.josam.com/#sle](http://www.josam.com/#sle).
3. Zurn Industries, LLC: [www.zurn.com/#sle](http://www.zurn.com/#sle).

B. Cleanouts at Exterior Surfaced Areas:

1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas:

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Floor Areas :

1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and nickel bronze round gasketed scored cover in service areas and round or square nickel bronze gasketed depressed cover to accept floor finish in finished floor areas. Zurn ZN-1400.

E. Cleanouts at Interior Finished Wall Areas:

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1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw. Zurn Z-1441 or Z-1443.
- F. Cleanouts in concealed aboveground cast iron soil or waste lines: Zurn Z-1440A with raised head ABS plastic plug.

## 2.05 TRAP PRIMERS

- A. Provide trap primers, 1/2 inch size, where indicated on drawings. Provide with built-in air gap and install 1/2" shutoff valve. PVC housings are not acceptable. Install trap primer line with 1/4" per foot slope to insure full drainage to floor drain or floor sink. Install tap primer behind wall with access door.
- B. Provide a distribution unit with feeder piping for a maximum of four (4) traps where multiple traps are serviced by a single trap primer.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface as indicated on plans. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install cleanouts in all horizontal soil and waste piping at 100 feet maximum spacing inside building, 100 feet maximum spacing outside building, at every 135 degree change of direction and where shown on Drawings.
- E. Install two way cleanout in building drain (waste line leaving the building) just outside of the building.
- F. Install cleanouts in waste drops from each urinal and sink.
- G. Install cleanouts in rain water (storm drain) drops 18 inches above finished floor. For concealed rainwater drops extend cleanout to building exterior for access.
- H. Install floor cleanouts at elevation to accommodate finished floor.
- I. Pipe relief from backflow preventer to nearest drain.

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- J. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatoriessinks and washing machine outletswater closets and as shown on plans.

END OF SECTION 22 10 06

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SECTION 23 01 30.51

HVAC AIR-DISTRIBUTION SYSTEM CLEANING

PART 2 PRODUCTS

1.01 TOOLS AND EQUIPMENT

- A. Vacuum Devices and Other Tools: Exceptionally clean, in good working order, and sealed when brought into the facility.
- B. Vacuum Devices That Exhaust Air Inside Building, Including Hand-Held and Wet Vacuums: Equipped with HEPA filtration with 99.97 percent collection efficiency for minimum 0.3-micron size particles and DOP test number.
- C. Vacuum Devices That Exhaust Air Outside Building, Including Truck- and Trailer-Mounted Types: Equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system; exhausted in manner that prevents contaminant re-entry to building; compliant with applicable regulations as to outdoor environmental contamination.

END OF SECTION 23 01 30.51

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SECTION 23 05 10  
MECHANICAL GENERAL PROVISIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. References.
- B. Description of Work.
- C. Drawings and Specifications.
- D. Industry Standards and Codes.
- E. Site Examination.
- F. Permits, Fees and Utility Connections.
- G. Coordination of Work.
- H. Progress of Work.
- I. Submittals
- J. Operation and Maintenance Manuals.
- K. Project Record Documents.
- L. Warranty.
- M. Quality and Care
- N. Access Doors.
- O. Starting Equipment and Systems.

1.02 RELATED SECTIONS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.



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**1.03 REFERENCES**

- A. ANSI - American National Standards Institute.
- B. ASTM - American Society for Testing Materials.
- C. CEC - California Electric Code.
- D. NEMA - National Electric Manufacturers' Association.
- E. NFPA - National Fire Protection Association.
- F. OSHA - Occupational Safety and Health Act.
- G. UL - Underwriters' Laboratories.
- H. See detailed References that are listed in individual sections.

**1.04 DESCRIPTION OF WORK**

- A. The work included in this division of the specifications consists of furnishing labor, tools, equipment, supplies and materials, unless otherwise specified, and in performing operations necessary for the installation of the complete Mechanical System as required by these specifications or shown on the Drawings, subject to the terms and conditions of the Contract Agreement.
- B. The work shall also include the completion of details of mechanical work not mentioned or shown which are necessary for the successful operation of mechanical systems described on the drawings or required by these specifications. Furnish and install any incidental work not shown or specified which is required to provide a complete and operational system.

**1.05 DRAWINGS AND SPECIFICATIONS**

- A. Drawings are schematic and diagrammatic. Drawings indicate the general arrangement of equipment, piping, ductwork and other mechanical work. Use judgement and care to install mechanical work to fit the job conditions within the building construction and finishes, and to function properly.
- B. The Contractor shall investigate the building conditions affecting the Work and shall arrange his work accordingly providing offsets, fittings, valves and accessories to fit the actual job conditions. The Contractor shall be responsible to field measure and confirm new and existing mechanical systems locations with respect to other architectural, structural, and electrical work, existing and new. Do not scale distances off of the mechanical drawings. Use actual building dimensions.

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- C. The drawings and specifications are complimentary each to the other. What is required by one shall be as binding as if called for by both.
- D. Examine all drawings and specifications prior to bidding the Work. Report any discrepancies to the Engineer.

1.06 INDUSTRY STANDARDS AND CODES

- A. The Mechanical Contractor shall comply with the latest provisions of all codes, regulations, laws and ordinances applicable to the work involved. This does not relieve the Contractor from furnishing and installing work shown or specified which may exceed the requirements of such codes, regulations laws and ordinances.
- B. All materials, products, devices, fixtures forms or types of construction included in this project shall meet or exceed the published requirements of the publications listed below. These publications form a part of this specification.
  - 1. California Building Code, 2022.
  - 2. California Mechanical Code, 2022.
  - 3. California Plumbing Code, 2022.
  - 4. California Electrical Code, 2022.
  - 5. National Fire Protection Association.
  - 6. California Fire Code, 2022.
  - 7. California State Fire Marshal.
  - 8. Occupational Safety and Health Administration, including CAL-OSHA.
  - 9. California Energy Code, 2022.
  - 10. California Green Building Standards Code, 2022.
  - 11. State of California Code of Regulations, Title 24.
  - 12. Other applicable state laws.
- C. Nothing in the Drawings or Specifications shall be construed to permit work that does not conform these codes. When Contract Documents differ from governing codes, furnish and install to the higher standard required at no extra charge. The Contract Documents are not intended to repeat the code requirements except where necessary for clarity.

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- D. No material or product installed as a part of the Work shall contain asbestos in any form.

#### 1.07 SITE EXAMINATION

- A. Contractor shall examine the site, verify dimensions and locations with Drawings, check utility connection locations, and familiarize himself with the existing conditions and limitations. No extras will be allowed because of the Contractor's misunderstanding of the amount of work involved or his lack of knowledge of any site condition which may affect his work. Any apparent variance of the drawings or specifications from the existing conditions at the site shall be called to the attention of the Engineer immediately.

#### 1.08 PERMITS, FEES AND UTILITY SERVICES

- A. Contractor shall pay for and obtain all permits and service required in the installation of this work.
- B. Contractor shall arrange for all required inspections and will secure approvals from authorities having jurisdiction.

#### 1.09 COORDINATION OF WORK

- A. It is recognized that the contract documents are diagrammatic in showing certain physical relationships which must be established within the mechanical work, and in its interface with other work and that such establishment is the exclusive responsibility of the contractor.
- B. The Contractor shall give careful consideration to the work of the General, Electrical and other contractors on the job and shall organize his work so that it will not interfere with the work of other trades. He shall consult the drawings and specifications for work of other trades for correcting information, and the pertinent drawings for details and dimensions.
- C. Arrange mechanical work in a neat, well-organized manner with the piping, conduit, and similar services running parallel and/or perpendicular to primary lines of the building construction. Locate operating and control equipment properly to provide easy access, and arrange entire mechanical work with adequate access for operation and maintenance.
- D. Verify the location of all equipment, and devices, etc. and if interference develops, the Owner/Engineer's decision will be final and no additional compensation will be allowed for the moving of misplaced air devices or equipment.

#### 1.10 PROGRESS OF WORK

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- A. This Contractor shall organize his work so that the progress of the mechanical work will conform to the progress of the other trades, and shall complete the entire installation as soon as the conditions of the building will permit. Any cost resulting from defective or ill timed work performed under this section shall be borne by this Contractor.

#### 1.11 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS

- A. Mechanical systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.
- B. Mechanical systems and equipment shall include, but are not limited to, all piping, heating and ventilating equipment, electrical and control panels, conduits and other components.
- C. For all non-standard installations not detailed in one of the approved systems, the Contractor shall provide details of supports, anchorages and restraints, including attachments to building structure, with supporting calculations all stamped and signed by a licensed professional structural engineer registered in the state in which the Work is performed.

#### 1.12 SUBMITTALS

- A. See Section 013300 - Submittal Procedures, for additional submittal procedures.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project.
- D. Organize submittals in sequence according to Specification Section. Submit in bound document with tabs identifying each Specification Section. Provide a Table of Contents identifying the Specifications Sections being submitted and the contents within each tabbed section. Prepare Submittals in multiple volumes if required. Provide a complete Submittal package at one time. Do not submit individual Sections piecemeal.
- E. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- F. Furnish, upon request, installation instructions for all equipment and materials to Inspector of Record prior to installation.

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- G. Maintain a copy of the fire and smoke damper installation instructions on site for use by the Inspector of Record.

### 1.13 SUBSTITUTION PROCEDURES

- A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
- B. LP Consulting Engineers, Inc. will consider requests for substitutions only within 7 days after date of Agreement.
- C. Substitutions may be considered when a product becomes unavailable through no fault of the .
- D. Failure by the Contractor to order materials or equipment in a timely manner will not constitute justification for a substitution.
- E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- F. A request for substitution constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
  - 2. Will provide the same warranty for the substitution as for the specified product.
  - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
  - 5. Will reimburse Owner and LP Consulting Engineers, Inc. for review or redesign services associated with reapproval by authorities including obtaining reapproval by authorities.
- G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- H. If excessive review, as judged by the Engineer, is required caused by complicated, numerous or repetitive requests, Contractor shall reimburse Engineer and its Consultants for such review at their standard billing rates.

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I. Substitution Submittal Procedure:

1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
3. The LP Consulting Engineers, Inc. will notify in writing of decision to accept or reject request.
4. Present each substitution individually. If a proposed substitute is not found to be acceptable, then the specified item shall be supplied.

1.14 OPERATION AND MAINTENANCE MANUALS

- A. See Div. 01 for Closeout Submittals for Operation and Maintenance Manual requirements.
- B. Provide operating and maintenance instructions, diagrams and parts lists for all components of all mechanical systems and each piece of equipment furnished under these specifications.
- C. Operating and maintenance instructions shall be furnished for the following equipment and systems:
  1. Ventilating Systems.
  2. Air Conditioning Systems.
  3. Piping Systems.
  4. Temperature Controls Systems.
  5. Motors.
  6. Testing, Adjusting, and Balancing Reports.
- D. Provide manufacturer's model number, design data, capacities, etc. for each piece of mechanical equipment furnished as a part of the Work.
- E. The operating instructions shall include procedures for starting, stopping and emergency manual operation for all equipment and systems.
- F. Provide maintenance instructions of each item of individual equipment including applicable maintenance data as recommended by the manufacturer, including

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frequency of lubrication, lubricants, inspections required, adjustment procedures, belt and pulley sizes, etc.

- G. Provide manufacturer's parts bulletins with part numbers for each item of equipment included in the Work. Parts bulletins shall be specific to the equipment provided. Extraneous information that does not apply to the equipment provided shall be eliminated from the literature.
- H. Include copies of test reports (startup, check, etc.) and inspections performed for each piece of equipment provided in the Work.
- I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- J. Provide supplier and manufacturer contacts, telephone numbers and addresses in the front portion of the operation and maintenance manual.

#### 1.15 PROJECT RECORD DOCUMENTS

- A. See Section 017700 - Closeout Procedures.
- B. Provide red-lined drawings accurately showing location of equipment and devices and size and routing of ductwork. Include notes explaining installed condition for complete understanding.

#### 1.16 QUALITY ASSURANCE

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

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1.17 PROJECT CONDITIONS

- A. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.18 WARRANTY

- A. See Div. 01 - Closeout Procedures, for additional warranty requirements.
- B. Correct defective Work within a one-year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 QUALITY AND CARE

- A. All materials shall be new and in perfect condition when installed unless specifically indicated otherwise. Materials shall be tested within the Continental United States by an independent, nationally recognized testing agency and shall be listed in accordance with testing agency requirements. When not otherwise specified, all material shall conform to applicable National Standards (ANSI).
- B. All capacities, sizes and efficiency ratings shown on the drawing are minimum.
- C. Each category of material or equipment shall be of the same brand or manufacturer throughout the Work wherever possible.
- D. The quality of materials and equipment to be provided is defined by the brand names, manufacturers, model and catalog numbers listed on the Drawings and in the Specifications. Contractor shall provide each item listed, of the quality specified, or equal.
- E. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.
- F. Inspect and report concealed damage to carrier within their required time period.
- G. Store materials in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect from dirt, water, construction debris, and traffic.
- H. Equipment which has been damaged, exposed to weather or is, in the opinion of the Engineer or Owner, otherwise unsuitable because of improper



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fabrication, storage or installation shall be removed and replaced by this Contractor at his expense.

## 2.02 ACCESS DOORS

- A. Coordinate access door requirements with Div. 08. The more stringent requirements shall govern.
- B. Provide access doors where access through floors, walls or ceilings is required to access mechanical, plumbing, control system components, fire dampers and fire alarm system components (such as smoke detectors, fire/smoke dampers, etc.) or other systems requiring access for maintenance, test or observation.
  - 1. Access doors requiring hand access or access for observation only shall be 14"x14" minimum usable opening.
  - 2. Access doors where entrance of a service person may be required shall be 24"x30" minimum usable opening.
- C. Established standard: Milcor of types listed below. Other acceptable manufacturers: CESCO, J.L. Industries, Karp, Larsen's, or equal. Comply with the following:
  - 1. Form doors and frames of welded, ground smooth steel construction, 14 gauge for doors, 16 gauge for frames. Provide prime coat finish except for stainless steel type.
  - 2. Concealed hinges to allow 175 degree opening.
  - 3. Locks: flush, screw driver operated cam lock(s).
  - 4. Provide anchoring devices suitable for the construction into which the doors are framed.
- D. Application (as applicable):
  - 1. In gypsum drywall walls and ceilings: Type DW.
  - 2. In ceramic tile walls: Type MS (stainless steel).
  - 3. In fire rated walls: Type Fire Rated (rating as required for wall or ceiling), self closing, 250 F in 30 min. temperature rating.

## PART 3 EXECUTION

### 3.01 INSTALLATION

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A. Access Doors

1. Coordinate the exact location of access doors to provide proper access to the item concealed. Obtain written approval for access door locations from Architect.
2. Coordinate installation of access doors with the trades performing the construction assemblies into which the access doors are placed.
3. Install all access doors neatly and securely, to open and close completely, and to operate freely and without binding. Install rated doors in accordance with their listing requirements.
4. Test operate all doors and make all adjustments required for satisfactory operation. Replace all damaged materials.
5. Install in accordance with manufacturer's instructions.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with the requirements within this section.
- B. Test all piping with no leak or loss in pressure in accordance with the requirements within this section.

3.03 GENERAL TESTING REQUIREMENTS FOR MECHANICAL AND PLUMBING SYSTEMS

- A. Contractor shall assign a responsible person to be an independent representative to witness testing and to sign as witness of times, pressure and losses of testing media for all hydronic piping and duct testing.
  1. Test all piping as noted below with no leak or loss of pressure. Repair or replace defective piping until tests are accomplished successfully.
  2. Submit to the Engineer for review a log of all tests made which shall include time, temperature, pressure, water makeup and other applicable readings, necessary to indicate the systems have been operated and tested in the manner outlined in the construction documents.
  3. After producing the specified test pressure, disconnect the pressurizing source; do not introduce further pressure for the duration of the test period, repair leaky piping and retest. Repeat the procedure until the entire system is proven tight.

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- B. Test the following systems with the medium listed to the pressure indicated for the time period listed:
1. Hydronic Piping: Pressure=125 Psig / Medium= Water / Duration=4 Hours.

### 3.04 CUTTING AND PATCHING

- A. Submit written request in advance of cutting or alteration which affects:
1. Structural integrity of any element of Project.
  2. Integrity of weather exposed or moisture resistant element.
  3. Efficiency, maintenance, or safety of any operational element.
  4. Visual qualities of sight exposed elements.
  5. Work of Owner or separate Contractor.
- B. Execute cutting and patching to complete the work, to uncover work to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit Products together to integrate with other work.
- C. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- E. Restore work with new Products in accordance with requirements of Contract Documents.
- F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Code requirements, to full thickness of the penetrated element.
- H. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

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3.05 PRIMING AND PAINTING

- A. Apply primer to all exposed ferrous metals that are not factory primed, factory finished, galvanized, stainless steel or anodized. Exposed black steel piping shall be primed and finish painted to match Architectural finish requirements.
  - 1. Primer shall be as recommended by the paint manufacturer for each specific application.
  - 2. Acceptable Products include: Fuller O'Brien Blox-Rust Metal All Purpose Primer, equivalent Rust-Oleum product, or equal. See Section 092216 for other acceptable products.
- B. Apply two coats of primer to metal surfaces of items to be insulated or jacketed, except ductwork and piping, or factory primed or finished.
- C. Preparation:
  - 1. Do not start work until surfaces to be finished are in proper condition to produce finished surfaces of uniform, satisfactory appearance.
  - 2. Stains and Marks: Remove completely, if possible, using materials and methods recommended by coating manufacturer; seal stains and marks which cannot be completely removed using Devco KILSTAIN primers, shellac, or other coating acceptable to paint manufacturer any marks or defects that might bleed through paint finishes.
  - 3. Remove mildew from impervious surfaces by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow substrate to thoroughly dry.
  - 4. Galvanized Surfaces:
    - a. Remove surface contamination and oils by solvent cleaning in accordance with SSPC-SP 1 and allow to dry.
    - b. Apply Devco MIRROLAC Galvanized Metal Primer in accordance with manufacturer instructions.
  - 5. Uncoated Steel And Iron Surfaces:
    - a. Remove grease, rust, scale, and dust from steel and iron surfaces using solvent in accordance with SSPC-SP 1.

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- b. Where heavy coatings of scale or contaminants are evident, hand tool clean in accordance with SSPC-SP 2 or use other approved SSPC SP method as needed.

- 6. Shop Primed Steel Surfaces: Remove loose primer and dust. Sand and feather edges to smooth surface. Clean areas with solvent and spot prime bare metal surfaces with appropriate Devco MIRROLAC metal primer or primer recommended by manufacturer.

D. Application:

- 1. Apply each coat to uniform coating thickness in accordance with manufacturer's instructions, not exceeding manufacturer's specified maximum spread rate for indicated surface; thins, brush marks, roller marks, orange-peel, or other application imperfections are not permitted.
- 2. Allow manufacturer's specified drying time, and ensure correct coating adhesion, for each coat before applying next coat.
- 3. Remove dust and other foreign materials from substrate immediately prior to applying each coat.

E. Finish Painting: See Div. 09.

3.06 STARTING EQUIPMENT AND SYSTEMS/COMMISSIONING

- A. Start equipment and systems in accordance with manufacturer's written instructions..
- B. Adjust for proper operation within manufacturer's published tolerances.
- C. Demonstrate proper operation of equipment to Owner's designated representative.

D. Description:

- 1. Comply with all start up of mechanical and electrical equipment systems as required in the various sections and herein.
- 2. Coordinate all testing and startup procedures with all other trades so that all non-mechanical and non-electrical work is completed and operational so that the specified testing can be performed.

E. Preliminary Work:

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1. Prior to the startup, the Contractor shall ensure that the systems are ready to operate, and the following items have been completed and checked including but not limited to:
  - a. Proper motor and pump rotation.
  - b. Flushing and cleaning of the system.
  - c. Wiring
  - d. Auxiliary connections
  - e. Lubrication.
  - f. Venting.
  - g. Controls.
  - h. Installation of filters and strainers.
  - i. Setting of relief and safety valves.
2. All electrical testing must be completed and test results submitted before equipment startup to avoid power interruptions during mechanical equipment startup and testing.
3. The Contractor shall submit at least 10 days in advance a schedule listing the date of completion of his work as it will be ready for equipment startup of Electrical/Mechanical equipment. This schedule shall include work on a system by system, floor by floor basis.
4. Two weeks prior to the startup of any major equipment, the Contractor shall certify in writing that the systems will be complete and ready for startup. Completeness shall not only include physical installation of individual pieces of equipment, but all related elements of other crafts to make all equipment operate as a system.
  - a. The startup checklist will cover all related crafts, e.g., controls, electrical, mechanical, and a clean environment for equipment startup.
5. The Contractor shall schedule a tour with the Owner's representative and the Engineer to review startup conditions prior to equipment startup. This tour shall take place during the associated Engineer's regularly scheduled visit. This tour does not relieve the Contractor of any responsibilities to properly start equipment. The Engineer will issue a notice of deficiencies that will be required to be corrected prior to equipment startup. The

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Contractor will be required to reschedule a back check with the Engineer prior to attempting an equipment startup.

6. Equipment of systems should not be started until systems and associated subsystems are completed. Verify that other continuing work could not possibly damage completed systems if they are in operation. Furnish signed off prestart up check sheet.

F. Startup and Commissioning:

1. System Startup and Operation:

- a. The Contractor shall provide all labor, materials and services necessary for the initial startup and operation of all systems and equipment furnished and installed under this section.
- b. The Contractor and the factory representative shall check all equipment during initial startup to insure correct rotation, proper lubrication, adequate fluids or air flows, nonoverloading electrical characteristics, proper alignment and vibration isolation. Systems shall be checked for air and/or water flows throughout without blockages. Air handling systems shall be checked for proper damper connections and positions, aligned and adjusted belt drives, proper lubrication, temporary air filters installed, nonexcessive electrical characteristics and minimal vibration. Other miscellaneous equipment shall be started and operated as described above as applicable. Manufacturer's representative shall submit a preliminary written copy of equipment startup check sheet prior to leaving job site.
- c. After initial startup and operation of systems, the Contractor shall submit a report, showing proper operation before commencement of the final "Operation Test".
- d. During initial operation of the system and until substantial completion, qualified personnel shall be provided and designated for maintaining the equipment and systems in good running order. Items such as strainers, cleanouts, filter replacement, bearing lubrication, packing replacement, and other consumables shall be provided without cost to the Owner. Failure of equipment during this period due to lack of proper supervision is the responsibility of the Contractor and continued failures shall be grounds for the Owner to provide such services with back charges to the Contractor. Submit written schedule of completed maintenance to the Engineer.

G. System Acceptance:

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1. General: The system installation shall be complete and tested for proper operation prior to acceptance testing "Operation Test" for the Owners authorized representative. A letter shall be submitted to the Engineer requesting system acceptance. This letter shall certify that all controls are installed and the software programs have been completely exercised for proper equipment operation. Acceptance testing shall commence at a mutually agreeable time within ten (10) calendar days of request. When the field test procedures have been demonstrated to the Owner's representative and pass, the system will be accepted. The warranty period may begin at this time.

H. Operation Test:

1. Provide all labor, equipment, and materials required to perform test.
2. The test shall occur after all major equipment startup and balance services have been performed as specified. The purpose is to demonstrate that individual pieces of equipment and all related elements operate as one complete system and not to identify incomplete or defective work.
3. All equipment is to be run in an automatic operating position and exercised for 72 hours to verify that they perform in accordance with the specified sequence of operation and designed operation logic.
4. The Engineer's representative shall be notified and may be present for the initiation of the test.
5. A log shall be prepared by the Contractor, to be submitted to the Engineer, of all tests including, but not limited to: time, temperatures, pressures, and other readings to prove all equipment is operating as specified.
6. All temperatures, pressures, status indication, etc., shall be verified by at least one other means of measurement or visual verification of condition.
7. Change set points and simulate conditions as directed to demonstrate:
  - a. Ability to control to new set point.
  - b. Interface between systems, fire alarm/fire sprinkler systems.
  - c. Proper sequence and operation.
  - d. Equipment safety systems and all automatic changeover/backup systems and alarms are functioning or will function.



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8. If unsatisfactory performance or a system failure is experienced for any reason, the test shall be repeated until 72 hour consecutive hours are achieved. The Engineer's representative shall make all final decisions of a satisfactory test.

END OF SECTION 23 05 10

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SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Strut systems for pipe or equipment support.
- B. Beam clamps.
- C. Pipe hangers.
- D. Pipe rollers and roller supports.
- E. Pipe supports, guides, shields, and saddles.
- F. Seismic bracing hardware.
- G. Nonpenetrating rooftop supports for low-slope roofs.
- H. Anchors and fasteners.

1.02 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping 2023.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2022).
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures 1999 (Reapproved 2022).

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- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2023.
- J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.
- K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023b.
- L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- N. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

### 1.03 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
- C. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

## PART 2 PRODUCTS

### 2.01 GENERAL REQUIREMENTS

- A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of mechanical work.

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- B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.
- C. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
- D. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
- E. Fire Resistance: Provide hardware rated for 120 minutes resistance unless specifically indicated by the authority having jurisdiction.
- F. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.
  - 1. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.
- G. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.
  - 1. Indoor Dry Locations: Use approved equivalent or galvanized steel unless otherwise indicated.
  - 2. Outdoor, Damp, or Wet-Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.

## 2.02 STRUT SYSTEMS FOR PIPE OR EQUIPMENT SUPPORT

- A. Strut Channels:
  - 1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
  - 2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.
- B. Hanger Rods:
  - 1. Threaded zinc-plated steel unless otherwise indicated.
  - 2. Minimum Size, Unless Otherwise Indicated or Required:

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- a. Equipment Supports: 1/2 inch diameter.
- b. Piping up to 4 inch: 3/8 inch diameter.
- c. Piping larger than 4 inch: 1/2 inch diameter.
- d. Trapeze Support for Multiple Pipes: 3/8 inch in length.

C. Channel Nuts:

- 1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring as indicated on drawings.

2.03 BEAM CLAMPS

- A. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
- B. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
- C. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

2.04 PIPE HANGERS

A. J-Hangers, Adjustable:

- 1. MSS SP-58 type 5, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
- 2. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.

B. Swivel Ring Hangers, Adjustable:

- 1. MSS SP-58 type 10, epoxy-painted, zinc-colored.
- 2. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
- 3. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.

C. Clevis Hangers, Adjustable:

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1. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.
2. Felt-Lined: MSS SP-58 type 1, zinc-plated, silicone-free carbon steel.
3. Light-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.
4. Standard-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.

## 2.05 PIPE CLAMPS

### A. Riser Clamps:

1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.

### B. Extension Split Pipe Clamp:

1. MSS SP-58 type 12, hinged split ring and yoke roller hanger with epoxy copper or plain finish.
2. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
3. Provide hanger rod and nuts of the same type and material for a given pipe run.
4. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

### C. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.

### D. Strut Clamps:

1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.
2. Cushioned Pipe or Tubing Strut Clamp: Provide strut clamp with thermoplastic elastomer cushion having dielectric strength of 670 V/mil.

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E. Insulation Coupling:

1. Two bolt-type clamps designed for installation under insulation.
2. Material: Carbon steel with epoxy copper or zinc finish.

2.06 PIPE ROLLERS AND ROLLER SUPPORTS

- A. MSS SP-58 type 43 based on required load, nonconductive and corrosion resistant.
- B. Steel Yoke Type: MSS SP-58 type 44, vertically adjustable, nonconductive, and corrosion resistant.
- C. Material: Zinc plated ASTM A36/A36M carbon steel or ASTM A47/A47M malleable iron.

2.07 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES

- A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.
- B. Stanchions:
  1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
  2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
  3. For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.
- C. U-Bolts:
  1. MSS SP-58 type 24, carbon steel u-bolt for pipe support or anchoring.
- D. Pipe Alignment Guides, Galvanized steel:
  1. Pipe Sizes 8 inch and Smaller: Spider or sleeve type.
  2. Pipe Sizes 10 inch and Larger: Roller type.
- E. Pipe Shields for Insulated Piping:

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1. MSS SP-58 type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
2. General Construction and Requirements:
  - a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
  - b. Shields Material: UV-resistant polypropylene with glass fill.
  - c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
  - d. Service Temperature: Minus 40 to 178 degrees F.
  - e. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

F. Pipe Supports:

1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
2. Liquid Temperatures Up to 122 degrees F:
  - a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.
  - b. Support From Below: MSS SP-58 types 35 through 38.
3. Operating Temperatures from 122 to 446 degrees F:
  - a. Overhead Support: MSS SP-58 type 1 or 3 through 12 clamps with appropriate saddle of MSS SP-58 type 40 for insulated pipe.
  - b. Roller Chair: MSS SP-58 types 41 or 43 through 46 roller chair support with appropriate saddle of MSS SP-58 type 39 for insulated pipe.
  - c. Sliding Support: MSS SP-58 types 35 through 38.

G. Pipe Supports, Thermal Insulated:

1. General Requirements:
  - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.



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- b. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.
  - c. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
  - d. Provide pipe supports for 1/2 to 30 inch iron pipes.
  - e. Insulation inserts to consist of rigid phenolic foam insulation surrounded by 360 degree, PVC jacketing.
2. PVC Jacket:
- a. Pipe insulation protection shields to be provided with ball bearing hinge and locking seam.
  - b. Minimum Service Temperature: Minus 40 degrees F.
  - c. Maximum Service Temperature: 180 degrees F.
  - d. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
  - e. Minimum Thickness: 60 mil, 0.06 inch.

## 2.08 SEISMIC BRACING HARDWARE

### A. Cable Sway Bracing Systems:

- 1. Cable wire hanger with fix and release spring mechanism enclosed using zinc housing with 302 stainless steel components for pipe or equipment suspension to surface-mounted end-fixing fittings.
- 2. Provide cable wire and end-fixing as required to hold minimum weight of 100 lb.

### B. NONPENETRATING ROOFTOP SUPPORTS FOR LOW-SLOPE ROOFS

- C. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.

- D. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.

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- E. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
- F. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
- G. ANCHORS AND FASTENERS
- H. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
- I. Concrete: Use preset concrete inserts or expansion anchors.
- J. Solid or Grout-Filled Masonry: Use expansion anchors.
- K. Hollow Masonry: Use toggle bolts.
- L. Hollow Stud Walls: Use toggle bolts.
- M. Steel: Use beam clamps, machine bolts, or welded threaded studs.
- N. Sheet Metal: Use sheet metal screws.
- O. Wood: Use wood screws.
- P. Plastic and lead anchors are not permitted.
- Q. Powder-actuated fasteners are not permitted.
- R. Hammer-driven anchors and fasteners are not permitted.
- S. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
- T. Preset Concrete Inserts: Continuous metal strut channel and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
  - 1. Channel Material: Use galvanized steel.
  - 2. Manufacturer: Same as manufacturer of metal strut channel framing system.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.

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- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- D. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- H. Equipment Support and Attachment:
  - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
  - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- I. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

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- J. Secure fasteners according to manufacturer's recommended torque settings.
- K. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 23 05 29

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SECTION 23 05 53  
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Ceiling tacks.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

1.03 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2023.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.
- B. Air Terminal Units: Nameplates.
- C. Control Panels: Nameplates.

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- D. Dampers: Ceiling tacks, where located above lay-in ceiling.
- E. Heat Transfer Equipment: Nameplates.
- F. Major Control Components: Nameplates.
- G. Piping: Pipe markers.
- H. Pumps: Nameplates.
- I. Small-sized Equipment: Tags.
- J. Tanks: Nameplates.
- K. Thermostats: Nameplates.
- L. Valves: Tags and ceiling tacks where located above lay-in ceiling.

## 2.02 MANUFACTURERS

- A. Brady Corporation: [www.bradycorp.com](http://www.bradycorp.com).
- B. Seton Identification Products: [www.seton.com/aec](http://www.seton.com/aec).

## 2.03 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
  - 1. Letter Color: White.
  - 2. Letter Height: Air Handling Units, Control panels: 1 inch.
  - 3. Letter Height: All others: 1/4 inch.
  - 4. Background Color: Black.
  - 5. Plastic: Comply with ASTM D709.

## 2.04 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

## 2.05 PIPE MARKERS

- A. Color: Comply with ASME A13.1.

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- B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Secure to pipe using two (2) bands of adhesive tape with flow arrows supplied by the manufacturer. Install securing bands completely around pipe and overlapped.
- C. Underground Plastic Pipe Markers: Bright-colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

## 2.06 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color coded head.
- B. Color code as follows:
  - 1. Fire Dampers and Smoke Dampers: Red.
  - 2. Heating/Cooling Valves: Blue.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

### 3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- D. Identify fans and filter boxes with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- E. Identify chilled/hot water equipment, including chillers, boilers, pumps, expansion tanks, air separators, etc. with plastic nameplates.
- F. Identify air conditioning units, air handling units, heating and ventilating units, exhaust fans, pumps, heat transfer equipment, tanks, fire/smoke damper access doors, and water treatment devices with nameplates. Small devices, such as terminal units, in-line pumps, may be identified with tags.

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- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify thermostats/sensors relating to fan unit and/or zone unit with nameplates.
- I. Identify valves in main and branch piping with tags.
- J. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- K. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 23 05 53



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SECTION 23 05 93  
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Commissioning activities.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

1.03 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008, with Errata (2019).
- C. NEBB (TAB) - Procedural Standard for Testing Adjusting and Balancing of Environmental Systems 2019.
- D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing 2002.

1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component and include controls contractor to assist in testing, adjusting, and balancing procedures. Submit plan for each phase.
  - 1. Submit to LP Consulting Engineers, Inc..
  - 2. Submit to the Commissioning Authority.
  - 3. Submit four weeks prior to starting the testing, adjusting, and balancing work.
  - 4. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the

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LP Consulting Engineers, Inc. and other installers to sufficiently understand the design intent for each system.

5. Include at least the following in the plan:
  - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
  - b. List of all air flow measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
  - c. Completed planned test sheets listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
  - d. Single-line drawings with system test locations.
  - e. Identification and types of measurement instruments to be used and their most recent calibration date.
  - f. Detailed step-by-step procedures for TAB work for each system and issue, including:
    - 1) SA, RA, EA, OA, for each AHU.
    - 2) Economizer proportioning and vfd speed adjustments.
    - 3) Rechecking.
  - g. Confirmation of understanding of the outside air ventilation criteria under all conditions.
  - h. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
  - i. Method of checking building static and exhaust fan and/or relief damper capacity.
  - j. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
- C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

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1. Submit to LP Consulting Engineers, Inc. within 2 days after completion of testing, adjusting, and balancing.
  2. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
  3. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
  4. Units of Measure: Report data in I-P (inch-pound) units only.
  5. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE Std 111, or NEBB forms.
  6. Include the following on the title page of each report:
    - a. Name of Testing, Adjusting, and Balancing Agency.
    - b. Address of Testing, Adjusting, and Balancing Agency.
    - c. Telephone number of Testing, Adjusting, and Balancing Agency.
    - d. Project name.
    - e. Project location.
    - f. Project Engineer.
    - g. Project altitude.
    - h. Report date.
- D. Test and balance shall be performed by an independent test and balance agency.
- E. Perform total system balance in accordance with AABC MN-1, ASHRAE Std 111, or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.
- F. TAB Agency Qualifications: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience certified by AABC or NEBB.
- G. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor experienced in performance of this Work and licensed at the .

PART 2 PRODUCTS - NOT USED

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PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
  - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
  - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
  - 3. SMACNA (TAB).
- B. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- C. TAB Agency Qualifications:
  - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
  - 2. Having minimum of three years documented experience.
  - 3. Certified by one of the following:
    - a. AABC, Associated Air Balance Council: [www.aabc.com/#sle](http://www.aabc.com/#sle); upon completion submit AABC National Performance Guaranty.
    - b. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: [www.tabbcertified.org/#sle](http://www.tabbcertified.org/#sle).
- D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 TESTING, ADJUSTING, AND BALANCING AGENCIES

- A. RS Analysis Inc.; [www.rsanalysis.com](http://www.rsanalysis.com); (888-330-1935).
- B. Mesa 3; [www.mesa3.com](http://www.mesa3.com); (408-928-3000).
- C. Raglen System Balance; [www.raglensystembalance.com](http://www.raglensystembalance.com); (775-747-0100).

3.03 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

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1. Systems are started and operating in a safe and normal condition.
  2. Temperature control systems are installed complete and operable.
  3. Final filters are clean and in place. If required, install temporary media in addition to final filters.
  4. Duct systems are clean of debris.
  5. Fans are rotating correctly.
  6. Fire and volume dampers are in place and open.
  7. Air coil fins are cleaned and combed.
  8. Access doors are closed and duct end caps are in place.
  9. Air outlets are installed and connected.
  10. Hydronic systems are flushed, filled, and vented.
  11. Pumps are rotating correctly.
  12. Proper strainer baskets are clean and in place.
  13. Service and balance valves are open.
- B. Contractor to inspect ductwork and piping systems at 60% and 90% completion to verify systems are ready for testing and balancing.
- C. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- D. Beginning of work means acceptance of existing conditions.

#### 3.04 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to LP Consulting Engineers, Inc. to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

#### 3.05 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust total airflow(s) to within plus 10 percent and minus 5 percent of design.

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- B. Air Outlets and Inlets: Adjust outlets and inlets in space to within plus 10 percent and minus 5 percent of design.
- C. Hydronic Systems: Adjust to within plus 10 percent and minus 5 percent of design.

### 3.06 RECORDING AND ADJUSTING

- A. Field Logs: Maintain written logs including:
  - 1. Running log of events and issues.
  - 2. Discrepancies, deficient or uncompleted work by others.
  - 3. Contract interpretation requests.
  - 4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.

### 3.07 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- E. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

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- F. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- G. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

### 3.08 TITLE 24 TESTING

- A. Complete applicable Title 24 Acceptance Testing as delineated in contract drawings.

### 3.09 SCOPE

- A. Test, adjust, and balance the following:
  - 1. Air Handling Units.
  - 2. Fans.
  - 3. Air Filters.
  - 4. Air Inlets and Outlets.

### 3.10 MINIMUM DATA TO BE REPORTED

- A. Electric Motors:
  - 1. Manufacturer.
  - 2. Model/Frame.
  - 3. HP/BHP.
  - 4. Phase, voltage, amperage; nameplate, actual, no load.
  - 5. RPM.
  - 6. Service factor.
  - 7. Starter size, rating, heater elements.
  - 8. Sheave Make/Size/Bore.
- B. Cooling Coils:
  - 1. Location.
  - 2. Service.

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3. Manufacturer.
4. Air flow, design and actual.
5. Entering air DB temperature, design and actual.
6. Entering air WB temperature, design and actual.
7. Leaving air DB temperature, design and actual.
8. Leaving air WB temperature, design and actual.
9. Saturated suction temperature, design and actual.
10. Air pressure drop, design and actual.

C. Air Moving Equipment:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

D. Return Air/Outside Air/Exhaust Air:

1. Identification/location.



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2. Design air flow (determined by initial test)
3. Actual air flow.
4. Design return air flow (determined by initial test)
5. Actual return air flow.
6. Design outside air flow (determined by initial test)
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Actual mixed air temperature.

E. Duct Traverses:

1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

END OF SECTION 23 05 93

## COMMISSIONING FOR HVAC

### SECTION 23 08 00 COMMISSIONING FOR HVAC

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. The Work of this Section is supplemental to and does not supersede any other requirements of the Contract Documents.

##### 1.2 SUMMARY

- A. The commissioning process is described in Section 01 91 00 Commissioning.
- B. Provide all labor and materials required to complete the commissioning of those Division 23 systems and equipment identified as Commissioning Systems and Equipment in Section 01 91 00 Commissioning.
- C. Related Sections include:
  - 1. Section 01 91 00 Commissioning.
  - 2. All Sections of Division 23.

##### 1.3 SUBMITTALS

- A. Refer to Section 01 91 00 Commissioning.

#### PART 2 PRODUCTS

##### 2.1 TEST EQUIPMENT

- A. Refer to Section 01 91 00 Commissioning.

#### PART 3 EXECUTION

##### 3.1 COMMISSIONING RESPONSIBILITIES – COMMISSIONING PROVIDER

- A. Refer to Section 01 91 00 Commissioning.

##### 3.2 COMMISSIONING RESPONSIBILITIES – SUBCONTRACTOR

- B. Refer to Section 01 91 00 Commissioning.

##### 3.3 FACTORY ACCEPTANCE TESTING

## COMMISSIONING FOR HVAC

- A. Refer to Section 01 91 00 Commissioning.

### 3.4 MEETINGS

- A. Refer to Section 01 91 00 Commissioning.

### 3.5 INSTALLATION, CHECK-OUT, START-UP, AND PREFUNCTIONAL CHECKLISTS

- A. Refer to Section 01 91 00 Commissioning.

### 3.6 FUNCTIONAL TESTING

- A. Refer to Section 01 91 00 Commissioning.

### 3.7 INTEGRATED SYSTEMS TESTING

- A. Refer to Section 01 91 00 Commissioning.

### 3.8 TRAINING

- A. Refer to Section 01 91 00 Commissioning.

END OF SECTION 23 08 00

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SECTION 23 23 00  
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping.
- B. Valves.
- C. Flexible connections.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

1.03 REFERENCE STANDARDS

- A. AHRI 730 (I-P) - Flow Capacity Rating of Suction Line Filters and Suction Line Filter Driers 2013 (Reapproved 2014).
- B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems 2022, with Errata (2023).
- C. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2023.
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.
- E. ASME B31.5 - Refrigeration Piping and Heat Transfer Components 2022.
- F. ASME B31.9 - Building Services Piping 2020.
- G. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service 2020.
- H. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.
- I. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- J. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical Current Edition, Including All Revisions.

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- K. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- L. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

#### 1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide general assembly of specialties, including manufacturer's catalogue information. Provide manufacturer's catalog data including load capacity.
- C. Design Data: Submit design data indicating pipe sizing. Indicate load-carrying capacity of trapeze, multiple pipe, and riser support hangers.
- D. Test Reports: Indicate results of leak test, acid test.
- E. Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.

#### 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store piping and specialties in shipping containers with labeling in place.
- B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
- C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

### PART 2 PRODUCTS

#### 2.01 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure integrity of system is not

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jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

- B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.
- C. Valves:
  - 1. Use service valves on suction and discharge of compressors.
- D. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

## 2.02 REGULATORY REQUIREMENTS

- A. Comply with ASME B31.9 for installation of piping system.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.
- C. Welders Certification: In accordance with ASME BPVC-IX.
- D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

## 2.03 PIPING

- A. Copper Tube: ASTM B 280, H58 hard drawn, sealed ends.
  - 1. Fittings: ASME B16.22 wrought copper.
  - 2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
- B. Pipe Supports and Anchors:
  - 1. Conform to ASME B31.5.
  - 2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron adjustable swivel, split ring.
  - 3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
  - 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  - 5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

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6. Vertical Support: Steel riser clamp.
7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
8. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
9. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
10. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

## 2.04 VALVES

### A. Manufacturers:

1. Hansen Technologies Corporation: [www.hantech.com/#sle](http://www.hantech.com/#sle).
2. Henry Technologies: [www.henrytech.com/#sle](http://www.henrytech.com/#sle).
3. Flomatic Valves: [www.flomatic.com/#sle](http://www.flomatic.com/#sle).

### B. Service Valves:

1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or soldered ends, for maximum pressure of 500 psi.

## 2.05 FLEXIBLE CONNECTORS

### A. Manufacturers:

1. Circuit Hydraulics, Ltd: [www.circuit-hydraulics.co.uk/#sle](http://www.circuit-hydraulics.co.uk/#sle).
2. Flexicraft Industries: [www.flexicraft.com/#sle](http://www.flexicraft.com/#sle).
3. Penflex: [www.penflex.com/#sle](http://www.penflex.com/#sle).

- ### B. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

## PART 3 EXECUTION

### 3.01 PREPARATION

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- A. Ream pipe and tube ends. Remove burrs. Bevel plain-end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

### 3.02 INSTALLATION

- A. Install refrigeration specialties in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and avoid interference with use of space.
- D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Pipe Hangers and Supports:
  - 1. Install in accordance with ASME B31.5.
  - 2. Steel hanger rods and clevis shall be cadmium or zinc plated.
  - 3. Support horizontal piping as indicated.
  - 4. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 5. Place hangers within 12 inches of each horizontal elbow.
  - 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  - 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  - 8. Provide copper plated hangers and supports for copper piping.
- G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
- H. Provide clearance for installation of insulation and access to valves and fittings.



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- I. Provide access to concealed valves and fittings.
- J. Flood piping system with nitrogen when brazing.
- K. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.
- L. Insulate piping.
- M. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.
- N. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.
- O. Fully charge completed system with refrigerant after testing.

### 3.03 FIELD QUALITY CONTROL

- A. Test refrigeration system in accordance with ASME B31.5.

### 3.04 SCHEDULES

- A. Hanger Spacing for Copper Tubing.
  - 1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
  - 2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - 3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
  - 4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 5. 2-1/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 6. 2-5/8 inch OD: Maximum span, 9 feet; minimum rod size, 3/8 inch.

END OF SECTION 23 23 00

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SECTION 23 31 00  
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal ducts.
- B. Flexible ducts.
- C. Air plenums and casings.
- D. Ducts for kitchen exhaust applications.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 230713 - Duct Insulation.
- C. Section 23 33 00 - Air Duct Accessories.

1.03 REFERENCE STANDARDS

- A. ASHRAE Std 126 - Method of Testing HVAC Air Ducts 2020.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023b.
- F. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2023a.
- G. ASTM E2336 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems 2020.

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- H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2024.
- I. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems 2024.
- J. NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids 2020.
- K. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations 2024.
- L. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2020.
- M. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines 2001.
- N. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors Current Edition, Including All Revisions.
- O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.
- P. UL 1978 - Grease Ducts Current Edition, Including All Revisions.
- Q. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies Current Edition, Including All Revisions.

#### 1.04 RELATED SECTIONS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.

#### 1.05 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide data for duct materials.

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- C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for all ductwork systems. Provide 1/4"=1'-0" ductwork layout plans showing duct routing, offsets, fittings, duct accessories, fire/smoke dampers, hydronic piping, seismic bracing, etc. Shop drawings shall be fully coordinated with all other trades, including the building structure, finishes, fire sprinkler piping, plumbing piping, hydronic piping and electrical systems.
- D. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

#### 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.
- B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

#### 1.07 FIELD CONDITIONS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

### PART 2 PRODUCTS

#### 2.01 GENERAL REQUIREMENTS

- A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A, NFPA 90B, and SMACNA (DCS) guidelines unless stated otherwise.
- B. Ductwork to be galvanized steel unless otherwise indicated.
- C. Duct Sealing and Leakage in accordance with Static Pressure Class:
  - 1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:
    - a. Supply Air: 2 in-wc pressure class, galvanized steel.
    - b. Outside Air Intake: 1/2 in-wc pressure class, galvanized steel.

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- c. Return and Relief Air: 1 in-wc 2 in-wc pressure class, galvanized steel.
- d. General Exhaust Air: 1/2 in-wc pressure class, galvanized steel.
- 2. Low Pressure Service: Up to 2 in-wc:
  - a. Seal: Class C, apply to seal off transverse joints.
- 3. Low Pressure Service: From 2 in-wc to 3 in-wc:
  - a. Seal: Class B, apply sealing of transverse joints and longitudinal seams.
- 4. Medium and High Pressure Service: Above 3 in-wc:
  - a. Seal: Class A, apply sealing of transverse joints, longitudinal seams, and duct wall penetrations.
- D. Duct Fabrication Requirements:
  - 1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
  - 2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
  - 3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
  - 4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
  - 5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
  - 6. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.
  - 7. Exposed ductwork within occupied spaces shall be 20 gauge minimum.

## 2.02 METAL DUCTS

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A. Material Requirements:

1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.
2. Stainless Steel: ASTM A666, Type 304.
  - a. Application: Kitchen exhaust.

B. Round Spiral Duct:

1. Round spiral lock seam duct with galvanized steel outer wall.
2. Manufacturers:
  - a. EHG, a DMI Company: [www.ehgduct.com/#sle](http://www.ehgduct.com/#sle).
  - b. Elgen Manufacturing Company, Inc: [www.elgenmfg.com/#sle](http://www.elgenmfg.com/#sle).
  - c. Linx Industries, Inc, a DMI Company: [www.li-hvac.com/#sle](http://www.li-hvac.com/#sle).
  - d. MKT Metal Manufacturing: [www.mktduct.com/#sle](http://www.mktduct.com/#sle).

C. Connectors, Fittings, Sealants, and Miscellaneous:

1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
2. Transverse Duct Connection System: SMACNA "E" rated rigid class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).
  - a. Manufacturers:
    - 1) Carlisle HVAC Products: [www.carlislehvac.com/#sle](http://www.carlislehvac.com/#sle).
    - 2) Ductmate Industries, Inc, a DMI Company  
: [www.ductmate.com/#sle](http://www.ductmate.com/#sle).
    - 3) Elgen Manufacturing Company, Inc: [www.elgenmfg.com/#sle](http://www.elgenmfg.com/#sle).
3. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
  - a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.

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- b. VOC Content: Not more than 250 g/L, excluding water.
  - c. Sealants intended for use outdoors to include UV inhibitors.
  - d. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
  - e. Manufacturers:
    - 1) Carlisle HVAC Products; Hardcast Duct-Seal 321 Indoor/Outdoor Water Based Duct Sealant: [www.carlislehvac.com/#sle](http://www.carlislehvac.com/#sle).
    - 2) Design Polymerics; DP 1010 Water Based Smooth Duct Sealant, Premium Quality: [www.designpoly.com/#sle](http://www.designpoly.com/#sle).
    - 3) Ductmate Industries, Inc, a DMI Company  
: [www.ductmate.com/#sle](http://www.ductmate.com/#sle).
4. Gasket Tape:
- a. Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle ring connections.
  - b. Manufacturers:
    - 1) Design Polymerics; DP 1040 100 Percent Solids, High Pressure/High-Velocity Butyl Gasket Tape: [www.designpoly.com/#sle](http://www.designpoly.com/#sle).
    - 2) Elgen Manufacturing Company, Inc; 440 Butyl Gasket Tape: [www.elgenmfg.com/#sle](http://www.elgenmfg.com/#sle).

## 2.03 FLEXIBLE DUCTS

### A. Flexible Air Ducts:

- 1. UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound spring steel wire.
- 2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
- 3. Pressure Rating: From 4 in-wc positive to 0.5 in-wc negative.
- 4. Maximum Velocity: 4,000 fpm.
- 5. Temperature Range: Minus 20 to 210 degrees F.

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6. Manufacturers:

- a. JP Lamborn Co: [www.jplflex.com/#sle](http://www.jplflex.com/#sle).
- b. Atco Rubber Products, Inc..

## 2.04 AIR PLENUMS AND CASINGS

- A. Fabricate in accordance with SMACNA (DCS) for indicated operating pressures indicated.
- B. Minimum Fabrication Requirements:
  - 1. Fabricate acoustic plenum or casing with reinforcing turned inward.
  - 2. Provide 16-gauge, 0.059-inch sheet steel back facing and 22-gauge, 0.029-inch perforated sheet steel front facing with 3/32 inch diameter holes on 5/32 inch centers.
  - 3. Construct panels 1 inches thick, packed with 4.5 pcf minimum glass fiber insulation media, on inverted channel of 16-gauge, 0.059-inch sheet steel.
- C. Access Doors:
  - 1. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.
  - 2. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles.

## 2.05 DUCTS FOR KITCHEN EXHAUST APPLICATIONS

- A. Provide ductwork, fittings, and appurtenances per NFPA 96, SMACNA (KVS), UL 1978, and UL 2221 requirements and guidelines.
- B. Class 1 duct for air with gas and grease particle exhaust at an air velocity of 1,500 to 2,500 fpm.
- C. Where ducts are not self-draining back to equipment, provide low-point drain pocket with the copper drain pipe to a sanitary sewer.
- D. Design, fabricate, and install liquidtight preventing exhaust leakage into building.
- E. Dishwasher Exhaust Duct:
  - 1. Duct Size: 1 in-wc pressure class stainless steel.



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2. Fabricate using single wall, 16-gauge, 0.059-inch sheet steel with continuous external welded joints to form rectangular sections.

F. Kitchen Hood and Grease Exhaust Duct:

1. Fabricate in accordance with ductwork manufacturer's instructions, SMACNA (DCS), SMACNA (KVS), and NFPA 96.
2. Round, Single-Wall, Premanufactured Grease Exhaust Duct:
  - a. UL Listed and labeled to UL 1978.
  - b. Construct of 20-gauge, 0.035-inch Type 304 stainless steel.
3. Rectangular, Single-Wall, Premanufactured Grease Exhaust Duct:
  - a. UL Listed and labeled to UL 1978.
  - b. Construct of 16-gauge, 0.059-inch sheet steel using continuous external welded joints in rectangular sections.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install products following the manufacturer's instructions.
- C. Comply with safety standards NFPA 90A and NFPA 90B.
- D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.
- E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- F. Ductwork exposed to view outdoors shall be primed and painted, color by architect.
- G. Flexible Ducts: Connect to metal ducts with adhesive plus sheet metal screws.
- H. Flexible Ducts: Maximum length of single runout to air inlet or outlet to be 5 feet per CMC.

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- I. Duct sizes indicated are outside dimensions. For lined ducts, duct sizes must be increased to account for lining.
- J. Seal all standing seams and transverse joints in all sheetmetal ductwork with Hardcast DT tape, 4 inches wide, and Hardcast FTA-20 adhesive.
- K. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- L. Use double nuts and lock washers on threaded rod supports.
- M. Connect diffusers boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.
- N. Use stainless steel for ductwork exposed to view in Kitchen areas.
- O. Kitchen hood exhaust ductwork shall so be constructed and installed that grease cannot be pocketed in any portion thereof, and the system shall slope not less than 1/4 unit vertical in 12 units horizontal (2% slope) toward the hood or toward an approved grease reservoir.
- P. Kitchen hood exhaust ductwork shall be wrapped with a 2 hour fire resistive duct wrap designed for use specifically with kitchen grease ducts, installed in accordance with manufacturer's installation instructions.
- Q. Grease ductwork systems shall be leakage tested per CMC 510.5.3.1 and CMC 510.5.6. Perform light test: A light of no less than 100 watts is passed through the entire duct system, including the hood-to-duct connection. If any light shines through any portion of the ductwork in a darkened room, the hole must be found and welded so that the light is no longer visible.

END OF SECTION 23 31 00

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SECTION 23 33 00  
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air turning devices.
- B. Backdraft dampers - metal.
- C. Combination fire and smoke dampers.
- D. Duct access doors.
- E. Duct test holes.
- F. Fire dampers.
- G. Flexible duct connectors.
- H. Volume control dampers.
- I. Miscellaneous Products:
  - 1. Damper operators.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 23 31 00 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

- A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating 2018.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023b.
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2024.
- D. NFPA 92 - Standard for Smoke Control Systems 2021, with Amendment.
- E. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations 2024.

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- F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2020.
- G. UL 33 - Safety Heat Responsive Links for Fire-Protection Service Current Edition, Including All Revisions.
- H. UL 555 - Standard for Fire Dampers Current Edition, Including All Revisions.
- I. UL 555C - Standard for Safety Ceiling Dampers Current Edition, Including All Revisions.
- J. UL 555S - Standard for Smoke Dampers Current Edition, Including All Revisions.
- K. UL 1978 - Grease Ducts Current Edition, Including All Revisions.

#### 1.04 RELATED SECTIONS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.
- D. Section 013300 - Submittals.

#### 1.05 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

#### 1.06 PROJECT RECORD DOCUMENTS

- A. Record actual locations of access doors and test holes.

#### 1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

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- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

### PART 2 PRODUCTS

#### 2.01 AIR TURNING DEVICES

- A. Manufacturers:
  - 1. ProRail, Ductmate Industries, Inc.
  - 2. Duro Dyne Corp.
- B. Manufactured turning vanes with 2" single thickness curved blades set at 1-1/2" on-center mounted in 2" vane rails, self-aligning, hot dipped galvanized steel.
- C. Turning vanes, vane rails and mounting shall be constructed and installed in accordance with the SMACNA "HVAC Duct Construction Standards".

#### 2.02 BACKDRAFT DAMPERS - METAL

- A. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.
- B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

#### 2.03 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers:
  - 1. Pottorff: [www.pottorff.com/#sle](http://www.pottorff.com/#sle).
  - 2. Ruskin Company: [www.ruskin.com/#sle](http://www.ruskin.com/#sle).
- B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.
- C. Provide factory sleeve and collar for each damper.

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- D. Multiple Blade Dampers: Fabricate with 16 gauge, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.
- E. Operators: UL listed and labelled oil immersed with spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft. Provide circuitry to activate pilot light on remote key (test) switch located in corridor ceiling adjacent to damper.
- F. All actuators for combination fire and smoke dampers or smoke dampers shall be rated for continuous "On" duty and shall have a cycle time requirement of no more frequently than every six months.

#### 2.04 DUCT ACCESS DOORS

- A. Manufacturers:
  - 1. Ductmate Industries, Inc, a DMI Company: [www.ductmate.com/#sle](http://www.ductmate.com/#sle).
  - 2. Ruskin Company: [www.ruskin.com/#sle](http://www.ruskin.com/#sle).
  - 3. or equal.
- B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick-fastening locking devices. For insulated ducts, install minimum 1-inch thick insulation with sheet metal cover.
  - 1. High Temperature Duct Access Doors:
    - a. Comply with NFPA 96.
    - b. Comply with UL 1978.
- C. Access doors with sheet metal screw fasteners are not acceptable.

#### 2.05 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

#### 2.06 FIRE DAMPERS

- A. Manufacturers:

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1. Pottorff: [www.pottorff.com/#sle](http://www.pottorff.com/#sle).
  2. Ruskin Company: [www.ruskin.com/#sle](http://www.ruskin.com/#sle).
- B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
- C. Ceiling (Radiation) Dampers: Galvanized steel, 22-gauge, 0.0299-inch frame and 16-gauge, 0.0598-inch flap, two layers of 0.125-inch thick ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.
1. Rated for three hour service in compliance with UL 555C.
- D. Horizontal Dampers: Galvanized steel, 22-gauge, 0.0299-inch frame, stainless steel closure spring, and lightweight, heat-retardant, non-asbestos fabric blanket.
- E. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1-inch pressure-class ducts up to 12 inches in height.
- F. Multiple Blade Dampers: 16-gauge, 0.0598-inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
- G. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

## 2.07 FLEXIBLE DUCT CONNECTORS

- A. Manufacturers:
1. Carlisle HVAC Products: [www.carlislehvac.com/#sle](http://www.carlislehvac.com/#sle).
  2. Ductmate Industries, Inc, a DMI Company: [www.ductmate.com/#sle](http://www.ductmate.com/#sle).
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Flexible Duct Connections (Indoors): Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq yd.
    - a. Net Fabric Width: Approximately 2 inches wide.
  2. Metal: 3 inches wide, 24 gauge, 0.0239 inch thick galvanized steel.

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- D. Flexible Duct Connections (Outdoors): Fabric crimped into metal edging strip.
1. Fabric: Ventfabrics Ventlon UL listed fire-retardant duPont's Hypalon coated woven glass fiber fabric to NFPA 90A, minimum density 26 oz per sq yd, sunlight, ozone and weather resistant.
    - a. Net Fabric Width: Approximately 3 inches wide.
  2. Metal: 3 inches wide, 24 gage thick galvanized steel.

## 2.08 VOLUME CONTROL DAMPERS

- A. Manufacturers:
1. Nailor Industries, Inc: [www.nailor.com/#sle](http://www.nailor.com/#sle).
  2. Ruskin Company: [www.ruskin.com/#sle](http://www.ruskin.com/#sle).
  3. United Enertech: [www.unitedenertech.com/#sle](http://www.unitedenertech.com/#sle).
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Single Blade Dampers for Round Ductwork and Rectangular Ductwork up to 10 inches in Height: 18 gauge steel minimum.
- D. Multi-Blade Damper for Rectangular Ductwork: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware; Model CD35 Manufactured by Ruskin. Provide Ruskin Model CD50 for installation in medium pressure ductwork and/or ducts with velocities exceeding 1500 FPM.
- E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings, Ventlok Model 607. On multiple blade dampers, provide oil impregnated nylon or sintered bronze bearings.
- F. Quadrants:
1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
  2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
  3. Where rod lengths exceed 30 inches provide regulator at both ends.

## 2.09 MISCELLANEOUS PRODUCTS



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- A. Remote Balancing Damper Operator: Cable operated remote damper controller.
  - 1. Manufacturers:
    - a. Young Regulator Co.; [www.youngregulator.com](http://www.youngregulator.com)
  - 2. "Bowden" damper regulator with mounting bracket, hub and cable coupling.
  - 3. "Bowden" stainless steel operating cable and control wrench. Cable to be 50 foot length standard.
  - 4. Recessed control box with control shaft, cable coupling and cover plate.
  - 5. Provide options and accessories as needed for balancing damper.

### PART 3 EXECUTION

#### 3.01 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

#### 3.02 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 31 00 for duct construction and pressure class.
- B. Coordinate fire/smoke damper requirements with Division 26 and Division 28.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96 Provide minimum 14 by 14 inch size access door for hand and shoulder access, or as indicated on drawings.
- D. For concealed balancing dampers only where damper is inaccessible, provide Young Regulator "Bowden" cable operated damper controller.
- E. Provide duct test holes where indicated and required for testing and balancing purposes.
- F. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire-rated components, and where required by authorities having jurisdiction. Install with

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required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

- G. Install combination smoke and fire dampers in accordance with NFPA 92A.
- H. Demonstrate re-setting of fire dampers to Owner's representative.
- I. Provide balancing dampers at points on supply, return, outside air and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 23 33 00

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SECTION 23 34 23  
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof exhausters.
- B. Ceiling exhaust fans.
- C. Inline centrifugal fans and blowers.
- D. Kitchen hood upblast roof exhausters.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 23 33 00 - Air Duct Accessories: Backdraft dampers.

1.03 REFERENCE STANDARDS

- A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program 2015.
- B. AMCA 99 - Standards Handbook 2016.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans 2020.
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016, with Errata (2018).
- E. AMCA 211 - Certified Ratings Program Product Rating Manual for Fan Air Performance 2022, with Editorial Revision (2023).
- F. AMCA 260 - Laboratory Methods of Testing Induced Flow Fans for Rating 2020.
- G. AMCA 300 - Reverberant Room Method for Sound Testing of Fans 2014.
- H. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data 2022.
- I. AMCA 311 - Certified Ratings Program Product Rating Manual for Fan Sound Performance 2016.

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- J. ANSI Z9.5 - Laboratory Ventilation 2022.
- K. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- L. NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids 2020.
- M. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations 2024.
- N. UL 705 - Power Ventilators Current Edition, Including All Revisions.
- O. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances Current Edition, Including All Revisions.

#### 1.04 RELATED SECTIONS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.
- D. Section 013300 - Submittals.

#### 1.05 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Manufacturer's Instructions: Indicate installation instructions.
- D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

#### 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

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- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

#### 1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Protect units from physical damage by storing indoors or off site until roof mounting curbs or other mountings are in place, ready for immediate installation of units.

#### 1.08 WARRANTY

- A. See Div. 01 - Contract Closeout, for additional warranty requirements.
- B. Provide a full parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Greenheck Fan Corporation: [www.greenheck.com/#sle](http://www.greenheck.com/#sle).
- B. Loren Cook Company: [www.lorencook.com/#sle](http://www.lorencook.com/#sle).

#### 2.02 POWER VENTILATORS - GENERAL

- A. Static and Dynamically Balanced: Comply with AMCA 204.
- B. Performance Ratings: Comply with AMCA 210, bearing certified rating seal.
- C. Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.
- D. Fabrication: Comply with AMCA 99.
- E. UL Compliance: UL 705, listed, labeled, designed, manufactured, and tested.
- F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- G. Kitchen Hood Exhaust Fans: Comply with requirements of NFPA 96 and UL 762.

#### 2.03 ROOF EXHAUSTERS

- A. Product Requirements:

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1. Performance Ratings: Conform to AMCA 210 and bearing the AMCA Certified Rating Seal.
  2. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal.
  3. Fabrication: Conform to AMCA 99.
  4. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- B. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.
- C. Roof exhaust fans fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure. The fan shroud shall have a rolled bead for added strength.
- D. Motors shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Motors and drives shall be mounted on vibration isolators, out of the airstream. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants. Motors shall be readily accessible for maintenance.
- E. A disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment.
- F. A fan conduit chase shall be provided through the curb cap to the motor compartment for ease of installation.
- G. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.
- H. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.
- I. Roof Curb: 12 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, and insulation.
- J. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.

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- K. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm gets attained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
- L. See drawing schedule for additional optional equipment requirements.

#### 2.04 CEILING EXHAUST FANS

- A. The fan wheel shall be of the galvanized steel, forward curved, centrifugal type. Wheels shall be dynamically and statically balanced.
- B. Motors shall be of the heavy duty type with permanently sealed ball bearings. The wheel shaft shall be ground and polished steel mounted in permanently sealed pillow block bearings. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the machined cast iron type, keyed and securely attached to the wheel and motor shafts. The motor pulleys shall be adjustable for final system balancing.
- C. All fans shall bear the AMCA Certified Ratings Seal for air performance.
- D. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- E. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing , resilient mounted motor.
- F. Disconnect Switch: Cord and plug-in housing for thermal overload protected motor and wall mounted switch.
- G. Grille: Aluminum with baked white enamel finish.
- H. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is reached with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

#### 2.05 INLINE CENTRIFUGAL FANS AND BLOWERS

- A. Centrifugal Fan Unit: V-belt or direct driven, with galvanized steel housing lined with acoustic insulation, resiliently-mounted motor, gravity backdraft damper in discharge.
- B. Disconnect Switch: Cord and plug-in housing for thermal overload protected motor and wall mounted switch.

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- C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm gets reached with sheaves set at mid-position; fan shaft with self-aligning prelubricated ball bearings.
- D. Provide flexible duct connections at inlet and outlet of fan.
- E. Provide housed spring isolators for fan support.

## 2.06 KITCHEN HOOD UPBLAST ROOF EXHAUSTERS

### A. Direct Drive Fan:

- 1. Fan Wheel:
  - a. Type: Non-overloading, backward inclined centrifugal.
  - b. Material: Aluminum, statically and dynamically balanced.
- 2. Statically and dynamically balanced.
- 3. Motors:
  - a. Open drip-proof (ODP).
  - b. Heavy duty ball bearing type.
  - c. Mount on vibration isolators or resilient cradle mounts, out of air stream.
  - d. Fully accessible for maintenance.
- 4. Housing:
  - a. Construct of heavy gauge aluminum including curb cap, windband, and motor compartment.
  - b. Rigid internal support structure.
  - c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
  - d. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.
  - e. Provide breather tube for fresh air motor cooling and wiring.

### B. Shafts and Bearings:



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1. Fan Shaft:
  - a. Ground and polished steel with anti-corrosive coating.
  - b. First critical speed at least 25 percent over maximum cataloged operating speed.
2. Bearings:
  - a. Permanently sealed or pillow block type.
  - b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
  - c. 100 percent factory tested.
- C. Drive Assembly:
  1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
  2. Belts: Static free and oil resistant.
  3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
  4. Motor pulley adjustable for final system balancing.
  5. Readily accessible for maintenance.
- D. Disconnect Switches:
  1. Factory mounted and wired.
  2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
  3. Positive electrical shutoff.
  4. Wired from fan motor to junction box installed within motor compartment.
- E. Roof Curb: 12 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, ventilated double wall, and factory installed nailer strip.
- F. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

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G. Options/Accessories:

1. Clean Out Port: Removable grease repellent compression rubber plug allows access for cleaning wheel through windband.
2. Roof Curb Extension: Vented curb extension where required for compliance with minimum clearances required by NFPA 96.
3. Grease Trap:
  - a. Aluminum.
  - b. Built-in drain connection.
  - c. Container system to collect grease residue.
4. Hinge Kit:
  - a. Aluminum hinges.
  - b. Hinges and restraint cables mounted to base sleeve.
  - c. Allows fan to tilt away for access to wheel and ductwork for inspection and cleaning.
5. Heat Baffle: Prevents heat from radiating into motor compartment.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with stainless steel lag screws to roof curb. See drawings for additional mounting requirements.
- C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.
- D. Provide sheaves required for final air balance.
- E. Provide speed control on direct drive fans required for final air balance.
- F. Install backdraft dampers on inlet to roof exhausters.
- G. Provide backdraft dampers on outlet from cabinet and ceiling exhaust fans and as indicated.

END OF SECTION 23 34 23

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SECTION 23 37 00  
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Diffusers
- B. Registers/grilles
- C. Door grilles.
- D. Louvers:
- E. Gravity ventilators.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Div. 09 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCE STANDARDS

- A. ADC 1062: GRD - Test Code for Grilles, Registers & Diffusers; Air Diffusion Council; 1984.
- B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating 2023.
- C. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices 2021, with Editorial Revision (2022).
- D. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers 2022.
- E. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets 2023.
- F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023b.

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- I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2024.
- J. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems 2024.
- K. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.
- L. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2020.

#### 1.04 RELATED SECTIONS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.

#### 1.05 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
- C. Project Record Documents: Record actual locations of air outlets and inlets.

#### 1.06 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Test and rate louver performance in accordance with AMCA 500-L.
- C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

### PART 2 PRODUCTS

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**2.01 MANUFACTURERS**

- A. Krueger-HVAC: [www.krueger-hvac.com/#sle](http://www.krueger-hvac.com/#sle).
- B. Price Industries: [www.price-hvac.com/#sle](http://www.price-hvac.com/#sle).
- C. Ruskin Company: [www.ruskin.com/#sle](http://www.ruskin.com/#sle).
- D. Titus, a brand of Air Distribution Technologies: [www.titus-hvac.com/#sle](http://www.titus-hvac.com/#sle).
- E. Tuttle and Bailey: [www.tuttleandbailey.com/#sle](http://www.tuttleandbailey.com/#sle).

**2.02 DIFFUSERS**

- A. Frame: Provide surface mount, snap-in, inverted T-bar, and spline type. In plaster ceilings, provide plaster frame and ceiling frame.
- B. Fabrication: Steel or aluminum with baked enamel finish.
- C. Color by Architect.
- D. Accessories: Provide radial opposed blade, butterfly, combination splitter, and volume control damper; removable core, sectorizing baffle, safety chain, wire guard, equalizing grid, operating rod extension, and gaskets for surface mounted diffusers with damper adjustable from diffuser face.
- E. SEE DRAWINGS FOR DIFFUSER SPECIFICATIONS.

**2.03 REGISTERS/GRILLES**

- A. Frame: Provide surface mount, snap-in, inverted T-bar, and spline type. In plaster ceilings, provide plaster frame and ceiling frame.
- B. Fabrication: Steel or aluminum with baked enamel finish.
- C. Color by Architect.
- D. Accessories: Provide radial opposed blade, butterfly, combination splitter, and volume control damper; removable core, sectorizing baffle, safety chain, wire guard, equalizing grid, operating rod extension, and gaskets for surface mounted diffusers with damper adjustable from diffuser face.
- E. SEE DRAWINGS FOR REGISTER/GRILLE SPECIFICATIONS.

**2.04 DOOR GRILLES**

- A. Type: V-shaped louvers of 20 gauge, 0.0359 inch thick steel, 1 inch deep on 1/2 inch centers.

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- B. Frame: 20 gauge, 0.0359 inch steel with auxiliary frame to give finished appearance on both sides of door, with factory prime coat finish.

## 2.05 COMBINATION LOUVERS

- A. Damper-combined, drainable louver:
- B. Size: As indicated on the drawings.
- C. Material: Extruded aluminum.
- D. Paint Finish and Color: To be selected by Architect from manufacturer's full range.
- E. Sleeve or Flange: Factory-mounted standard.
- F. Linkage: Concealed in frame.

## 2.06 GRAVITY VENTILATORS

- A. Hood Intake and Relief Gravity Ventilator:
  - 1. Manufacturers:
    - a. Greenheck Fan Corporation: [www.greenheck.com/#sle](http://www.greenheck.com/#sle).
    - b. Loren Cook Company: [www.lorencook.com/#sle](http://www.lorencook.com/#sle).
  - 2. General:
    - a. Low silhouette for intake and relief applications with natural gravity or negative pressure system(s).
    - b. Performance ratings and factory testing in accordance with AMCA 511 and AMCA 550.
    - c. Suitable for non-ducted applications.
    - d. Equipment to bear permanently affixed manufacturer's nameplate listing model and serial number.
  - 3. Hood and Base:
    - a. Material: Aluminum.
    - b. Hood Construction: Precision formed, arched panels with interlocking seams.
    - c. Vertical End Panels: Fully locked into hood end panels.

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4. Birdscreen:
  - a. Fabricate in accordance with ASTM B221 (ASTM B221M).
  - b. Construction: 1/2 inch Galvanized mesh.
  - c. Horizontally mounted across hood intake area.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.
- C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
- D. Install diffusers to ductwork with air tight connection.
- E. Provide balancing dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.
- F. Paint ductwork visible behind air outlets and inlets matte black, see Div. 09.

END OF SECTION 23 37 00

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SECTION 23 81 26

SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air-source heat pumps.
- B. Forced air furnaces.
- C. Air cooled condensing units.
- D. Indoor air handling (fan and coil) units for ducted systems.
- E. Indoor air handling (fan and coil) units for ductless systems.

1.02 RELATED REQUIREMENTS

- A. Section 22 10 05 - Plumbing Piping: Includes indoor coil condensate drain.
- B. Section 23 31 00 - HVAC Ducts and Casings.
- C. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections and installation and wiring of thermostats and other controls components.

1.03 REFERENCE STANDARDS

- A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2023.
- B. AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment 2015, with Addendum (2016).
- C. AHRI 520 - Performance Rating of Positive Displacement Condensing Units 2004.
- D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems 2022, with Errata (2023).
- E. ASHRAE Std 23 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units 2022.
- F. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size 2017, with Addendum (2022).



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- G. ASHRAE Std 103 - Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers 2022.
- H. NEMA MG 1 - Motors and Generators 2021.
- I. NFPA 54 - National Fuel Gas Code 2021.
- J. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2024.
- K. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems 2024.
- L. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances 2024.
- M. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical Current Edition, Including All Revisions.
- N. UL 1995 - Heating and Cooling Equipment Current Edition, Including All Revisions.

#### 1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
- D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
- E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- F. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

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1.06 WARRANTY

- A. See Div. 01 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Mitsubishi Electric: [www.mitsubishicomfort.com](http://www.mitsubishicomfort.com)
- B. LG: [www.lghvac.com](http://www.lghvac.com)
- C. Carrier Corporation: [www.carrier.com/#sle](http://www.carrier.com/#sle).
- D. Trane Inc: [www.trane.com/#sle](http://www.trane.com/#sle).

2.02 SYSTEM DESIGN

- A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
  - 1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator; auxiliary electric heat.
  - 2. Heating: Natural gas fired.
  - 3. Cooling: Outdoor electric condensing unit with evaporator coil in central ducted indoor unit.
  - 4. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.
- B. Performance Requirements: See Drawings for additional requirements.

2.03 INDOOR AIR HANDLING UNITS FOR DUCTED SYSTEMS

- A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
  - 1. Air Flow Configuration: horizontal and upflow.
  - 2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.

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- B. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.
  - 1. Motor: NEMA MG 1; 1750 rpm single speed, permanently lubricated, hinge mounted.
  - 2. Motor Electrical Characteristics:
- C. Air Filters: 2 inch thick glass fiber disposable type arranged for easy replacement.
- D. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
  - 1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
  - 2. Manufacturers: System manufacturer.

#### 2.04 INDOOR AIR HANDLING UNITS FOR DUCTLESS SYSTEMS

- A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
- B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
  - 1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
  - 2. Manufacturer: System manufacturer.

#### 2.05 OUTDOOR UNITS

- A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
  - 1. Comply with AHRI 210/240.
  - 2. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
  - 3. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23 and UL 207.

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- B. Compressor: Hermetic, two speed 1800 and 3600 rpm, AHRI 520 resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high-pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.
- C. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
- D. Accessories: Filter drier, high-pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
  - 1. Provide thermostatic expansion valves.
  - 2. Provide heat pump reversing valves.
- E. Operating Controls:
  - 1. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig and off when pressure drops below 140 psig for operation to 0 degrees F.

## 2.06 GAS FURNACE COMPONENTS

- A. Heat Exchanger: Aluminized and stainless steel tubular type.
- B. Insulation: Foil-faced.
- C. Burner: Atmospheric type with adjustable combustion air supply,
  - 1. Gas valve, two stage provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
  - 2. Combustion air damper with synchronous spring return damper motor.
  - 3. Non-corrosive combustion air blower with permanently lubricated motor.
- D. Burner Safety Controls:
  - 1. Thermocouple Sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
  - 2. Flame Rollout Switch: Installed on burner box and prevents operation.
  - 3. Vent Safety Shutoff Sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.

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4. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature, automatic resets.

E. Operating Controls:

1. Cycle burner by room thermostat to maintain room temperature setting.
2. Supply fan energized from bonnet temperature independent of burner controls, with adjustable timed off delay and fixed timed on delay, with manual switch for continuous fan operation.

F. Flue Termination: Concentric roof kit.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.
- B. Verify that proper power supply is available and in correct location.
- C. Verify that proper fuel supply is available for connection.

#### 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.
- B. Install in accordance with NFPA 90A and NFPA 90B.
- C. Install gas fired furnaces in accordance with NFPA 54.
- D. Provide vent connections in accordance with NFPA 211.
- E. Install refrigeration systems in accordance with ASHRAE Std 15.

END OF SECTION 23 81 26

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SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 CONTRACT PROVISIONS

- A. The requirements of this Section are in addition to the requirements of Division 1, General Conditions and Supplementary Conditions.

1.02 SUMMARY

- A. This section describes the requirements for the electrical work includes, among others, the furnishing and installation of the following:
1. Electrical service from the Main Switchboard to the building Distribution Panel(s) including transformer(s), conduit and trenching, conductors.
  2. Power distribution system.
  3. Grounding system.
  4. Lighting and lighting control systems.
  5. Wiring systems including power wiring to plumbing and HVAC and other misc. appliances and equipment.
  6. Electrical services for Communications management system.  
(voice/video/media/clock) as described in Division 27 and as indicated on the drawings.
  7. Electrical services for Computer data systems, as described in Division 28 and as indicated on the drawings to include outlets, raceways, and cabling.
  8. Emergency egress lighting.
  9. Testing and commissioning for all electrical work installed under this contract and as described in these specifications and indicated on the drawings.
- B. Furnish and install all electrical equipment and systems as shown on the Drawings and as described in this Division of the Specifications to provide a complete and functional electrical installation. This work includes but is not limited to all material and labor required for installation of electrical and special systems complete as described herein this specification and drawings; and connections (and installation where not otherwise provided for) of electrical equipment furnished by others. Provide and install all items of equipment, devices, supports, etc., which are incidental to the major components shown on

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the Drawings or described in these Specifications.

### 1.03 DEFINITIONS

- A. The meaning of words shall be as defined in the CEC Article 100, Definitions, unless defined otherwise in an individual specification section.
- B. The following specification development organizations are referenced throughout the various specification sections of Division 26:
  - 1. ADAAG – Americans with Disabilities Act Accessibility Guidelines.
  - 2. ANSI – American National Standards Institute.
  - 3. AQMD – Air Quality Management District.
  - 4. ASTM – American Society for Testing and Materials.
  - 5. CBC – California Building Code.
  - 6. 10. CCR – California Code of Regulations Title 24 State Chapters.
  - 7. 11. CEC – California Electrical Code.
  - 8. 12. CFC – California Fire Code.
  - 9. 15. EIA – Electronic Industries Association.
  - 10. 16. FCC – Federal Communications Commission.
  - 11. 19. ICEA – Insulated Cable Engineers Association.
  - 12. 20. IEC – International Electromechanical Commission.
  - 13. 21. IEEE – Institute of Electrical and Electronic Engineers.
  - 14. 24. ISO – International Organization for Standardization.
  - 15. 27. NECA – National Electrical Contractors Association.
  - 16. 28. NEMA – National Electrical Manufacturing Association.
  - 17. 29. NETA – National Electrical Testing Association.
  - 18. 30. NFPA – National Fire Protection Association.
  - 19. 32. OSHA – Occupational Safety and Health Administration.
  - 20. 34. UL – Underwriters Laboratories.

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1.04 RELATED WORK INCLUDED IN OTHER DIVISIONS

- A. Finish painting except factory applied finishes and repair of factory finishes shall be provided in accordance with appropriate sections of this Specification. Coordinate "painting" requirements of this Division with other trades as required to assure timely and satisfactory completion of required work. In finished areas, all exposed raceway, boxes, galvanized steel box covers (where allowed), and other electrical "structure" shall be finished to match adjacent structures. Verify that all raceway openings are closed and box covers are in place prior to finishing work done by others.
- B. Examine the drawings and specification for mechanical and plumbing equipment and provide electrical installation for heating, ventilation and air conditioning equipment, motors, pumps and associated motor starters and controls as described in Division 22 and Division 23.
- C. Examine the Architectural drawings and specification for electrical appliances and equipment which may not be shown on the plans to include and provide electrical installations as described in the architectural division of work.
- D. Examine the Architectural drawings and provide all construction necessary to maintain the integrity of the fire rated barriers.
- E. Examine the Architectural drawings and coordinate with the Architect to provide access doors, whether shown on drawings or not, where floors, walls, or ceiling must be penetrated for access to electrical equipment, outlet boxes, devices, etc., and as specified in this specification.
- F. Provide and install, as part of the work described in this Division, all power and control wiring fed from a source of 30 Volts or more (i.e. all wiring except temperature control wiring) for mechanical equipment described in Division 23.
- G. Examine the fire sprinkler system drawings and specifications for electrical work which may not be shown on the electrical and/or fire detection and alarm plans to be included in the electrical work as necessary as described in the Division 21 fire sprinkler system.

1.05 APPLICATION OF OTHER DIVISIONS

- A. Where carpentry, masonry, concrete work, painting, etc., is required in the installation of equipment specified under this Division, the work shall be done in accordance with the applicable Division of these Specifications. This work could include for example: work associated with panelboard installation, equipment pads or bases, support structures, etc.

1.06 DRAWINGS AND SPECIFICATIONS



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- A. The information presented in these Specifications, and on the drawings, is intended to describe the utilitarian and physical aspects of the systems shown as well as the quality of the entire installation. All information is as complete and thorough as possible, but every condition or situation cannot be anticipated. Exact locations, dimensions, elevations, etc. must be determined "on the job" with careful attention to the "intent" of the Drawings and Specifications.
- B. The above paragraph shall not be construed as to allow significant deviation from either the Drawings or Specifications without prior approval of the Architect, but minor changes in conduit routing or equipment locations may be required or desired due to specific conditions encountered. This work shall be accomplished in accordance with these Specifications and no "extra charges" are to be created for any unanticipated labor or material.
- C. Any error or omissions of detail in either the drawings or the specifications shall not relieve the Contractor from correctly installing all materials necessary for complete and operating electrical systems.
- D. Contractor shall inspect the site and verify all measurements and conditions. No extra compensation will be allowed because of differences between work shown on the drawings and measurements at the site.
  - 1. The Drawings are diagrammatic in nature, but the locations of devices, equipment, outlets, and lighting fixtures are shown approximately where installations are intended. Architectural, structural, mechanical, audio/video, theatrical lighting and other drawings shall be examined, noting all conditions that may affect this work. Report conflicting conditions to the Architect/Engineer for adjustment before proceeding with the work. Should the Contractor proceed with work without reporting the matter, he does so on his own responsibility and shall alter work if directed by the Architect/Engineer at his own expense.
- E. Examine the architectural, structural, mechanical, fire sprinkler and manufacturer's drawings for various equipment in order to determine exact routing and final terminations for all conduits and cables. Conduits shall be stubbed up as near as possible to equipment enclosure.
- F. All equipment shall be located and installed so that it will be readily accessible for operation and maintenance. The Owner reserves the right to require minor changes in location of outlets or equipment, prior to rough in without incurring any additional cost or changes.
- G. If significant departures from the Drawings or Specifications are considered necessary by the Contractor, details of the changes and the reasons therefore

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shall be submitted to the Architect as within thirty days after award of contract. Prior written acceptance of the Architect is required for these departures.

- H. Clarification of plans and specifications for the purpose of facilitating construction, but not involving additional labor and materials, may be prepared during construction by the Architect/Engineer. Said revised plans and specifications shall become a part of the contract. The Contractor shall conform to the revised plans and specifications at no additional cost to the Owner.

#### 1.07 CODES, STANDARDS, RULES AND REGULATIONS

- A. All work and materials shall be in full accordance with the latest rules, codes, and/or regulations and not limited to the following:
- B. NFPA 70 - National Electrical Code; National Fire Protection Association, 2020 with 2022 California Electrical Code amendments
- C. NFPA 101 - Life Safety Code
- D. NFPA 72 - Fire Alarm Code
- E. Title 24 - State of California Administrative Code
- F. California Building Code (CBC)
- G. City or County Electrical Code as applicable.
- H. Utility rules and regulations.
- I. Any applicable additional codes and regulatory documents effective at the project site.
- J. Nothing on the Drawings or in the Specifications shall be construed to allow work not in conformance with these rules, codes, and regulations.
  - 1. The Drawings and/or Specifications shall take precedence where work and material described therein exceeds that required by rules, codes, or regulations.

#### 1.08 MANUFACTURER'S INSTRUCTIONS

- A. Follow the manufacturer's instructions when specific installation or connection details are not indicated or specified on the contract documents.
- B. Notify the Architect/Engineer of conflicts between the manufacturer's instructions and installation or connection details prior to the installation of materials.

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1.09 WORKMANSHIP

- A. High quality workmanship shall be evidenced in the installation of all electrical equipment and materials. Use the National Electrical Contractors Association's "Standard of Installation" as a guide to the workmanship required. Be prepared to replace or repair any material or equipment damaged by or installed in a manner exhibiting evidence of poor workmanship.

1.10 COORDINATION WITH OTHER TRADES

- A. Examine the Electrical Drawings and refer to the Drawings and Specifications describing other work to be accomplished. Verify and coordinate prior to bid. Continue to coordinate work planning and all work in the field to avoid conflicts, errors, and/or delays. No compensation will be allowed for extra work necessitated by lack of coordination.

1.11 AUTHORITY OF THE ARCHITECT

- A. As used in this paragraph only, the word "Architect" shall mean the Architect of record or his designated representative.
- B. The authority of the Architect shall be absolute with respect to all performance under this Specification. In case of dispute, the decision of the Architect shall be final.
- C. Where optional materials, methods, or installation techniques are allowed under the provisions of this Specification, they may be used at the discretion of the Architect. The Architect may require specific materials, methods, or techniques to be used in specific situations where use of other materials, methods, or techniques might in his judgment result in loss of aesthetics, accidental damage, life safety hazard, or loss of utility over the system design lifetime.
- D. No additional charges will be allowed for work or material require to be supplied under the conditions of this paragraph unless the need for such material or work could not have been anticipated by thorough study of the site, Drawings, and Specifications and knowledge of all applicable codes, laws, and ordinances.

1.12 EXAMINATION OF THE SITE

- A. The contractor is required to visit the site of construction prior to bid to determine existing conditions and their effect upon the work he will be required to perform. No additional compensation will be allowed for any extra expenses incurred by failure to detect and evaluate all existing conditions that will affect his work to be included in the bid to accomplish this contract document's goal.

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1.13 STRUCTURAL REQUIREMENTS

- A. Secure all anchors for electrical equipment in a manner, which will not decrease the structural value of any structure to an unsafe level. Install all equipment, fixtures, etc. to resist seismic movements. Inform the Architect in advance and provide drawings of any proposed modifications to the structure that involves cutting or patching of concrete, masonry, steel, or wood in this project.

1.14 PERMITS, FEES, AND, INSPECTIONS

- A. Obtain all permits and licenses as required and pay all fees incidental to construction.
- B. Inspections required by prevailing Local Authorities, and/or ordinances, shall be coordinated and arranged by the contractor. Provide the Architect with a schedule of inspections, where applicable, and submit all certificates of inspection to the Architect.
- C. The Contractor shall cooperate with the Architect and shall provide assistance at all times for the inspection of the electrical work. Remove covers, operate equipment, or perform any reasonable work, which, in the opinion of the Architect, will be necessary to determine the quality or adequacy of the work. Work shall not be closed in or covered before inspection and approval by the Architect. Cost of uncovering and making repairs where un-inspected work has been closed in shall be borne by the Contractor. If any material does not conform with these specifications the Contractor shall, within three days after being notified by the Architect, remove the materials from the premises.

1.15 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and equipment to project site in manufacturer's original packaging with labeling showing product name, brand, model, project name, address, and Contractor's name. Store in a location as agreeable to the Owner. Secure material from weather or accidental damage.

1.16 SEQUENCING AND SCHEDULING

- A. Sequence work under provisions of Division 1.
- B. Coordinate the incoming electrical, telephone and cable television services with the local serving utility companies. Install utility service trench and duct systems in accordance with the respective serving utility company requirements.
- C. Coordinate hand hole locations with the existing site conditions. Hand holes are to be located approximately five feet from building or as indicated on drawings.

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1.17 SHORT CIRCUIT AND PROTECTIVE DEVICE COORDINATION STUDY

- A. The contractor shall provide short circuit, protective device and arc flash studies for the complete electrical distribution system. Submit to the Electrical Engineer of Record for review. Provide all short circuit device and equipment characteristic information for all electrical components. Provide Time-Current curves for all overcurrent protective devices in the submittal. Set and adjust all devices in accordance with the results of this study prior to energizing equipment. Refer to Section 26 05 73, Power Systems Studies for additional requirements.
- B. The Contractor shall be responsible for obtaining all pertinent information necessary in order to perform the required short circuit, protective device coordination and arc flash studies to include but not limited to the following:
  - 1. Contacting the serving power utility to obtain the available short circuit current at the project point of connection and/or secondary of the serving utility company service transformer(s).
  - 2. Field investigation to determine the short circuit current rating for any existing electrical service and distribution equipment.
  - 3. Electrical characteristics for all proposed new electrical service and distribution equipment.
  - 4. The Contractor shall provide approved permanent labels for all electrical service and distribution equipment to clearly identify the available short circuit current and arc flash energy levels and required PPE (Personnel Protective Equipment).

1.18 OPERATING INSTRUCTIONS

- A. Instruct the Owner as to function, operation, maintenance, and adjustment of each system and piece of equipment provided.

1.19 RECORD DRAWING

- A. The Contractor shall keep a separate set of Electrical Drawings at the job site to be used as RECORD Drawings. These Drawings are to be kept current and in a neat and clean condition at all times. They are to be available for inspection by the Architect or Engineer at any time during site visitations. These Drawings shall be "red lined" to indicate all changes in equipment, device, and outlet locations; and to indicate the true locations of all concealed or underground work where different from that shown on the Drawings. Each sheet of this set shall be clearly and permanently marked "RECORD DRAWINGS".

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- B. Upon completion of the project and prior to final payment, transfer all RECORD DRAWINGS information to the provided original drawings. All information shall be clearly drawn with "RED" ink. The drawings shall be scanned, 100% edited, and converted into an AutoCAD ".dwg" version 2018 (or higher) electronic file. Deliver the original, final sets, and electronic files (CD) to the Architect for review and delivery to the Owner.

## 1.20 SPARE PARTS

- A. Spare parts shall be provided and maintained by the Contractor to support the maintenance response requirements defined in this document.
- B. At a minimum, the following spare parts shall be stored onsite at a location identified by the Owner's representative. The spare parts shall be the property of the Owner. The spare parts shall be of the same type submitted and installed in the facility to include the following:
- C. Lighting fixture LED driver, one for each fixture type.
- D. Branch circuit panelboard circuit breaker, one for each circuit breaker type.
- E. Fuses, one set of three for each fuse type and size.
- F. Lighting occupancy sensors and switches, one for each sensor and switch type.

## 1.21 GUARANTEE

- A. All electrical work, material, and equipment shall be guaranteed to be free from defects in workmanship or material for a period of two (2) year from the date of final acceptance. Repair or replace all such defects in a timely manner and any damage to the owner's property resulting from such defect or repair thereof. All equipment and material provided and all work accomplished under the requirements of this section shall be at no expense to the Owner.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Unless specifically indicated otherwise, all material shall be new and free from defects; it shall be listed by Underwriters' Laboratories where applicable. Like items shall be of the same manufacturer (except lighting fixtures - which shall be as specified).
- B. Except as noted otherwise, where material of a particular manufacturer is specified, the intent is to describe the quality and function of the item. The term "...or acceptable equal" is implied. A substitution of any of these items will

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require that the item be presented in a submittal whether specifically listed in the "Submittals" paragraph below or not.

## 2.02 SUBMITTALS

- A. Material submittals shall be complete and submitted all at the same time. The individual groups of submittal types (e.g.: lighting fixtures, wiring devices, distribution equipment, etc.) MUST be prefaced with a list of contents identifying each item by its project name or symbol, manufacturer, and complete catalog number. Each copy of each submittal group shall have the list of contents attached. These lists will be used to report submittal comments. The Contractor is responsible for submitting this information in a timely manner so that material may be ordered early enough to meet the construction schedule. If material is not ordered in time for whatever reason, pay such premium prices and special handling charges as are required to meet the construction schedule. No substitution of an "accepted" item will be allowed due to failure to plan for adequate material procurement lead time.
- B. Shop drawings shall be drawn to scale or completely dimensioned and shall give all information required to completely describe the item. The Contractor shall carefully check all the shop drawings for compliance with these specifications and the Plans.
- C. If the shop drawings show variations from the Contract requirements because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in order that if (acceptable) suitable action may be taken for proper adjustment of the Contract. The Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract, even though the shop drawings have been reviewed.
- D. Work requiring shop drawings shall not be started before receipt of the Architect's review and acceptance.
- E. The Architect's/Engineer's review of the submitted materials, items and shop drawings are for general compliance with the plans and specifications and general design and arrangement only. Therefore, it shall not relieve the Contractor from responsibility for errors of any sort in the materials, items, shop drawings or schedules. The Contractor shall verify all dimensions and job site conditions affecting the work, and shall be responsible for furnishing and installing the proper materials required by the Contract, whether or not indicated on the drawings and specifications.
- F. As a minimum, submittals are required for the following items:
  - 1. RACEWAY COMPONENTS

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2. WIRE AND CABLE
3. WIRING DEVICES
4. MAIN SWITCHBOARD AND DISTRIBUTION PANELS
5. PANELBOARDS
6. PULL BOXES
7. SAFETY SWITCHES, DISCONNECTS AND CIRCUIT BREAKERS
8. LIGHTING FIXTURES, CONTROL SYSTEMS, PEDESTALS AND POLES

### 2.03 SUBSTITUTIONS

- A. Specific brand names and catalog numbers are used to describe materials in order to establish of performance and quality.
- B. Only one substitution will be considered for any item. Substitute materials must be equal in quality and function to that specified. Allowance of a substitution does not permit any reduction of system performance or utility, and the Contractor is responsible for additional costs incurred due to use of a substituted item. If the proposed substitute item is "rejected", the specified item shall be provided (re-submittal required) without further discussions or delay.
- C. Any Contractor's proposed substitution of material, article, or method in the opinion of the Architect/Engineer are equal to that specified will be accepted, provided the Contractor submits a single written request, in triplicate, to the Architect, with the following information for each item:
  - D. Name of Manufacturer or supplier.
  - E. Trade or brand names.
  - F. Type, model, style, and/or catalog number.
    1. Size or capacity rating.
- G. After receipt of a written request from the contractor, the engineer of record will review product substitutions fourteen (14) days prior to the bid date. If system substitutions are submitted after the award of the project contract, the analysis for the whole system substitution will be charged to the contractor at senior engineer hourly rates.
- H. The decision of the Architect/Engineer shall govern as to what is equal to the item specified in the plans and specifications. Equality will be judge on the basis of the following:



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1. Conformance with description or performance required.
  2. Equal in quality.
  3. Comparable in appearance and artistic effect where these are in considerations.
  4. Comparable operation, maintenance and performance.
  5. Equal in longevity and service under conditions of climate and usage.
  6. Conformance with space allocations and requirements for operations from in details and construction of related work.
  7. Conformance with all applicable codes and regulations.
- I. If the Architect/Engineer considers it necessary, tests to determine the quality of the proposed materials shall be made, at the expense of the Contractor, by an unbiased laboratory, satisfactory to the Architect.

## 2.04 ENCLOSURES

- A. Provide enclosures suitable for the specific type of location in which they are installed.
1. Provide NEMA 1 or NEMA 12 boxes and enclosures for dry locations. Dry locations are all indoor areas that do not fall within the definitions below for wet or damp locations.
  2. Provide NEMA 3R boxes and enclosures for wet locations. Wet locations are all locations exposed to weather, whether under a roof or not.
  3. Provide NEMA 4 boxes and enclosures for damp locations. Damp locations are all indoor spaces wholly or partially underground or any area subject to water spray.
  4. Provide NEMA 4X, stainless steel enclosures in all kitchen and wash down areas.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. All equipment shall be set square and plumb, securely mounted, adequately supported, and permanent. Provide workspace around items of electrical equipment as required by California Electrical Code (CEC). In general, equipment is to be installed in accordance with manufacturer's instructions; but the requirements of these specifications shall take precedence where conflicts

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exist.

- B. WIRING METHODS: The cables and conductors of all systems specified in the Specification are required to be installed in raceway.
- C. Coordinate electrical work with the Owner's representative and work of other trades to avoid conflicts, errors, delays, and unnecessary interference with operation of the facility during construction.
- D. Check and coordinate the approximate locations of electrical stub-ups, light fixtures, electrical outlets, equipment, and other electrical system components shown on the Drawings for conflicts with openings, structural members, and components of other systems and equipment having fixed locations. In the event of conflicts, notify the architect in writing. The architect's decision shall govern. Make modifications and changes required to correct conflicts as required.

### 3.02 ELECTRICAL WORK FOR EQUIPMENT PROVIDED UNDER OTHER SECTIONS

- A. Install power conductors and terminate on equipment provided under other specification sections. Verify specific requirements.
- B. Install and terminate electrical controls as described on the Electrical Drawings (For mechanical equipment specified in Division 23).
- C. Line voltage control wiring of exhaust fans is to be accomplished under this Division. The controlling device may be specified elsewhere.
- D. Provide and install all disconnect/safety switches and motor starters except those devices specified to be furnished with equipment specified elsewhere.
- E. Unless provided for in another Division, install all items of electrical equipment provided by others.
- F. Assist others in equipment testing to verify that wiring and connections made under this Division are correct.

### 3.03 EQUIPMENT IDENTIFICATION

- A. Nameplates shall be installed on all items of electrical equipment as follows: switchboard(s) and switchboard circuit breakers, panelboards, terminal cabinets, time switches, contactors, motor control switches, wall switches (where noted on the Drawings), motor starters provided under this Division where the function is not immediately obvious, and safety switches.
- B. The nameplate shall identify the item by Drawing name where applicable and describe its use or function in this installation.

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- C. Permanently mark all utility outlets to show source of power panel and circuit breaker number.
- D. Provide nameplates per Section 26 05 53.

### 3.04 EXCAVATION AND BACKFILL

- A. Excavation and backfill shall be accomplished as required for installation of electrical equipment as shown on the Drawings. Restore all surfaces, roadways, walks, etc., and any existing underground structures which might be disturbed during this work to their original condition in a manner acceptable to the Architect.
- B. Trenches shall be straight except where otherwise indicated. Depth shall be as noted on the Drawings and at least as required to provide the minimum cover specified by applicable codes and regulations for the equipment installed. Bottom of trench shall be smooth and free of any rock points. Place a 4" sand bed in trench if these conditions cannot be met with native material.
- C. Backfill shall be clean and free of rocks and debris. Backfill is to be tamped in 6" layers to nominal 95% compaction using a mechanical tamper manufactured specifically for this purpose. In an area of engineered fill or other area of specified compaction, backfill shall be compacted to match that specified for that area.
- D. At a depth of 12" below finished grade and at least 6" above installed equipment, lay a 6" wide yellow warning tape on the compacted backfill for the full length of the trench. Do not stretch the tape. Use Brady "Identoline" stating: "CAUTION BURIED ELECTRICAL LINE". Installation under building slabs is not required unless noted otherwise.
- E. If at any time during a period of one-year dating from the date of final acceptance of the project, there shall be any settlement of conduit trenches, the Architect may notify the Contractor to immediately provide additional fill and to make such repairs or replacements in paving, planting, or structures, as may be deemed necessary at the Contractor's expense.
- F. Cooperate and coordinate with others in planning for and execution of all trench work.
  - 1. The Contractor is expected to exercise due care when excavating in an area of existing utilities to avoid damage to these facilities. Where it can be determined that underground facilities are likely to exist (either from the Drawings or inspection of the site), the Contractor is required to determine the exact locations of these existing installations. Damage to existing facilities, due to failure to properly accomplish the above, shall be repaired

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at the Contractors expense to the approval by the Architect and satisfaction of the Owner.

2. CALL AN UNDERGROUND SERVICE FIRM BEFORE TRENCHING, CALL U.S.A. (800) 624-2444.

### 3.05 SEALING PENETRATIONS

- A. Flash and counter flash roof and wall penetrations with equipment manufactured for the purpose and as described in other Divisions of these Specifications or as Directed by the Architect. Apply mastic as required to seal absolutely watertight.
- B. Conduits penetrating floor slabs or block or concrete walls shall be grouted and sealed watertight.

### 3.06 CUTTING AND PATCHING

- A. Obtain the Architect's acceptance prior to cutting existing surfaces or surfaces under construction. All such surfaces must be repaired or patched to the satisfaction of the Architect.

### 3.07 EQUIPMENT ANCHORING

- A. Seismic Withstand Requirements: Freestanding or wall-hung equipment shall be anchored in place by methods, which will meet the requirements of the applicable codes for seismic loads. The CONTRACTOR shall submit calculations in accordance with "Contractor Submittals", for the design of the anchoring systems for all equipment, including panels, transformers, etc. in excess of 250 pounds. Calculations shall be performed, signed and stamped by a Structural Engineer or a Civil Engineer experienced in structural design and licensed in the State of California. The calculation shall provide an analysis of lateral and overturning forces and shall include a factor of safety against overturning equal to 1.5. The calculation shall also provide an analysis of both the anchoring system and the foundation or wall system to receive the anchor loads and shall show that the foundation is capable of resisting all anchor loads. Submittal shall include data on attachment hardware and methods that will satisfy withstand criteria.
- B. Seismic bracing for light fixtures cable or pendant suspended from ceiling or roof structure shall be seismically braced to prevent fixture from swaying 45 degree in either direction of suspension point. Contractor shall use same cable used to suspend light fixture. Where pendants are used the contractor shall use air craft light fixture suspension cable. Submittal shall include data on attachment hardware and methods that will satisfy withstand criteria referred to in above paragraph.

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3.08 HOUSEKEEPING PADS AND FOUNDATIONS

- A. Concrete work required for housekeeping pads and foundations shall be provided by General Construction Work.
- B. Furnish required dimensional drawings and specify locations for all equipment pads and foundations. Minimum height of housekeeping pads shall be four inches and shall extend out six inches from the footprint of the equipment. Extend pad dimensions where required to maintain accessibility and meet all code requirements.
- C. Furnish anchor bolts and sleeves, verify accuracy of installation.
- D. Provide housekeeping pads for the following:
  - 1. Outdoor switchboards.
  - 2. Outdoor distribution panels.
  - 3. Other equipment as required or as noted on the drawings.

3.09 PROTECTION CLEANING AND REPAIRS

- A. All electrical equipment shall be protected from damage or degradation during construction. Electrical equipment stored or installed shall be protected from dust, water, or damage from other sources.
- B. After all other work has been accomplished, such as plastering, painting, etc., and prior to final review by the Architect; all electrical equipment, especially equipment enclosures, panelboards, switchboards, and lighting fixtures shall be thoroughly cleaned (inside and out) of all dirt, water, grease, plaster, paint, or other construction debris. All surfaces shall be clean and in "new" condition. All scratches, dents, marks, cracks, etc., shall be repaired to the satisfaction of the Architect or the equipment shall be replaced at no additional cost.

3.10 ELECTRICAL EQUIPMENT DELIVERABLES

- A. Retain and safeguard all detachable and spare devices, equipment, and literature (O&M manuals, instruction books, wiring diagrams, test reports, keys, fixtures, etc.) until completion of work. At this time, all items will be delivered to the Owner as directed by the Architect.

3.11 TESTS

- A. Prior to energization of equipment, check the insulation resistance of listed circuits, with a 500 volt "Megger".

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- B. Take precaution during the testing period to insure the safety of personnel and equipment.
- C. Test all wiring for continuity and grounds before any fixtures or equipment are connected. Where such tests indicate faulty installation or other defects, the fault(s) shall be located and repaired at the Contractor's expense. The repaired installation shall then be retested.
- D. Verify rotation of all three phase motors and reconnect if necessary.
- E. Verify the resistance of the grounding electrode system(s).
- F. Balance all loads on each panelboard and all other types of distribution equipment as applicable.

### 3.12 ADJUSTING

- A. Inspect all equipment and put into good working order.

### 3.13 CLEANING

- A. Clean work under provisions of Division 01.
- B. Clean all electrical items. Fixtures and equipment shall be free of dirt, dust and other construction debris.

### 3.14 START UP

- A. Operate all electrical systems in good working order for a period of five consecutive days at a time period agreed to by the Owner's representative.

END OF SECTION 26 05 00

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SECTION 26 05 05 - SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical demolition.
- B. The requirements of this Section are in addition to the requirements of Division 1 – General Conditions and Supplementary Conditions.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00-Common Work Results for Electrical.

1.03 SUBMITTALS

- A. Sustainable Design Documentation: Submit certification of removal and appropriate disposal of abandoned cables containing lead stabilizers.

1.04 REQUIREMENTS INCLUDED

- A. The Contractor shall furnish materials, equipment, and labor necessary to perform and complete demolition work.
- B. The work includes demolition of the existing electrical system and equipment.
- C. The work shall include, but not limited to. Removal of existing electrical equipment and devices, conduits, and wiring.
- D. Manufactured articles, materials, equipment, and accessories shall be demolished in accordance with the manufacturer's specifications and recommendations, and industry standards.
- E. Notify the Owner's Representative at least 72 hours prior to any electrical systems shutdown and receive approval prior to proceeding.

1.05 PROTECTION

- A. It is essential that there be minimal interruption of existing systems such as power, fire protection, and other systems, in addition to the normal operations of the Owner's facilities.
- B. Take care to ensure that there will be no damage to structural elements or portions there-of-which are not to be removed. Erect and maintain temporary shoring, bracing and other means to safeguard the structural integrity of the existing building(s) and structures.

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- C. Erect and maintain temporary bracing, shoring, lights, barricades, signs, and other means to protect the public, workers, and other persons; finishes, and improvements to remain; and adjoining property from damage from demolition work; all in accordance with applicable regulatory requirements.
- D. Protect existing structures, facilities, and plant life from damage. Items damaged as a result of demolition operations shall be repaired or replaced, at no cost to the Owner.
- E. Perform demolition to provide the least interference and most protection to existing facilities and improvements to remain.
- F. Demolish concrete in small sections.
- G. Perform demolition as much as possible with small tools.
- H. Jackhammering:
  - 1. Jackhammering will be permitted only to a limited degree, and only with the prior written approval of the Owner.
  - 2. Do not jackhammer within 2-inches of reinforcing or structural steel to remain; remove final 2-inches of material with chipping gun.

#### 1.06 CUTTING AND PATCHING

- A. Make new openings neat, as close as possible to profiles indicated, and only to extent necessary for new work.
- B. Do not cut or alter structural members unless specifically indicated or approved, and do not damage reinforcing or structural steel to remain.
- C. At concrete, masonry, paving, and other materials where edges of cuts and holes will remain exposed in the completed work, make cuts using power-sawing and coring equipment. Do not over cut at corners of cut openings – saw overruns will not be permitted. Core hole at corner of proposed openings to insert blade and chip square.
- D. Upon completion of cutting and coring, clean remaining surfaces of loose particles and dust.
- E. Repair and patch all holes and openings from the removed electrical equipment, outlet boxes, etc.: Coordinate with the General Contractor and Architect to include and provide finishes to match adjacent surfaces.

#### 1.07 PIPES, DUCTS AND CONDUITS



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- A. Remove deactivated electrical conduits, including fasteners, connections, and other related appurtenances and accessories which would otherwise be exposed in the completed work or interfere with construction operations.
- B. Unless noted otherwise, remove existing exposed conduits and abandon existing concealed conduits in walls, ceilings and underground whether shown on drawings or not.
- C. Cap deactivated piping systems at point of cutoff.

#### 1.08 DEMOLITION DEBRIS

- A. All demolished equipment and associated materials must be disposed of in an approved manner and in accordance with all applicable federal, state and local laws.
- B. Regularly remove debris from the site so that it's presence will not delay the progress of the work.
- C. Nothing removed from the site shall be stored, sold, or burned on site without the Owner's prior written acceptance.

#### 1.09 RECONDITIONING EXISTING SUBSTRATES

- A. Clean surfaces on which new materials will be applied, removing adhesives, bitumen, and other adhering materials, as necessary to furnish acceptable substrates for new materials.
- B. Perform sandblasting, chipping, grinding, acid washing, etching, and other work as required by conditions encountered and new materials involved.
- C. Use of acids or other cleaning agents shall include neutralizing, washing, rinsing, and drying, as applicable.
- D. Determine substrate requirements for reconditioned surfaces in cooperation with the manufacturer's representative and installer of each new installer involved.

#### 1.10 DISPOSAL OF FLUORESCENT LAMPS AND BALLASTS

- A. All existing fluorescent lamps and ballasts shall be properly disposed or recycled according to the Environmental Protection Agency (EPA) and Resource Conservation and Recovery Act (RCTA) standards. Include all costs for disposal or recycling in the bid proposal.
  - 1. Lamps: Dispose or recycle through "Allied Technology Group", 47375 Fremont Blvd., Fremont, CA, 94538, (510) 490-3008 or equal.

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2. Ballasts: Dispose or recycle through "Fulcircle Ballast Recyclers", 550 Montori Court, Pleasanton, CA, 94556, (510) 417-5967 or equal.

#### 1.11 ASBESTOS

- A. In the event asbestos is found to be present in areas conflicting with electrical work, before continuation of work in these areas, notify the General Contractor and/or Owner's Representative and if applicable, for the removal of such hazardous material by a certified asbestos contractor.

### PART 2 PRODUCTS

#### 2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual sections.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify field measurements and circuiting arrangements are as indicated.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition drawings are based on field observation and existing record documents.
- D. Report discrepancies to Architect and Owner before disturbing existing installation.
- E. Report discrepancies to Electrical Engineer on Record before disturbing existing installation.
- F. Beginning of demolition means installer accepts existing conditions.

#### 3.02 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- B. Coordinate utility service outages with utility company.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

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1. Obtain permission from Owner Representative at least 24 hours and receive approval before partially or completely disabling system.
2. Make temporary connections to maintain service in areas adjacent to work area.

### 3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
  1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
  2. PCB- and DEHP-containing lighting ballasts.
  3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply.
- D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- E. 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.
- F. Disconnect and remove abandoned panelboards and distribution equipment.
- G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- I. Repair adjacent construction and finishes damaged during demolition and extension work.
- J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

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- K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment that remain or that are to be reused.
- 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. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION 26 05 05

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SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Scope: furnish all labor, materials, equipment, and incidentals required to install wire and cable for a complete operable electrical system as shown on the drawings and as described in the specifications.
- B. Section Includes:
  - 1. Single conductor building wire
  - 2. Metal-clad cable.
  - 3. Wire and cable for 600 volts and less.
  - 4. Wiring connectors.
  - 5. Electrical tape.
  - 6. Heat shrink tubing.
  - 7. Oxide inhibiting compound.
  - 8. Wire pulling lubricant.
  - 9. Cable ties.
  - 10. Firestop sleeves.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00-Common Work Results for Electrical.
- B. Section 26 05 05 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 21 00 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conductors.

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- F. Section 28 46 00 - Fire Detection and Alarm: Fire alarm system conductors and cables.
- G. Section 31 23 33: Trenching and backfilling.

1.03 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011 (Reapproved 2017).
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).
- E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2021).
- F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation; 2018.
- G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.
- H. FS A-A-59544 - Cable and Wire, Electrical (Power, Fixed Installation); 2008a (Validated 2019).
- I. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- J. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.
- K. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
- L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

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- N. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- O. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.
- P. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- Q. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- R. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.
- S. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.
- T. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
- U. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate the installation of direct burial cable with other trades to avoid conflicts with piping or other potential conflicts.
  - 3. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
  - 4. Notify Electrical Engineer of Record of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- B. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content

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requirements.

- C. Product Data: Provide for each cable assembly type.
- D. Test Reports: Indicate procedures and values obtained.
- E. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.
- F. Field Quality Control Test Reports.
- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- H. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
- J. Project Record Documents: Record actual locations of components and circuits.

#### 1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. All wire and cable shall comply with applicable standards of the Underwriters Laboratories Inc.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.07 DELIVERY, STORAGE, AND HANDLING



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- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

#### 1.08 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify the Electrical Engineer or Record and obtain direction before proceeding with work.

#### 1.09 PROJECT CONDITIONS

- A. Existing Conditions
  - 1. Wire and cable routing shown on the Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.
  - 2. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.
- B. Verify that field measurements are as shown or indicated on the Drawings.

### PART 2 PRODUCTS

#### 2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Metal-clad cable is permitted only as follows:
  - 1. Where not otherwise restricted, may be used:
    - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
      - 1) Maximum Length: 6 feet.
    - b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
      - 1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.

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2. In addition to other applicable restrictions, may not be used:
  - a. Unless approved by the Owner.
  - b. Where not approved for use by the authority having jurisdiction.
  - c. Where exposed to view.
  - d. Where exposed to damage.
  - e. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.
  - f. For isolated ground circuits, unless provided with an additional isolated/insulated grounding conductor.
  - g. For patient care areas of health care facilities requiring redundant grounding.
- D. Concealed Dry Interior Locations: Use only building wire in raceway.
- E. Exposed Dry Interior Locations: Use only building wire in raceway.
- F. Above Accessible Ceilings: Use only building wire in raceway.
- G. Wet or Damp Interior Locations: Use only building wire in raceway.
- H. Exterior Locations: Use only building wire with Type THWN/THW insulation in raceway.
- I. Underground Installations: Use only building wire with Type THWN/THW insulation in raceway.
- J. Use solid conductor for feeders and branch circuits 10 AWG and smaller.
- K. Use stranded conductors for control circuits.
- L. Use conductor not smaller than 12 AWG for power and lighting circuits.
- M. Use conductor not smaller than 14 AWG for control circuits.
- N. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
- O. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 150 feet.
- P. Conductor sizes are based on copper unless indicated as aluminum or "AL".

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2.02 WIRE MANUFACTURERS (LISTED IN ALPHABETICALLY ORDER ONLY AND NOT NECESSARY BY PREFERENCE)

- A. Cerro Wire LLC: [www.cerrowire.com](http://www.cerrowire.com).
- B. Industrial Wire & Cable, Inc: [www.iewc.com](http://www.iewc.com).
- C. Southwire Company: [www.southwire.com](http://www.southwire.com).
- D. Or approved equal.
- E. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Provide conductors and cables with lead content less than 300 parts per million.
- D. Provide new conductors and cables manufactured not more than one year prior to installation.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- F. Comply with NEMA WC 70.
- G. Comply with FS A-A-59544 where applicable.
- H. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- I. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- J. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.
- K. Conductors and Cables Installed in Cable Tray: Listed and labeled as suitable for cable tray use.
- L. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.

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M. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

N. Conductor Material:

1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.

O. Minimum Conductor Size:

1. Branch Circuits: 12 AWG.
  - a. Exceptions:
    - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
    - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
    - 3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
2. Control Circuits: 14 AWG.

P. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

Q. Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
  - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:

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- a. 208Y/120 V, 3 Phase, 4 Wire System:
  - 1) Phase A: Black.
  - 2) Phase B: Red.
  - 3) Phase C: Blue.
  - 4) Neutral/Grounded: White.
- b. Equipment Ground, All Systems: Green.
- c. Isolated Ground, All Systems: Green with yellow stripe.
- d. Travelers for 3-Way and 4-Way Switching: Pink.
- e. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
- f. For control circuits, comply with manufacturer's recommended color code.

## 2.04 SINGLE CONDUCTOR BUILDING WIRE

### A. Manufacturers:

- 1. Copper Building Wire:
  - a. Cerro Wire LLC: [www.cerrowire.com/#sle](http://www.cerrowire.com/#sle).
  - b. Encore Wire Corporation: [www.encorewire.com/#sle](http://www.encorewire.com/#sle).
  - c. General Cable Technologies Corporation:  
[www.generalcable.com/#sle](http://www.generalcable.com/#sle).
  - d. Service Wire Co: [www.servicewire.com/#sle](http://www.servicewire.com/#sle).
  - e. Southwire Company: [www.southwire.com/#sle](http://www.southwire.com/#sle).

### B. Description: Single conductor insulated wire.

### C. Conductor Stranding:

- 1. Feeders and Branch Circuits:
  - a. Size 10 AWG and Smaller: Solid.
  - b. Size 8 AWG and Larger: Stranded.

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- 2. Control Circuits: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
  - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.
    - a. Size 4 AWG and Larger: Type XHHW-2 or THHN/THWN.
    - b. Installed Underground: Type XHHW-2 or THHN/THWN.
    - c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.
- F. Conductor: Copper.
  - 1. For Sizes Smaller Than 4 AWG: Copper.
  - 2. For Sizes 4 AWG and Larger: Copper.
- G. Insulation Voltage Rating: 600 volts.
- H. Insulation: NFPA 70, Type THHN/THWN.

## 2.05 METAL-CLAD CABLE

- A. Manufacturers:
  - 1. AFC Cable Systems Inc: [www.afcweb.com/#sle](http://www.afcweb.com/#sle).
  - 2. Encore Wire Corporation: [www.encorewire.com/#sle](http://www.encorewire.com/#sle).
  - 3. Service Wire Co: [www.servicewire.com/#sle](http://www.servicewire.com/#sle).
  - 4. Southwire Company: [www.southwire.com/#sle](http://www.southwire.com/#sle).
- B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
- C. Conductor Stranding:
  - 1. Size 10 AWG and Smaller: Solid.
  - 2. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.

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- E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- F. Provide oversized neutral conductors where indicated or required.
- G. Provide dedicated neutral conductor for each phase conductor where indicated or required.
- H. Grounding: Full-size integral equipment grounding conductor.
  - 1. Provide additional isolated/insulated grounding conductor where indicated or required.
- I. Armor: Steel, interlocked tape.
- J. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

## 2.06 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.
- C. Wiring Connectors for Splices and Taps:
  - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
  - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- D. Wiring Connectors for Terminations:
  - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
  - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
  - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.

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4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
  5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
  6. Aluminum Conductors: Use compression connectors for all connections.
  7. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
  8. Conductors for Control Circuits: Use crimped terminals for all connections.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
1. Manufacturers:
    - a. 3M: [www.3m.com/#sle](http://www.3m.com/#sle).
    - b. Ideal Industries, Inc: [www.idealindustries.com/#sle](http://www.idealindustries.com/#sle).
    - c. NSI Industries LLC: [www.nsiindustries.com/#sle](http://www.nsiindustries.com/#sle).
    - d. Or approved equal.
- H. Push-in Wire Connectors: Rated 600 V, 221 degrees F.
1. Manufacturers:
    - a. Ideal Industries, Inc: [www.idealindustries.com/#sle](http://www.idealindustries.com/#sle).
    - b. NSI Industries LLC: [www.nsiindustries.com/#sle](http://www.nsiindustries.com/#sle).
    - c. Wago Corporation: [www.wago.us/#sle](http://www.wago.us/#sle).
    - d. Or approved equal.
- I. Mechanical Connectors: Provide bolted type or set-screw type.



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1. Manufacturers:
  - a. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
  - b. IlSCO: [www.ilsco.com/#sle](http://www.ilsco.com/#sle).
  - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
  - d. Or approved equal.
- J. Compression Connectors: Provide circumferential type or hex type crimp configuration with prestressed insulation to equal the insulation of wire being installed. .
  1. Manufacturers:
    - a. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - b. IlSCO: [www.ilsco.com/#sle](http://www.ilsco.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - d. Or approved equal.
- K. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
  1. Manufacturers:
    - a. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - b. IlSCO: [www.ilsco.com/#sle](http://www.ilsco.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - d. Or approved equal.
- L. Power Conductor Splicers
  1. Blackburn.
  2. Burndy "Hylug".
  3. Ilso.
  4. O.Z. Gedney.

## 2.07 ACCESSORIES

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A. Electrical Tape:

1. Manufacturers:
  - a. 3M: [www.3m.com/#sle](http://www.3m.com/#sle).
  - b. Plymouth Rubber Europa: [www.plymouthrubber.com/#sle](http://www.plymouthrubber.com/#sle).
  - c. Or approved equal.
2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

1. Manufacturers:
  - a. 3M: [www.3m.com/#sle](http://www.3m.com/#sle).
  - b. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).

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- c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
  - d. Or approved equal.
- C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
- 1. Manufacturers:
    - a. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - b. Ideal Industries, Inc: [www.idealindustries.com/#sle](http://www.idealindustries.com/#sle).
    - c. IlSCO: [www.ilsco.com/#sle](http://www.ilsco.com/#sle).
    - d. Or approved equal.
- D. Wire Pulling Lubricant:
- 1. Manufacturers:
    - a. 3M: [www.3m.com/#sle](http://www.3m.com/#sle).
    - b. American Polywater Corporation: [www.polywater.com/#sle](http://www.polywater.com/#sle).
    - c. Ideal Industries, Inc: [www.idealindustries.com/#sle](http://www.idealindustries.com/#sle).
    - d. Or approved equal.
  - 2. Listed and labeled as complying with UL 267.
  - 3. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
  - 4. Suitable for use at installation temperature.
- E. Cable Ties: Material and tensile strength rating suitable for application.
- 1. Manufacturers:
    - a. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - b. Scotchflex.
    - c. Thomas & Betts.
    - d. Or approved equal.

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- F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.

1. Products:

- a. Menzies Metal Products; Electrical Roof Stack and Cap: [www.menzies-metal.com/#sle](http://www.menzies-metal.com/#sle).
- b. Menzies Metal Products; Electrical Retro Box: [www.menzies-metal.com/#sle](http://www.menzies-metal.com/#sle).

- G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

1. Products:

- a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: [www.holdrite.com/#sle](http://www.holdrite.com/#sle).

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that raceway installation is complete and supported.
- E. Verify that field measurements are as indicated.
- F. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

### 3.03 INSTALLATION

- A. Circuiting Requirements:

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1. Unless dimensioned, circuit routing indicated is diagrammatic.
  2. When circuit destination is indicated without specific routing, determine exact routing required.
  3. Arrange circuiting to minimize splices.
  4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
  5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
  6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
  7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
    - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
    - b. Increase size of conductors as required to account for ampacity derating.
    - c. Size raceways, boxes, etc. to accommodate conductors.
    - d. Record any circuit changes on record drawings.
  8. Common Neutrals: Sharing of neutral/grounded conductors among branch circuits is not permitted.
  9. Provide oversized neutral/grounded conductors where indicated and as specified below.
    - a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
    - b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install metal-clad cable (Type MC) in accordance with NECA 120.

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- E. Installation in Raceway:
1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
  2. Pull all conductors and cables together into raceway at same time.
  3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
  4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
  2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- H. Terminate cables using suitable fittings.
1. Metal-Clad Cable (Type MC):
    - a. Use listed fittings.
    - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
    - c. Do not use direct-bearing set-screw type fittings for cables with aluminum armor.
- I. Install conductors with a minimum of 12 inches of slack at each outlet.
- J. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

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- K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- M. Make wiring connections using specified wiring connectors.
  - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
  - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
  - 3. Do not remove conductor strands to facilitate insertion into connector.
  - 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.
  - 5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
  - 6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  - 7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
  - 1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
    - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
    - b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
  - 2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.

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- a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
  - b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
3. Wet Locations: Use heat shrink tubing.
- O. Insulate ends of spare conductors using vinyl insulating electrical tape.
- P. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- Q. Identify conductors and cables in accordance with Section 26 05 53.
- R. Color Code Legend: Provide identification label identifying color code for ungrounded conductors at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
- S. Install firestopping to preserve fire resistance rating of partitions and other elements.
- T. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.
- U. Install wire and cable securely, in a neat and workmanlike manner, as specified in NECA 1.
- V. Route wire and cable as required to meet project conditions.
- 1. Wire and cable routing indicated is approximate unless dimensioned.
  - 2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
  - 3. Include wire and cable of lengths required to install connected devices within 10 ft of location shown.
- W. Use wiring methods indicated.
- X. Pull all conductors into raceway at same time.
- Y. Use suitable wire pulling lubricant for building wire 4 AWG and larger.



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- Z. Protect exposed cable from damage.
- AA. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.
- BB. Use suitable cable fittings and connectors.
- CC. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- DD. Clean conductor surfaces before installing lugs and connectors.
- EE. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- FF. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- GG. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- HH. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- II. Trench and backfill for direct burial cable installation as specified in 31 23 33. Install warning tape along entire length of direct burial cable, within 3 inches of grade, as specified in Section 26 05 53.
- JJ. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

### 3.04 FIELD QUALITY CONTROL

- A. Inspect wire for physical damage and proper connections.
- B. Measure tightness of bolted connections and compare torque measurements with manufacturer's values.
- C. Inspect and test in accordance with NETA ATS, except Section 4.
- D. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
  - 1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential

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testing with SPDs connected.

- E. Correct deficiencies and replace damaged or defective conductors and cables.
- F. Perform field inspection
- G. Megger test and record all feeder conductors.
  - 1. Replace conductors failing test.
  - 2. Test replaced conductors in same manner.

END OF SECTION 26 05 19

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SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Scope: provide a complete grounding and bonding system as shown on the electrical drawings and as described in the specifications such that the entire raceway system including all equipment enclosures, data racks, telephone backboards and cabinets, fixtures, and outlets, etc. are effectively connected to ground.
- B. Grounding and bonding requirements.
- C. Section includes:
  - 1. Materials and methods for grounding systems and equipment.
  - 2. Grounding electrodes and conductors.
  - 3. Equipment ground conductors.
  - 4. Bonding
  - 5. Grounding well.
  - 6. Ground bars.
  - 7. Ground plate electrodes.
- D. Connectors for grounding and bonding.
- E. Ground bars.
- F. Ground rod electrodes.
- G. Chemically-enhanced ground electrodes.
- H. Ground plate electrodes.
- I. Ground enhancement material.
- J. Ground access wells.
- K. Pre-fabricated signal reference grids.
- L. Provide all components necessary to complete the grounding system(s) consisting of:
  - 1. Metal underground water pipe.

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2. Metal frame of the building.
3. Concrete-encased electrode.
4. Existing metal underground gas piping system.
5. Metal underground gas piping system.

#### 1.02 RELATED REQUIREMENTS

- A. Section 26 05 00-Common Work Results for Electrical.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables:  
Additional requirements for conductors for grounding and bonding, including conductor color coding.
  1. Includes oxide inhibiting compound.
- C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 56 00 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

#### 1.03 REFERENCE STANDARDS

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2023.
- G. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

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1. Verify exact locations of underground metal water service pipe entrances to building.
  2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
  3. Notify Electrical Engineer of Record of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
1. Do not install ground rod electrodes until final backfill and compaction is complete.

#### 1.05 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance:
1. Building grounding electrode: 10 ohms.
  2. Separately Derived Sources Grounding Electrode: 10 ohms
  3. Non-current carrying metal parts: 25 ohms
  4. Grounds not covered above: 25 ohms

#### 1.06 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- B. Shop Drawings:
1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.
- C. Product Data: Provide for grounding electrodes and connections.
- D. Test Reports: Indicate overall resistance to ground and resistance of each electrode.
- E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Field quality control test reports.
- G. Project Record Documents: Record actual locations of grounding electrode system components and connections.

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- H. Project Record Documents: Record actual locations of components and grounding electrodes.
- I. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

#### 1.07 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

### PART 2 PRODUCTS

#### 2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
- B. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

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E. Grounding System Resistance:

1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Electrical Engineer of Record. Precipitation within the previous 48 hours does not constitute normally dry conditions.
2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

F. Grounding Electrode System:

1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
  - a. Provide continuous grounding electrode conductors without splice or joint.
  - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
2. Metal Underground Water Pipe(s):
  - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
  - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
  - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
3. Metal In-Ground Support Structure:
  - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
4. Concrete-Encased Electrode:
  - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of bare copper conductor not smaller than 4 AWG

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embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.

5. Ground Ring:

- a. Where indicated on drawings, provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.
- b. Where location is not indicated, locate ground ring conductor at least 24 inches outside building perimeter foundation.
- c. Provide ground enhancement material around conductor where indicated.
- d. Provide connection from ground ring conductor to:
  - 1) Perimeter columns of metal building frame.
  - 2) Ground rod electrodes located as indicated.
  - 3) Building structural steel.

6. Ground Rod Electrode(s):

- a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
- b. Space electrodes not less than 10 feet from each other and any other ground electrode.
- c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
- d. Provide ground enhancement material around electrode where indicated.
- e. Provide ground access well for each electrode.

7. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

8. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode



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conductor provided for service-supplied system grounding to this ground bar.

- a. Ground Bar Size: 1/4 by 4 by 12 inches unless otherwise indicated or required.
  - b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
  - c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
9. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.

G. Service-Supplied System Grounding:

1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

H. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:

1. Provide grounding electrode system for each separate building or structure.
2. Provide equipment grounding conductor routed with supply conductors.
3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.

I. Separately Derived System Grounding:

1. Separately derived systems include, but are not limited to:
  - a. Transformers (except autotransformers such as buck-boost transformers).

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- b. Uninterruptible power supplies (UPS), when configured as separately derived systems.
  - c. Generators, when neutral is switched in the transfer switch.
- 2. Provide grounding electrode conductor to connect derived system grounded conductor to common grounding electrode conductor ground riser. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
  - 3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
  - 4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
  - 5. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
  - 6. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
  - 7. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- J. Bonding and Equipment Grounding:
- 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
  - 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding

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conductor.

3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
  4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
  5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
  6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
  7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
    - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
    - b. Metal gas piping.
    - c. Metal process piping.
  8. Provide bonding for interior metal air ducts.
  9. Provide bonding for metal building frame.
  10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
  11. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.
- K. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
  2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.

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- a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
- b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
- c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
- d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

## 2.02 GROUNDING AND BONDING COMPONENTS

### A. General Requirements:

- 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
- 2. Provide products listed and labeled as complying with UL 467 where applicable.

### B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:

- 1. Use insulated copper conductors unless otherwise indicated.
  - a. Exceptions:
    - 1) Use bare copper conductors where installed underground in direct contact with earth.
    - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- 2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gauge of specified conductors.

### C. Connectors for Grounding and Bonding:

- 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
- 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.

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a. Exceptions:

- 1) Use mechanical connectors for connections to electrodes at ground access wells.

3. Unless otherwise indicated, use mechanical connectors for accessible connections.

a. Exceptions:

- 1) Use exothermic welded connections for connections to metal building frame.

4. Manufacturers - Mechanical and Compression Connectors:

- a. Advanced Lightning Technology (ALT): [www.altfab.com/#sle](http://www.altfab.com/#sle).
- b. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
- c. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
- d. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
- e. Or approved equal.

5. Manufacturers - Exothermic Welded Connections:

- a. Burndy LLC; \_\_\_\_\_: [www.burndy.com/#sle](http://www.burndy.com/#sle).
- b. ThermOweld, subsidiary of Continental Industries; division of Burndy LLC; \_\_\_\_\_: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
- c. Or approved equal.

D. Ground Bars:

1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:
  - a. Advanced Lightning Technology (ALT): [www.altfab.com/#sle](http://www.altfab.com/#sle).
  - b. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).

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- c. ThermOweld, subsidiary of Continental Industries; division of Burndy LLC: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
- d. Or approved equal.

E. Ground Rod Electrodes:

- 1. Comply with NEMA GR 1.
- 2. Material: Copper-bonded (copper-clad) steel.
- 3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
- 4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.
- 5. Manufacturers:
  - a. Advanced Lightning Technology (ALT): [www.altfab.com/#sle](http://www.altfab.com/#sle).
  - b. Galvan Industries, Inc: [www.galvanelectrical.com/#sle](http://www.galvanelectrical.com/#sle).
  - c. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
  - d. Or approved equal.

F. Ground Plate Electrodes:

- 1. Material: Copper.
- 2. Size: 24 by 24 by 1/4 inches, unless otherwise indicated.
- 3. Manufacturers:
  - a. Advanced Lightning Technology (ALT): [www.altfab.com/#sle](http://www.altfab.com/#sle).
  - b. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
  - c. ThermOweld, subsidiary of Continental Industries; division of Burndy LLC: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
  - d. Or approved equal.

G. Ground Enhancement Material:

- 1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.
- 2. Resistivity: Not more than 20 ohm-cm in final installed form.

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3. Manufacturers:

- a. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
- b. ThermOweld, subsidiary of Continental Industries; division of Burndy LLC: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
- c. Or approved equal.

H. Ground Access Wells:

- 1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
  - a. Areas Exposed to Vehicular Traffic: Rated for not less than 2000 pounds vertical design load.
- 2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
  - a. Round Wells: Not less than 8 inches in diameter.
  - b. Rectangular Wells: Not less than 12 by 12 inches.
- 3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
- 4. Cover: Factory-identified by permanent means with word "GROUND".
- 5. Manufacturers:
  - a. Advanced Lightning Technology (ALT): [www.altfab.com/#sle](http://www.altfab.com/#sle).
  - b. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
  - c. ThermOweld, subsidiary of Continental Industries; division of Burndy LLC: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
  - d. Or approved equal.

I. Oxide Inhibiting Compound: Comply with Section 26 05 19.

2.03 MANUFACTURERS

- A. Cooper Power Systems: [www.cooperpower.com](http://www.cooperpower.com).
- B. Framatome Connectors International: [www.fciconnect.com](http://www.fciconnect.com).

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C. Or approved equal.

## 2.04 ELECTRODES

A. Manufacturers:

1. Cooper Power Systems: [www.cooperpower.com](http://www.cooperpower.com).
2. Framatome Connectors International: [www.fciconnect.com](http://www.fciconnect.com).
3. Or approved equal.

B. Rod Electrodes: Copper.

1. Diameter: 3/4 inch.
2. Length: 10 feet.

C. Foundation Electrodes: 3/0 AWG. unless noted on plan.

## 2.05 CONNECTORS AND ACCESSORIES

A. Mechanical Connectors: Bronze.

B. Exothermic Connections: Weld

C. Wire: Stranded copper.

D. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

E. Grounding Well:

1. Well Pipe: 8 inch by 24 inch long clay tile pipe with belled end.
2. Well Cover: Cast iron with legend "GROUND" embossed on cover.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify existing conditions prior to beginning work.



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- E. Verify that final backfill and compaction has been completed before driving rod electrodes.

### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Electrodes: Provide a grounding electrode system in the main electrical room/space of each building as follows:
  - 1. Provide a 2-inch x 1/4-inch copper ground bar. Length shall be a minimum of 12 inches but longer as required for the number of connections made to the bar. This bar shall serve as the connection point for all grounding electrodes in the building. Install the copper ground bar in a NEMA 1 screw cover cabinet, minimum size 18 inches x 12 inches x 6 inches.
  - 2. Connect the copper ground bar to the underground metal pipe (other than gas).
    - a. Connect to metal pipe with approved pipe clamp near the pressure reducing valve.
    - b. Connect to ground bar with exothermic weld.
    - c. Connect to metal pipe with copper clamp where copper water pipe occurs and with a malleable iron clamp where cast iron pipe occurs.
    - d. Install grounding conductor, sized as indicated on plans, in a 3/4-inch metal conduit from the ground cabinet to the water pipe. Provide grounding bushings at each end of the conduit.
  - 3. Connect the copper ground bar to the metal frame of the building.
    - a. At all steel framed buildings, provide a connection to the closest column.
    - b. Connect to column with exothermic weld.
    - c. Connect to the ground bar with exothermic weld or bolted-type connector.
    - d. Install grounding conductor, sized as indicated on the plans, in a 3/4-inch metal conduit from the ground cabinet to the column. Provide grounding bushing at each end of the conduit.
  - 4. Connect the copper ground bar to a concrete-encased electrode/Ufer.

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- a. Install a minimum of 20 feet of #3/0 AWG conductor (minimum unless noted otherwise) encased in a minimum of 3 inches of concrete. Provide a non-metallic protective sleeve, minimum 6 inches long (3 inches in the concrete and 3 inches out of the concrete), located where the conductor exits the concrete.
  - b. Install a #3/0 conductor from the ground bar to the concrete-encased electrode in a 3/4-inch metal conduit with grounding bushings. Make connections to the concrete-encased electrode with a bolted-type connector and transition from the metal conduit and non-metallic sleeve.
  - c. Connect to the ground bar with exothermic weld or bolted-type connector.
5. Provide additional ground rod or concrete-encased electrodes as required to meet the performance requirements listed in these specifications at the ground bar.
- a. Install additional ground rods a minimum of 5 feet from any other rod.
  - b. Notify the Owner's Representative if performance requirements have not been met after installing 2 additional ground rods or concrete-encased electrodes.
6. Install other grounding electrodes as indicated on the single line diagram and other Contract Documents.

D. Grounding Electrode Conductor

1. Install grounding electrode conductor from the main normal and emergency power panels and each separately derived system in the building to the ground bar (grounding electrode system). Install grounding electrode conductor in steel conduit and bond grounding conductor to conduit at entrance and exit. Connect to the ground bar (grounding electrode system) with exothermic weld.
  - a. Unless otherwise indicated, install main ground unspliced.
  - b. Make connections easily accessible for inspection in ground bar cabinet.
2. Grounding electrode conductor shall be of the same type and quality as other conductors in the building.
3. The main neutral to ground bonding jumper will be located at the site utilities switchboard. Locate additional neutral to ground bonding jumper at

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separately derived systems only, or at the main service panel when the building is served from a dedicated transformer. Neutral bar with all interior secondary neutrals shall be isolated from the common equipment grounding bus at all other locations.

E. Bonding

1. Provide bonding to meet requirements of CEC.
2. Bond together metal siding not attached to grounded structure, bond to ground.
3. Bond prefabricated metal building to grounding electrode system at a minimum of one location.
4. Bond together all metallic conduit, boxes, cabinets, and enclosures.

F. Grounding Conductors

1. Provide grounding conductor for each branch circuit indicated.
2. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder circuit raceway and within each motor feeder raceway. Terminate each end on suitable lug, bus, or bushing.
3. Provide separate, isolated grounding conductor for each circuit which is installed (all or in part) in non-metallic conduit.
4. Provide separate grounding conductor for circuits installed in flexible steel conduit. Terminate each end on a suitable lug, bus or bushing.
5. Ground all conduit systems, cabinets, equipment, motor frames, etc., in accordance with CEC and applicable codes.

G. Grounding Connections

1. Ground shields of shielded power cable and signal cable at each splice or termination in accordance with recommendations of the splice or termination manufacturer.
2. Ground metal sheathing and exposed metal vertical structural elements of buildings. Ground metal fences enclosing electrical equipment. Bond any metal equipment platforms which support electrical equipment to that equipment. Provide good electrical contact between metal frames and railings supporting pushbutton stations, receptacles, instrument cabinets, etc., and raceways carrying circuits to these devices.
3. Ground all fencing as shown on the grounding details on the Drawings.

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4. Bond neutrals of transformers within buildings to the system ground network, and to additional indicated grounding electrodes.
  5. Unless shown otherwise, make connections of grounding conductors to ground rods at the upper end of the rod with the end of the rod and the connection point below finished grade.
  6. Make connections of sections of outdoor ground mats (counterpoise) for substations or other equipment underground. Make connections of other grounding conductors generally accessible.
  7. In manhole pull boxes, install ground rods with ends 4 to 6 inches above the floor with connections of grounding conductors fully visible and accessible.
  8. When making thermite welds, wire brush or file the point of contact to a bare metal surface. Use thermite welding cartridges and molds in accordance with the manufacturer's recommendations. After welds have been made and cooled, brush slag from the weld area and thoroughly clean the joint. Re-galvanize area if required. For compression connectors, use homogeneous copper, anti-corrosion, surface treatment compound at connectors in accordance with connector manufacturer's recommendations. Use connectors of proper size for conductors and ground rods specified. Use connector manufacturer's compression tool. Notify the Owner's Representative prior to backfilling any ground connections.
  9. Grounding pad plates shall be cast into the slab with the surface flush with the finished floor.
- H. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
  2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.
  3. Provide ground well for future access to rod electrodes.
- I. Ground Plate Electrodes: Unless otherwise indicated, install ground plate electrodes at a depth of not less than 30 inches.
- J. Make grounding and bonding connections using specified connectors.

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1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
  2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
  3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
  4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- K. Identify grounding and bonding system components in accordance with Section 26 05 53.
- L. Install ground electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
- M. Provide grounding well pipe with cover at each rod location. Install well pipe top flush with finished grade.
- N. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing . Bond steel together.
- O. Provide bonding to meet requirements described in Quality Assurance.
- P. Provide isolated grounding conductor for circuits supplying electronic cash registers and other similar electronic equipment loads. .
- Q. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

### 3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.13.
- C. Site Tests:
  1. Notify the Owner's Representative five days before inspection and testing.

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2. Use suitable test instruments to measure resistance to ground of systems. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.
  3. Remove main bonding jumper at main service switchboard and at each separately derived system and test for infinite resistance between neutral and ground systems. Reconnect bonding jumper(s) after completion of testing.
  4. Record test results in accordance with Section 26 05 00 and submit.
- D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.
- F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 26 05 26

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SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 33.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- C. Section 26 05 33.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- D. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- E. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
- F. Section 26 56 00 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
- D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023b.
- F. MFMA-4 - Metal Framing Standards Publication; 2004.
- G. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2009.

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- H. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2006
- I. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2010
- J. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2009.
- K. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

- 1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
- 2. Coordinate work to provide additional framing and materials required for installation.
- 3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
- 4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
- 5. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

- 1. Do not install products on or provide attachment to concrete surfaces until concrete has cured.

#### 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-



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installed concrete/masonry anchors.

1. Fiberglass Channel/Strut Framing Systems: Include requirements for strength derating according to ambient temperature.
- B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- C. Design Data
  1. Indicate hanger and support framing and attachment methods.
  2. Submit seismic and structural calculations for proposed methods of support and attachment.
- D. Derating Calculations for Fiberglass Channel/Strut Framing Systems: Indicate load ratings adjusted for applicable service conditions.
- E. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.
- F. Installer's qualification statement.
- G. Product Data: Provide manufacturer's catalog data for fastening systems.
- H. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at project site one copy of each referenced document that prescribes execution requirements.
- C. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

### PART 2 PRODUCTS

#### 2.01 SUPPORT AND ATTACHMENT COMPONENTS

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A. General Requirements:

1. Comply with the following. Where requirements differ, comply with most stringent.
  - a. NFPA 70.
  - b. Applicable building code.
  - c. Requirements of authorities having jurisdiction.
2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 25%. Include consideration for vibration, equipment operation, and shock loads where applicable.
5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
  - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
  - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
  - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
  - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

- B. Components for Vibration Isolation and/or Seismic Controls: See Section 26 05 48.

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C. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.

1. Manufacturers:

- a. ABB: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
- b. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
- c. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
- d. HoldRite, a brand of Reliance Worldwide Corporation:  
[www.holdrite.com/#sle](http://www.holdrite.com/#sle).
- e. nVent; Caddy: [www.nvent.com/#sle](http://www.nvent.com/#sle).

2. Conduit Straps: One-hole or two-hole type; steel or malleable iron.

3. Conduit Clamps: Bolted type unless otherwise indicated.

D. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

E. Metal Channel/Strut Framing Systems:

1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.

2. Comply with MFMA-4.

3. Channel/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.

4. Channel Material:

- a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
- b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.

5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.

6. Minimum Channel Dimensions: 1-5/8 inch width by 1-5/8 inch height.

F. Fiberglass Channel/Strut Framing Systems:

1. Description: Factory-fabricated, continuous-slot, fiberglass channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.

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2. Channel Material: Use polyester resin or vinyl ester resin.
  3. Minimum Channel Dimensions: 1-5/8 inch wide by 1 inch high.
  4. Flammability: Fire retardant with NFPA 101, Class A flame spread index, maximum of 25, when tested in accordance with ASTM E84; self extinguishing in accordance with ASTM D635.
- G. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
    - a. Equipment Supports: 1/2-inch diameter.
    - b. Busway Supports: 1/2-inch diameter.
    - c. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.
    - d. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.
    - e. Trapeze Support for Multiple Conduits: 3/8-inch diameter.
    - f. Outlet Boxes: 1/4-inch diameter.
    - g. Luminaires: 1/4-inch diameter.
- H. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
  2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
  3. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
  4. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
- I. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
  2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.

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3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Hammer-driven anchors and fasteners are not permitted.
10. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
  - a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
  - b. Comply with MFMA-4.
  - c. Channel Material: Use galvanized steel.
  - d. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
11. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

2.02 MANUFACTURERS (LISTED IN ALPHABETICALLY ORDER ONLY AND NOT NECESSARY BY PREFERENCE)

- A. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
- B. Threaded Rod Company: [www.threadedrod.com](http://www.threadedrod.com).
- C. Or Approved Equal.

2.03 SUPPORTS

- A. Pipe hangers for individual conduits shall be factory made, consisting of a pipe ring and threaded suspension rod. The pipe ring shall be malleable iron, split and hinged, or shall be springable wrought steel. Rings shall be bolted to or interlocked with the suspension rod socket.
- B. Pipe racks for groups of parallel conduits shall be constructed of galvanized structural steel preformed channels of length as required, suspended on

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threaded rods and secured thereto with nuts above and below the cross bar.

- C. Factory made pipe straps shall be one hole malleable iron or two hole galvanized clamps.
- D. Supporting rods shall be at least 3/8" diameter and channel shall be at least 3/4" deep. Supporting hardware shall be galvanized steel.

## 2.04 MATERIALS

- A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Supports: Fabricated of structural steel or formed steel members; galvanized.
- C. Anchors and Fasteners:
  - 1. Sheet Metal Screws: Steel
  - 2. Machine Screws Bolts, Nuts and Washers: Steel
  - 3. Precast Inserts: Suitable for the purpose.
  - 4. Anchor Bolts, expansion type (stainless steel).
    - a. Phillips Red-Head
    - b. Hilti Kwik-Bolt.
    - c. WEJ-IT.
  - 5. Cast-in-Place Anchors: Suitable for the purpose (hot-dip galvanized except cadmium plated in dry locations)
  - 6. Beam Clamps: Steel.
- D. Concrete Structural Elements: Use precast inserts, expansion anchors, or preset inserts.
- E. Steel Structural Elements: Use beam clamps or welded fasteners.
- F. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
- G. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
- H. Solid Masonry Walls: Use expansion anchors or preset inserts.

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- I. Sheet Metal: Use sheet metal screws.
- J. Wood Elements: Use wood screws.
- K. Fastener Types:
  - 1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
  - 2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
  - 3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
  - 4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
  - 5. Other Types: As required.
  - 6. Manufacturers:
    - a. Powers Fasteners, Inc: [www.powers.com](http://www.powers.com).
    - b. Or approved equal.
- L. Formed Steel Channel as indicated on drawings.
- M. Steel Spring Clips: As indicated on drawings

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.02 INSTALLATION

- A. General
  - 1. Install products in accordance with manufacturer's instructions.
  - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
  - 3. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- B. Install hangers and supports in accordance with NECA 1.

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- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
  - 1. Concrete – Precast inserts, cast-place anchors, or expansion type anchor bolts.
    - a. When installing drilled-in anchors in non-prestresses reinforced concrete, avoid the reinforcing bars.
    - b. When installing drilled-in anchors into prestressed concrete (Pre- or Post-tensioned) locate tendons by using a non-destructive method prior to installation. Maintain a minimum clearance of one-inch between the reinforcement and the drilled-in anchor.
  - 2. Sheet Metal – Sheet metal screws or machine bolts, nuts, and washers.
  - 3. Structural Steel Members – Beam clamps, machine screws, bolts, nuts, and washers.
- D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- E. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from suspended ceiling support system or ceiling grid.
- F. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from roof deck.
- G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- H. Provide required vibration isolation and/or seismic controls; see Section 26 05 48.
- I. Equipment Support and Attachment:
  - 1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
  - 2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  - 3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.



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4. Unless otherwise indicated, mount floor-mounted equipment on properly sized concrete pad 3 inches in height.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
6. Install surface mounted cabinets and panelboards with minimum of four anchors.
7. In wet and damp locations, use steel channel supports to stand cabinets and panelboards 13/16-inch minimum off wall.
8. Use sheet metal channels to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
9. Support equipment in accordance with manufacturer's instructions.
10. Verify that equipment will fit support layouts indicated.
  - a. Where suitable equipment is used, revise indicated supports to fit at no additional cost.
11. Arrange for necessary openings to allow entry of equipment.
  - a. Where equipment cannot be installed as structure is being erected, provide and arrange for building-in of boxes, sleeves, or other devices to allow for later installation.

J. Conduit Support and Attachment

1. In damp or wet locations, space conduit support directly from concrete or metal structure out at least  $\frac{1}{4}$  inch using straps with spacers or, if three (3) or more conduits are located in a parallel run, they shall be spaced out from the wall approximately  $\frac{5}{8}$  inch to 1 inch by means of a channel.
2. Runs of individual conduit suspended from the floor or ceiling shall be supported with pipe hangers. Where three (3) or more conduits are suspended from the floor or ceiling, suitable racks shall be constructed from channel material with suitable fittings.
3. Space supporting points no greater than required by CEC.

K. Sleeves

1. Set sleeves in position in formwork. Provide reinforcing around sleeves.
2. Extend sleeves through floors 1 inch above finished floor levels. Caulk sleeves full depth and provide floor plate.

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3. Where raceway penetrated floor, ceiling, or wall. Close off space between pipe or duct and adjacent work with fire stopping insulation and caulk seal.
- L. Conduit Support and Attachment: See Section 26 05 33.13 for additional requirements.
- M. Box Support and Attachment: See Section 26 05 33.16 for additional requirements.
- N. Interior Luminaire Support and Attachment: See Section 26 51 00 for additional requirements.
- O. Exterior Luminaire Support and Attachment: See Section 26 56 00 for additional requirements.
- P. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- Q. Secure fasteners in accordance with manufacturer's recommended torque settings.
- R. Remove temporary supports.
- S. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

### 3.03 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.
  1. Obtain permission from the Architect and the Structural Engineer before drilling or cutting structural members.
- D. All expansion anchors shall have 50 percent of the bolts (alternate bolts in any group arrangement) proof tested in tension and certified by a recognized testing agency at the values indicated in the following table, except where shown otherwise in the Contract Documents. If there are any failures, the immediately adjacent bolts must then also be tested. Anchor capacities shall not exceed 80 percent of the values in the published ICBO report.

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ANCHOR CAPACITY (3,000 PSI MINIMUM STONE AGGREGATE CONCRETE)							
	1/2 inch	5/8 inch	3/4 inch	7/8 inch	1 inch	1-1/4 inches	UNITS
IN TENSION	680	960	1,360	1,900	2,700	3,600	LBS
IN SHEAR	1,170	1,680	2,420	3,500	5,020	6,700	LBS
TYPE OF TEST:							
DIRECT PULL- TENSION, LBS.	1,360	1,920	2,720	3,800	5,400	7,200	LBS
MINIMUM EMBEDMENT	3	3-3/4	4-1/2	5-1/4	6	7-1/2	INCHES

END OF SECTION 26 05 29

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SECTION 26 05 33.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Scope: Provide rigid metallic conduit, rigid non-metallic conduit, intermediate metal conduit, flexible metal conduit, electrical metallic tubing, surface metal and/or non-metallic raceways, cable tray and wireways as shown on the drawings and as described in the specifications.

1.02 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Galvanized steel intermediate metal conduit (IMC).
- C. PVC-coated galvanized steel rigid metal conduit (RMC).
- D. Flexible metal conduit (FMC).
- E. Liquidtight flexible metal conduit (LFMC).
- F. Galvanized steel electrical metallic tubing (EMT).
- G. Rigid polyvinyl chloride (PVC) conduit.
- H. Electrical nonmetallic tubing (ENT).
- I. Reinforced thermosetting resin conduit (RTRC).
- J. Conduit, fittings and conduit bodies.

1.03 RELATED REQUIREMENTS

- A. Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables:  
Cable assemblies consisting of conductors protected by integral metal armor.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
  - 1. Includes additional requirements for fittings for grounding and bonding.
- D. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- E. Section 26 05 33.16 - Boxes for Electrical Systems.
- F. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

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- G. Section 26 05 33.23 - Surface Raceways for Electrical Systems.
- H. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- I. Section 26 21 00 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.
- J. Section 31 23 33-Trenching and Backfilling
- K. The requirements of the kitchen equipment consultant plans and specifications.

#### 1.04 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
- C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A); 2020.
- D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.
- G. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.
- H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.
- I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- J. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.
- K. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.
- L. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.
- M. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT); 2014 (Reaffirmed 2019).

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- N. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series; 2015.
- O. NEMA TC 14.AG - Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; 2015 (Reaffirmed 2021).
- P. NEMA TC 14.BG - Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; 2015 (Reaffirmed 2020).
- Q. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- R. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- S. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- T. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.
- U. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.
- V. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- W. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- X. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- Y. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.
- Z. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.
- AA. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.
- BB. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.
- CC. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

## 1.05 ADMINISTRATIVE REQUIREMENTS

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A. Coordination:

1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
5. Notify Electrical Engineer of Record of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

#### 1.06 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

B. Shop Drawings:

1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
2. Include proposed locations of roof penetrations and proposed methods for sealing.

C. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

D. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, metallic tubing, nonmetallic conduit, fittings, and conduit bodies.

E. Project Record Documents: Accurately record actual routing of conduits larger than 1 1/4 inches.

#### 1.07 QUALITY ASSURANCE

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- A. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions and shop drawings.
- B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

#### 1.09 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on drawings.
- B. Verify conduit routing and termination locations of conduits prior to rough in.
- C. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring systems.

#### 1.10 RATED WALLS AND CEILINGS

- A. Inspect architectural plans for locations and fire ratings for all walls, ceilings, and floors. Install materials as required to maintain the fire integrity of the rated assemblies.

### PART 2 PRODUCTS

#### 2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal



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conduit.

C. Underground:

1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit or PVC-coated galvanized steel rigid metal conduit where emerging from underground.
5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows or PVC-coated galvanized steel rigid metal conduit elbows for bends.
6. Where galvanized rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) emerges from concrete into soil, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.

D. Embedded Within Concrete:

1. Within Slab on Grade: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC). Embed within structural slabs only where approved by Structural Engineer.
2. Within Slab Above Ground: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC),

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galvanized steel electrical metallic tubing (EMT), rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC). Embed within structural slabs only where approved by Structural Engineer.

3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
  4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit or PVC-coated galvanized steel rigid metal conduit where emerging from concrete.
  5. Where galvanized steel electrical metallic tubing (EMT) emerges from concrete into salt air, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.
- E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal

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conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

- J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
1. Locations subject to physical damage include, but are not limited to:
- a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
  - b. Where exposed below 20 feet in warehouse areas.
  - c. In Correctional Facilities, Galvanized rigid steel only for inmate accessible areas. Locations shall be verified with the architect.
- K. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- M. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit.
- N. Hazardous/Classified Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit (RMC).
- O. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
1. Maximum Length: 6 feet.
- P. Flexible Connections to Vibrating Equipment:
1. Dry Locations: Use flexible metal conduit (FMC).

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2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
  3. Maximum Length: 6 feet unless otherwise indicated.
  4. Vibrating equipment includes, but is not limited to:
    - a. Transformers.
    - b. Motors.
    - c. Engine generators.
- Q. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.
- R. Freezer and Refrigeration Rooms
1. Galvanized rigid steel conduit.
  2. Use sealing fittings on refrigeration and freezer room conduit runs in accordance with CEC 300-7(a).

## 2.02 CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70.
- B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.
- C. Electrical Service Conduits: See Section 26 21 00 for additional requirements.
- D. Fittings for Grounding and Bonding: See Section 26 05 26 for additional requirements.
- E. Provide conduit, fittings, supports, and accessories required for complete raceway system.
- F. Provide products listed, classified, and labeled as suitable for purpose intended.
- G. Minimum Conduit Size, Unless Otherwise Indicated:
  1. Branch Circuits: 1/2-inch trade size.
  2. Branch Circuit Homeruns: 3/4-inch trade size.
  3. Control Circuits: 1/2-inch trade size.

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4. Flexible Connections to Luminaires: 1/2 inch (16 mm) trade size.
  5. Underground, Interior: 1 inch (27 mm) trade size.
  6. Underground, Exterior: 1-inch trade size.
- H. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

## 2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

### A. Manufacturers:

1. Allied Tube & Conduit, a division of Atkore International:  
[www.alliedeg.com/#sle](http://www.alliedeg.com/#sle).
2. Nucor Tubular Products: [www.nucortubular.com/#sle](http://www.nucortubular.com/#sle).
3. Rymco USA: [www.rymcousa.com/#sle](http://www.rymcousa.com/#sle).
4. Western Tube, a division of Zekelman Industries:  
[www.westerntube.com/#sle](http://www.westerntube.com/#sle).
5. Wheatland Tube, a division of Zekelman Industries:  
[www.wheatland.com/#sle](http://www.wheatland.com/#sle).
6. Or approved equal.

### B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

### C. Fittings:

1. Manufacturers:
  - a. Bridgeport Fittings Inc: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
  - b. Appleton.
  - c. Crouse-Hinds.
  - d. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
  - e. Or approved equal.
2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.

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3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
4. Material: Use steel or malleable iron.
  - a. Do not use die cast zinc fittings.
5. Connectors and Couplings: Where an expansion type fitting is not required, use a coupling or "Erickson" type coupling as appropriate. Threadless set screw and compression (gland) type fittings are not permitted.
6. At building expansion joints, use expansion type fittings.
7. Make connections to NEMA 12 boxes with a threaded hub.

D. Locknuts

1. Hardened Steel or malleable iron construction, electro zinc plated, capable of insuring positive bond to enclosure.
  - a. Non-bonding: T & B Series 142 or approved equal.
  - b. Bonding: T & B Series 107 or approved equal.

E. Bushings

1. Insulted: T & B Series 223 or approved equal.
2. Insulated Metallic Bushing: T & B Series 1223 or approved equal.
3. Insulated Grounding and Bonding Bushing: T & B Series 3871 or approved equal.

F. Couplings

1. Non-metallic Conduit Coupling: By non-metallic conduit manufacturer for the application.
2. Threaded Rigid Metal Conduit Couplings: By conduit manufacturer for the application.
3. Threadless Coupling: "Erickson" Type Y & B Series 676 or approved equal.
4. Expansion Type: Permit  $\frac{3}{4}$  inch movement any direction.
  - a. Exposed: Weatherproof with external bonding jumper.

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- b. Embedded: Watertight with internal bonding jumper.

G. Connectors

- 1. Non-Metallic Conduit Connector: By conduit manufacturer for the application.
- 2. Threaded Hubs: Electro zinc coated with nylon insulated throat and oil/moisture resistant recessed sealing ring, raintight.
  - a. Non-bonding: T & B Series 371 or approved equal.
  - b. Bonding: T & B Series 371 with 107 series bonding locknut or approved equals.

H. Nipple: "Chase" Type, insulated: T & B Series 5263 or approved equal.

I. Sealing Gaskets: Oil and moisture resistant rubber bonded to metallic retainer.

- 1. With rigid conduit – T & B Series 5303 or approved equal.
- 2. Fittings not specifically listed but required shall be of similar style and quality.

2.04 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:

- 1. Allied Tube & Conduit, a division of Atkore International:  
[www.alliedeg.com/#sle](http://www.alliedeg.com/#sle).
- 2. Nucor Tubular Products: [www.nucortubular.com/#sle](http://www.nucortubular.com/#sle).
- 3. Western Tube, a division of Zekelman Industries:  
[www.westerntube.com/#sle](http://www.westerntube.com/#sle).
- 4. Wheatland Tube, a division of Zekelman Industries:  
[www.wheatland.com/#sle](http://www.wheatland.com/#sle).
- 5. Or approved equal.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:

- 1. Manufacturers:
  - a. Bridgeport Fittings, LLC: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).

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- b. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
- c. Or approved equal.
- 2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
- 3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
- 4. Material: Use steel or malleable iron.
  - a. Do not use die cast zinc fittings.
- 5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
- D. Conduit Size: Comply with NFPA 70.
  - 1. Exposed: Use rigid steel conduit or intermediate metal conduit for installation up to 8 feet.

## 2.05 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers:
  - 1. AFC Cable Systems, Inc: [www.afcweb.com/#sle](http://www.afcweb.com/#sle).
  - 2. Electri-Flex Company: [www.electriflex.com/#sle](http://www.electriflex.com/#sle).
  - 3. International Metal Hose: [www.metalhose.com/#sle](http://www.metalhose.com/#sle).
  - 4. Or approved equal.
- B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.
- C. Fittings:
  - 1. Manufacturers:
    - a. ABB; T&B: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
    - b. Bridgeport Fittings, LLC: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
    - c. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).



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- d. Or approved equal.
- 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
- 3. Material: Use steel or malleable iron.
  - a. Do not use die cast zinc fittings.
- D. Description: Interlocked steel construction.
- E. Connectors and Fittings: NEMA FB 1.
  - 1. Flexible metal conduit connector – Insulated throat, suitable as grounding means: T & B Series 3115.

## 2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers:
  - 1. AFC Cable Systems, Inc: [www.afcweb.com/#sle](http://www.afcweb.com/#sle).
  - 2. Electri-Flex Company: [www.electriflex.com/#sle](http://www.electriflex.com/#sle).
  - 3. International Metal Hose: [www.metalhose.com/#sle](http://www.metalhose.com/#sle).
  - 4. Or approved equal.
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
  - 1. Manufacturers:
    - a. ABB; T&B: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
    - b. Bridgeport Fittings, LLC: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
    - c. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
    - d. Or approved equal.
  - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 3. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.

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D. Description: Interlocked steel construction with PVC jacket.

E. Fittings: NEMA FB 1.

## 2.07 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube & Conduit: [www.alliedeg.com/#sle](http://www.alliedeg.com/#sle).
2. Nucor Tubular Products: [www.nucortubular/#sle](http://www.nucortubular/#sle).
3. Rymco USA: [www.rymcousa.com/#sle](http://www.rymcousa.com/#sle).
4. Western Tube, a division of Zekelman Industries:  
[www.westerntube.com/#sle](http://www.westerntube.com/#sle).
5. Beck Manufacturing, Inc: [www.beckmfg.com](http://www.beckmfg.com).
6. Wheatland Tube Company: [www.wheatland.com/#sle](http://www.wheatland.com/#sle).
7. Or Equal.\_\_\_\_\_.

B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:

1. Manufacturers:
  - a. Bridgeport Fittings, LLC: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
  - b. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
  - c. Or approved equal.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
  - a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use compression/gland type.
  - a. Do not use indenter type connectors and couplings.
  - b. Do not use set-screw type connectors and couplings.
  - c. EMT Coupling: Raintight T & B Series 5220 or approved equal.

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- d. EMT to Rigid Metal Conduit Connector, Raintight: T & B Series 531 or approved equal.
- 5. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.
- 6. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.
- D. Description: ANSI C80.3; galvanized tubing.
- E. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression type.

## 2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Manufacturers:
  - 1. Cantex Inc: [www.cantexinc.com/#sle](http://www.cantexinc.com/#sle).
  - 2. JM Eagle: [www.jmeagle.com/#sle](http://www.jmeagle.com/#sle).
  - 3. Or approved equal.
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- C. Fittings:
  - 1. Manufacturer: Same as manufacturer of conduit to be connected.
  - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

## 2.09 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

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- D. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- E. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.
- F. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.
  - 1. Internal to fittings
    - a. Approved by manufacturer for application.
  - 2. Manufacturer
    - a. Crouse-Hinds Chico A-P and Chico X fiber.
    - b. O.Z. Gedney.
    - c. Or approved equal.
- G. Sealing Systems for Concrete Penetrations:
  - 1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
  - 2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.
- H. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
  - 1. Products:
    - a. Menzies Metal Products; Electrical Roof Stack and Cap: [www.menzies-metal.com/#sle](http://www.menzies-metal.com/#sle).
    - b. Menzies Metal Products; Electrical Retro Box: [www.menzies-metal.com/#sle](http://www.menzies-metal.com/#sle).
    - c. Or approved equal.
- I. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
  - 1. Products:

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- a. Quickflash Weatherproofing Products, Inc:  
[www.quickflashproducts.com/#sle](http://www.quickflashproducts.com/#sle).
  - b. Or approved equal.
- J. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
- 1. Products:
    - a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: [www.holdrite.com/#sle](http://www.holdrite.com/#sle).
    - b. Or approved equal.
- K. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.
- 1. Products:
    - a. Advance Products & Systems, LLC; Duct Bank Spacers:  
[www.apsonline.com/#sle](http://www.apsonline.com/#sle).
    - b. Or approved equal.
- L. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for casing and conduit/duct arrangement to be installed.
- 1. Products:
    - a. Advance Products & Systems, LLC; Bore Spacers:  
[www.apsonline.com/#sle](http://www.apsonline.com/#sle).
    - b. Or approved equal.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify routing and termination locations of conduit prior to rough-in.

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- E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
- E. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by manufacturer.
- G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- H. Conduit Routing:
  - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
  - 2. When conduit destination is indicated without specific routing, determine exact routing required.
  - 3. Conceal conduits unless specifically indicated to be exposed.
  - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
    - a. Electrical rooms.
    - b. Mechanical equipment rooms.
    - c. Within joists in areas with no ceiling.
  - 5. Unless otherwise approved, do not route exposed conduits:
    - a. Across floors.
    - b. Across roofs.
    - c. Across top of parapet walls.
    - d. Across building exterior surfaces.

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6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
  7. Arrange conduit to maintain adequate headroom, clearances, and access.
  8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
  9. Arrange conduit to provide no more than 150 feet between pull points.
  10. Route conduits above water and drain piping where possible.
  11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
  12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
  13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    - a. Heaters.
    - b. Hot water piping.
    - c. Flues.
  14. Group parallel conduits in same area on common rack.
- I. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 05 29.
  2. Provide required vibration isolation and/or seismic controls; see Section 26 05 48.
  3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
  4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
  5. Use conduit strap to support single surface-mounted conduit.

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- a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
  6. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
  7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
  8. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
  9. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
  10. Use of spring steel conduit clips for support of conduits is not permitted.
    - a. Support of electrical metallic tubing (EMT) up to 1-inch (27 mm) trade size concealed above accessible ceilings and within hollow stud walls.
  11. Use of wire for support of conduits is not permitted.
    - a. For securing conduits to studs in hollow stud walls.
    - b. For suspending conduits supported by spring steel conduit clips, where specifically indicated or permitted.
  12. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.
- J. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
  2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
  3. Use suitable adapters where required to transition from one type of conduit to another.
  4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
  5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.



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6. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
8. Secure joints and connections to provide mechanical strength and electrical continuity.

K. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
8. Provide metal escutcheon plates for conduit penetrations exposed to public view.

L. Underground Installation:

1. Minimum Cover, Unless Otherwise Indicated or Required:
  - a. Underground, Exterior: 18 inches.
  - b. Under Slab on Grade: 12 inches to bottom of slab.
2. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 26 05 53.

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- M. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Maximum Conduit Size: 1-inch trade size unless otherwise approved.
  2. Minimum Conduit Spacing: As indicated on drawings.
  3. Install conduits within middle one third of slab thickness.
  4. Secure conduits to prevent floating or movement during pouring of concrete.
- N. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
  2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
  3. Where calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
  4. Where conduits are subject to earth movement by settlement or frost.
- O. Conduit Sealing:
1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
    - a. Where conduits enter building from outside.
    - b. Where service conduits enter building from underground distribution system.
    - c. Where conduits enter building from underground.
    - d. Where conduits may transport moisture to contact live parts.
  2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:

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- a. Where conduits pass from outdoors into conditioned interior spaces.
- b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- P. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- Q. Provide grounding and bonding; see Section 26 05 26.
- R. Identify conduits; see Section 26 05 53.

### 3.03 FIELD QUALITY CONTROL

- A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- B. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- C. Correct deficiencies and replace damaged or defective conduits.

### 3.04 EMPTY CONDUITS

- A. Certain conduits will have no conductors pulled in as a part of this contract. Identify with tags at each end of the origin and destination of each such empty conduits. Provide a permanent cap over each end of each empty conduit. Provide a nylon pull wire in each empty conduit, tie off at both ends.

### 3.05 TESTING AND INSPECTION

- A. So not cover up conduit work until inspected. Notify the Owner's Representative at least 3 days before desired inspection date.

### 3.06 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

### 3.07 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

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- B. All conduits shall be run concealed in walls and/or ceiling. Where conduits can not be run concealed in wall and/or ceiling space, the Contractor shall coordinate with the architectural and structural plans and the Architect for installing and routing of exposed conduits.

3.08 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements.

END OF SECTION 26 05 33.13

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SECTION 26 05 33.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Scope: Provide boxes, pull boxes, racks, and enclosures as shown on drawings or as required by code(s).
- B. Section Includes:
- C. Boxes and enclosures for integrated power, data, and audio/video.
- D. Boxes for hazardous (classified) locations.
- E. Floor boxes.
- F. Underground boxes/enclosures.
- G. Accessories.
- H. Wall and ceiling outlet boxes.
- I. Floor boxes.
- J. Pull and junction boxes.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 33.13 - Conduit for Electrical Systems:
  - 1. Conduit bodies and other fittings.
  - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- D. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 27 26 - Wiring Devices:
  - 1. Wall plates.
  - 2. Floor box service fittings.

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- 3. Poke-through assemblies.
- 4. Access floor boxes.
- 5. Additional requirements for locating boxes for wiring devices.
- G. Section 26 28 13 - Fuses: Spare fuse cabinets.
- H. The requirements of the kitchen equipment consultant plans and specifications.

### 1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).
- F. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013 (Reaffirmed 2020).
- G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. SCTE 77 - Specifications for Underground Enclosure Integrity; 2017.
- J. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- K. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- L. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.
- M. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.
- N. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.
- O. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

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#### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

B. Samples:

1. Floor Boxes: Provide one sample(s) of each floor box proposed for substitution upon request.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of

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product.

- D. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. Keys for Lockable Enclosures: Two of each different key.

#### 1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

### PART 2 PRODUCTS

#### 2.01 BOXES

- A. General Requirements:
  - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
  - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
  - 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
  - 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
  - 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.



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B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
4. Use cast aluminum boxes where aluminum rigid metal conduit is used.
5. Use nonmetallic boxes where exposed rigid PVC conduit is used.
6. Use suitable concrete type boxes where flush-mounted in concrete.
7. Use suitable masonry type boxes where flush-mounted in masonry walls.
8. Use raised covers suitable for the type of wall construction and device configuration where required.
9. Use shallow boxes where required by the type of wall construction.
10. Do not use "through-wall" boxes designed for access from both sides of wall.
11. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
12. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
13. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
14. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
15. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
16. Minimum Box Size, Unless Otherwise Indicated:

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- a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
  - b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
  - c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
17. Wall Plates: Comply with Section 26 27 26.
18. Manufacturers:
- a. Cooper Crouse-Hinds, a division of Eaton Corporation:  
[www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
  - b. Hubbell Incorporated; Bell Products: [www.hubbell-rtb.com/#sle](http://www.hubbell-rtb.com/#sle).
  - c. Hubbell Incorporated; RACO Products; \_\_\_\_\_: [www.hubbell-rtb.com/#sle](http://www.hubbell-rtb.com/#sle).
  - d. O-Z/Gedney, a brand of Emerson Electric Co; \_\_\_\_\_:  
[www.emerson.com/#sle](http://www.emerson.com/#sle).
  - e. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
  - f. Or equal.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
- 1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
  - 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
    - a. Indoor Clean, Dry Locations: Type 1, painted steel.
    - b. Outdoor Locations: Type 3R, painted steel.
    - c. Kitchens and food prep. Locations: Type 4X, stainless steel, unpainted.
  - 3. Junction and Pull Boxes Larger Than 100 cubic inches:
    - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

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- b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
- 4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
  - a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
  - b. Back Panels: Painted steel, removable.
  - c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
- 5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
- 6. Manufacturers:
  - a. Cooper B-Line, a division of Eaton Corporation:  
[www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
  - b. Hoffman, a brand of Pentair Technical Products:  
[www.hoffmanonline.com/#sle](http://www.hoffmanonline.com/#sle).
  - c. Hubbell Incorporated; Wiegmann Products: [www.hubbell-wiegmann.com/#sle](http://www.hubbell-wiegmann.com/#sle).
  - d. Or equal.
- D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.
  - 1. Manufacturers:
    - a. Hubbell Incorporated; \_\_\_\_\_: [www.hubbell.com/#sle](http://www.hubbell.com/#sle).
    - b. Or approved equal.
- E. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.
  - 1. Manufacturers:
    - a. Appleton, a brand of Emerson Electric Co; \_\_\_\_\_:  
[www.emerson.com/#sle](http://www.emerson.com/#sle).

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- b. Cooper Crouse-Hinds, a division of Eaton Corporation:  
[www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
- c. Hubbell Incorporated; Killark Products: [www.hubbell-killark.com/#sle](http://www.hubbell-killark.com/#sle).
- d. Or approved equal.

F. Floor Boxes:

- 1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 27 26; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
- 2. Use cast iron floor boxes within slab on grade.
- 3. Use sheet-steel or cast iron floor boxes within slab above grade.
- 4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
- 5. Manufacturer: Same as manufacturer of floor box service fittings.

G. Underground Boxes/Enclosures:

- 1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
- 2. Size: As indicated on drawings.
- 3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
- 4. Provide logo on cover to indicate type of service.
- 5. Applications:
  - a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
  - b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
  - c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.

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6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
  - a. Manufacturers:
    - 1) Hubbell Incorporated; Quazite Products:  
[www.hubbellpowersystems.com/#sle](http://www.hubbellpowersystems.com/#sle).
    - 2) MacLean Highline: [www.macleanhighline.com/#sle](http://www.macleanhighline.com/#sle).
    - 3) Oldcastle Precast, Inc: [www.oldcastleprecast.com/#sle](http://www.oldcastleprecast.com/#sle).
    - 4) Or equal.
  - b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.
  - c. Product(s):
    - 1) MacLean Highline PHA Series: Straight wall, all-polymer concrete splice box/pull box; available Tier 8, Tier 15, and Tier 22 load ratings.
      - (a) 11 by 18 by 12 inches nominal; Model PHA111812 (stackable).
    - 2) MacLean Highline CHA Series: Fiberglass/polymer concrete splice box/pull box; available Tier 8 and Tier 15 load ratings.
      - (a) 11 by 18 by 12 inches nominal; Model CHA111812.
    - 3) MacLean Highline CVA Series: Fiberglass/polymer concrete splice vault; available Tier 8, Tier 15, and Tier 22 load ratings.
      - (a) 30 by 48 by 18 inches nominal; Model CVA304818.
    - 4) Or approved equal.

## 2.02 ACCESSORIES

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.
  1. Manufacturers:
    - a. Quickflash Weatherproofing Products, Inc:  
[www.quickflashproducts.com/#sle](http://www.quickflashproducts.com/#sle).

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- b. Or approved equal.

## 2.03 MANUFACTURERS

- A. Appleton Electric: [www.appletonelec.com](http://www.appletonelec.com).
- B. Arc-Co./Division of Arcade Technology; Model \_\_\_\_\_: [www.arc-co.com](http://www.arc-co.com).
- C. Unity Manufacturing: [www.unitymfg.com](http://www.unitymfg.com).
- D. Or approved equal.

## 2.04 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
  - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
  - 2. Concrete Ceiling Boxes: Concrete type.
- B. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.
- C. Wall Plates for Finished Areas: As specified in Section 26 27 26.

## 2.05 FLOOR BOXES

- A. Floor Boxes: NEMA OS 1, fully adjustable, 1-1/2 inches deep.
- B. Material: Cast metal.
- C. Shape: Round.
- D. Service Fittings: As specified in Section 26 27 26.

## 2.06 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
  - 1. Material: Galvanized cast iron.
  - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.
- C. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:

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1. Material: Galvanized cast iron.
2. Cover: Smooth cover with neoprene gasket and stainless steel cover screws.
3. Cover Legend: "ELECTRIC".

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Boxes are indicated in approximate locations only on the drawings unless specifically dimensioned. Verify all box locations prior to rough-in.
- C. Verify that mounting surfaces are ready to receive boxes.
- D. Verify that conditions are satisfactory for installation prior to starting work.
- E. Verify locations of floor boxes and outlets prior to rough-in.
- F. Verify locations of all boxes required for kitchen equipment with kitchen consultant plans and specifications.

### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Box Locations:

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1. Locate boxes to be accessible. Provide access panels as required where approved by the Architect.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes as required for devices installed under other sections or by others.
  - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26.
4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.
6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
  - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
  - b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 33.13.
11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
  - a. Concealed above accessible suspended ceilings.



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- b. Within joists in areas with no ceiling.
- c. Electrical rooms.
- d. Mechanical equipment rooms.
- I. Box Supports:
  - 1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
  - 2. Provide required seismic controls in accordance with Section 26 05 48.
  - 3. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
  - 4. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
  - 5. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- J. Install boxes plumb and level.
- K. Flush-Mounted Boxes:
  - 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
  - 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
  - 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- L. Floor-Mounted Cabinets: Mount on properly sized 3 inch high concrete pad.
- M. Install boxes as required to preserve insulation integrity.
- N. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

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- O. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.
- P. Underground Boxes/Enclosures:
  - 1. Install enclosure on gravel base, minimum 6 inches deep.
  - 2. Flush-mount enclosures located in concrete or paved areas.
  - 3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
  - 4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.
- Q. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- R. Install firestopping to preserve fire resistance rating of partitions and other elements.
- S. Close unused box openings.
- T. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- U. Provide grounding and bonding in accordance with Section 26 05 26.
- V. Identify boxes in accordance with Section 26 05 53.
- W. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.
- X. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 72.
- Y. Coordinate installation of outlet boxes for equipment connected under Section 26 27 17.
- Z. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
- AA. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
  - 1. Adjust box locations up to 10 feet if required to accommodate intended purpose.

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- BB. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- CC. Maintain headroom and present neat mechanical appearance.
- DD. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- EE. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- FF. Install boxes to preserve fire resistance rating of partitions and other elements.
- GG. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- HH. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- II. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- JJ. Use flush mounting outlet box in finished areas.
- KK. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- LL. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in fire-rated and acoustic rated walls.
- MM. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- NN. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- OO. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- PP. Use adjustable steel channel fasteners for hung ceiling outlet box.
- QQ. Do not fasten boxes to ceiling support wires.
- RR. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.
- SS. Use gang box where more than one device is mounted together. Do not use sectional box.

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TT. Use gang box with plaster ring for single device outlets.

UU. Use cast outlet box in exterior locations exposed to the weather and wet locations.

VV. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

WW. Set floor boxes level.

XX. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

### 3.03 ADJUSTING

A. Adjust floor boxes flush with finish flooring material.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused box openings.

### 3.04 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

### 3.05 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 26 05 33.16

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SECTION 26 05 48 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL  
SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Seismic control requirements.
  - 1. Includes requirements for seismic qualification of equipment not specified in this section.
- C. Vibration-isolated equipment support bases.
- D. Vibration isolators.
- E. External seismic snubber assemblies.
- F. Anchoring and seismic restraint systems.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00 - Common Work Results for Electrical.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

1.03 SYSTEM DESCRIPTION

- A. Design Requirements
  - 1. Provide the work in compliance with CCR Title 24, Part 2, State Chapters, Drawings, and calculations to be stamped and signed by a California licensed structural engineer.
  - 2. Provide seismic restraints for the listed materials and equipment. The attachments shall resist forces to the center of gravity of the component. Criteria shall be the operating weight of the item times 0.5g for horizontal force to be applied in any direction. Wall-mounted or suspended components shall in addition, resist a downward force of 200 pounds minimum added to the operating weight of the component.

1.04 DEFINITIONS

- A. Electrical Component: Where referenced in this section in regards to seismic controls, applies to any portion of the electrical system subject to seismic evaluation in accordance with applicable codes, including distributed systems

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(e.g., conduit, cable tray).

- B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

#### 1.05 REFERENCE STANDARDS

- A. ASTM E2265-2003 – Standard Terminology for Anchors and Fasteners in Concrete and Masonry.
- B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- C. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.
- D. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.
- E. 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; 2022.
- F. FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.
- G. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage; 2012.
- H. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components; 2010, with Editorial Revision (2020).
- J. MFMA-4 - Metal Framing Standards Publication; 2004.
- K. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### 1.06 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

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1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
  2. Coordinate the work with other trades to provide additional framing and materials required for installation.
  3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
  4. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
  5. Seismic Controls:
    - a. Coordinate the arrangement of seismic restraints with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
    - b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
  6. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured.

#### 1.07 SUBMITTALS

- A. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
  2. Seismic Controls: Include seismic load capacities.
- C. Shop Drawings - Vibration Isolation Systems:

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1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
  2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.
- D. Shop Drawings - Seismic Controls:
1. Include dimensioned plan views and sections indicating proposed electrical component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
  2. Identify mounting conditions required for equipment seismic qualification.
  3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
  4. Indicate proposed arrangement of distributed system trapeze support groupings.
  5. Indicate proposed locations for distributed system flexible fittings and/or connections.
  6. Indicate locations of seismic separations where applicable.
  7. Include point load drawings indicating design loads transmitted to structure at each attachment location.
- E. Seismic Design Data:
1. Compile information on project-specific characteristics of actual installed electrical components necessary for determining seismic design forces required to design appropriate seismic controls, including but not limited to the following.
    - a. Component operating weight and center of gravity.
    - b. Component elevation in the building in relation to the roof elevation (z/h).
    - c. Component importance factor ( $I_p$ ).



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- d. For distributed systems, component materials and connection methods.
  - e. Component amplification factor ( $a_p$ ) and component response modification factor ( $R_p$ ), determined in accordance with ASCE 7 tables.
  - f. Applicability of overstrength factor (for certain anchorage in concrete and masonry).
2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.
- F. Certification for seismically qualified equipment; identify basis for certification.
  - G. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.
  - H. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
  - I. Evidence of qualifications for seismic controls designer.
  - J. Evidence of qualifications for manufacturer.
  - K. Manufacturer's detailed field testing and inspection procedures.
  - L. Field quality control test reports.

#### 1.08 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- D. Seismic Controls Designer Qualifications: Registered professional engineer licensed in California and with minimum five years experience designing seismic restraints for nonstructural components.
  - 1. Designer may be employed by the manufacturer of the seismic restraint products.

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- E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

#### 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

### PART 2 PRODUCTS

#### 2.01 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing electrical equipment and/or electrical connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
  - 1. Select vibration isolators to provide required static deflection.
  - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
  - 3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
  - 4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
  - 5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.
- D. Conduit Isolation:
  - 1. Use flexible conduit or cable for electrical connections to vibration-isolated equipment, including equipment installed under other sections or by others.
    - a. Minimum Length: 3 feet unless otherwise indicated.
  - 2. Vibration Isolators:

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- a. Provide vibration isolators for conduit supports:
  - 1) Located within 50 feet of connected vibration-isolated equipment where flexible connection to equipment is not possible.
  - 2) For conduits over 2 inch trade size located below or within 50 feet of noise-sensitive areas indicated.
- b. Minimum Static Deflection:
  - 1) First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.
  - 2) Remainder of Supports: 0.75 inch deflection unless otherwise indicated.
- c. Suspended Conduits, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
- d. Suspended Conduits, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
- e. Use modular seal or approved resilient material where vibration-isolated conduits penetrate building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.

## 2.02 SEISMIC CONTROL REQUIREMENTS

- A. Design and provide electrical component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor electrical components.
- B. Seismic Design Criteria: ICC (IBC)/ASCE 7.
- C. Component Importance Factor ( $I_p$ ): Electrical components to be assigned a component importance factor ( $I_p$ ) of 1.5 unless otherwise indicated.
- D. Seismic Qualification of Equipment:
  - 1. Provide special certification for electrical equipment furnished under other sections and assigned a component importance factor ( $I_p$ ) of 1.5, certifying that equipment will remain operable following a design level earthquake.

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2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
3. Notify LP Consulting Engineers, Inc. and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.

E. Seismic Restraints:

1. Provide seismic restraints for electrical components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
2. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
  - a. ASHRAE (HVACA).
  - b. FEMA 413.
  - c. FEMA E-74.
  - d. SMACNA (SRM).
3. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
4. Seismic Type Vibration Isolators:
  - a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
5. External Seismic Snubber Assemblies:
  - a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).

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- b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.

6. Seismic Restraint Systems:

- a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
- b. Use only cable restraints to restrain vibration-isolated electrical components, including distributed systems.
- c. Use only one restraint system type for a given electrical component or distributed system (e.g., conduit, cable tray) run; mixing of cable and rigid restraints on a given component/run is not permitted.
- d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain electrical component in all lateral directions; consider bracket geometry in anchor load calculations.
- e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported electrical component weight.
- f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported electrical component weight.
- g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
- h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
- i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.
- j. Manufacturer's certified seismic restraint design may be submitted as an alternative to project-specific design and documentation, subject to approval of authorities having jurisdiction.

F. Seismic Attachments:

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1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
  2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
  3. Do not use power-actuated fasteners.
  4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.
  5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
  6. Concrete Housekeeping Pads:
    - a. Increase size of pad as required to comply with anchor requirements.
    - b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.
- G. Seismic Interactions:
1. Include provisions to prevent seismic impact between electrical components and other structural or nonstructural components.
  2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.
  3. Comply with minimum clearance requirements between electrical equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs.
- H. Seismic Relative Displacement Provisions:
1. Use suitable fittings or flexible connections to accommodate:
    - a. Relative displacements at connections between components, including distributed systems (e.g., conduit, cable tray); do not exceed load limits for equipment utility connections.

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- b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
  - c. Design displacements at seismic separations.
  - d. Anticipated drifts between floors.
2. Include provisions to prevent interruption of utility service due to seismic displacements.

## 2.03 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

### A. Manufacturers:

- 1. Vibration-Isolated Equipment Support Bases:
  - a. Kinetics Noise Control, Inc: [www.kineticsnoise.com/#sle](http://www.kineticsnoise.com/#sle).
  - b. Mason Industries: [www.mason-ind.com/#sle](http://www.mason-ind.com/#sle).
  - c. Vibration Eliminator Company, Inc: [www.veco-nyc.com/#sle](http://www.veco-nyc.com/#sle).
  - d. Korfund Dynamics Corp.
  - e. Amber-Booth Co.
  - f. Consolidated Kinetics.
- 2. Source Limitations: Furnish vibration-isolated equipment support bases and associated components and accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

### B. Vibration-Isolated Structural Steel Bases:

- 1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.

### C. Vibration-Isolated Concrete Inertia Bases:

- 1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
- 2. Minimum Base Depth: 6 inches.

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3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
5. Concrete: Filled on site with minimum 3000 psi

## 2.04 VIBRATION ISOLATORS

### A. Manufacturers:

1. Vibration Isolators:
  - a. Kinetics Noise Control, Inc: [www.kineticsnoise.com/#sle](http://www.kineticsnoise.com/#sle).
  - b. Mason Industries: [www.mason-ind.com/#sle](http://www.mason-ind.com/#sle).
  - c. Vibration Eliminator Company, Inc: [www.veco-nyc.com/#sle](http://www.veco-nyc.com/#sle).
  - d. Korfund Dynamics Corp.
  - e. Amber-Booth Co.
  - f. Consolidated Kinetics.
  - g. Or approved equal.
2. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.

### B. General Requirements:

1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
2. Spring Elements for Spring Isolators:
  - a. Color code or otherwise identify springs to indicate load capacity.
  - b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
  - c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.



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- d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
  - e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
  - f. Selected to function without undue stress or overloading.
3. Seismic Snubbing Elements for Seismic Isolators:
- a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
  - b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

C. Vibration Isolators for Nonseismic Applications:

- 1. Resilient Material Isolator Pads:
  - a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
  - b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
  - c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
- 2. Resilient Material Isolator Mounts, Nonseismic:
  - a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material; fail-safe type.
- 3. Open (Unhoused) Spring Isolators:
  - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
  - b. Bottom Load Plate: Nonskid, molded, elastomeric isolator material or steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
  - c. Furnished with integral leveling device for positioning and securing supported equipment.

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4. Housed Spring Isolators:
  - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
  - b. Furnished with integral elastomeric snubbing elements, nonadjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
  - c. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
  - d. Furnished with integral leveling device for positioning and securing supported equipment.
5. Restrained Spring Isolators, Nonseismic:
  - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.
  - b. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
  - c. Furnished with integral leveling device for positioning and securing supported equipment.
  - d. Provides constant free and operating height.
6. Resilient Material Isolator Hangers, Nonseismic:
  - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.
7. Spring Isolator Hangers, Nonseismic:
  - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
  - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

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8. Combination Resilient Material/Spring Isolator Hangers, Nonseismic:
- a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.
  - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

D. Vibration Isolators for Seismic Applications:

1. Resilient Material Isolator Mounts, Seismic:
- a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.
2. Restrained Spring Isolators, Seismic:
- a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g., neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.
  - b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.
  - c. Furnished with integral leveling device for positioning and securing supported equipment.
  - d. Provides constant free and operating height.
3. Resilient Material Isolator Hangers, Seismic:
- a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.

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4. Spring Isolator Hangers, Seismic:
  - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
  - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
5. Combination Resilient Material/Spring Isolator Hangers, Seismic:
  - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) isolator material for the upper hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
  - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

## 2.05 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

### A. Manufacturers:

1. External Seismic Snubber Assemblies:
  - a. Kinetics Noise Control, Inc: [www.kineticsnoise.com/#sle](http://www.kineticsnoise.com/#sle).
  - b. Mason Industries: [www.mason-ind.com/#sle](http://www.mason-ind.com/#sle).
  - c. Vibration Eliminator Company, Inc: [www.veco-nyc.com/#sle](http://www.veco-nyc.com/#sle).
  - d. Korfund Dynamics Corp.
  - e. Amber-Booth Co.
  - f. Consolidated Kinetics.
  - g. Or approved equal.

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2. Source Limitations: Furnish external seismic snubber assemblies and associated accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.
- B. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.
- C. Seismic Snubbing Elements:
1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
  2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

## 2.06 SEISMIC RESTRAINT SYSTEMS

- A. Manufacturers:
1. Seismic Restraint Systems:
    - a. AFCON, a brand of Anvil International: [www.anvilintl.com/#sle](http://www.anvilintl.com/#sle).
    - b. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
    - c. Kinetics Noise Control, Inc: [www.kineticsnoise.com/#sle](http://www.kineticsnoise.com/#sle).
    - d. Mason Industries: [www.mason-ind.com/#sle](http://www.mason-ind.com/#sle).
    - e. Or approved equal.
  2. Source Limitations: Furnish seismic restraint system components and accessories produced by a single manufacturer and obtained from a single supplier.
- B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.
- C. Cable Restraints:
1. Comply with ASCE 19.
  2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.

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3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
  4. Use protective thimbles for cable loops where potential for cable damage exists.
- D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- C. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 CODE-REQUIRED SPECIAL INSPECTIONS

- A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or LP Consulting Engineers, Inc. and statement of special inspections as required by applicable building code.
- B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
  1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
  2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.
- C. Seismic special inspections include, but are not limited to:
  1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with certificate of compliance.
  2. Anchorage of electric equipment for emergency and standby power systems for Seismic Design Categories C, D, E, and F; periodic inspection.

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3. Anchorage of electrical equipment other than for emergency and standby power systems for Seismic Design Categories E and F; periodic inspection.
  4. Installation and anchorage of vibration isolation systems for Seismic Design Categories C, D, E, and F where Contract Documents require a nominal clearance of 1/4 inch or less between equipment support frame and seismic restraint; periodic inspection.
  5. Verification of required clearances between electrical equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs for Seismic Design Categories C, D, E, and F; periodic inspection.
- D. Seismic special inspections include, but are not limited to:
1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with certificate of compliance.
  2. Anchorage of electric equipment for emergency and standby power systems for Seismic Design Categories C, D, E, and F; periodic inspection.
  3. Anchorage of electrical equipment other than for emergency and standby power systems for Seismic Design Categories E and F; periodic inspection.
  4. Installation and anchorage of vibration isolation systems for Seismic Design Categories C, D, E, and F where Contract Documents require a nominal clearance of 1/4 inch or less between equipment support frame and seismic restraint; periodic inspection.
- E. Prior to starting work, to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.
- F. Special Inspection Agency services do not relieve from performing inspections and testing specified elsewhere.

### 3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install products in accordance with applicable requirements of NECA 1 (general workmanship).

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- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Secure fasteners according to manufacturer's recommended torque settings.
- E. Install flexible conduit and cable connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- F. Vibration Isolation Systems:
  - 1. Vibration-Isolated Equipment Support Bases:
    - a. Provide specified minimum clearance beneath base.
  - 2. Spring Isolators:
    - a. Position equipment at operating height; provide temporary blocking as required.
    - b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
    - c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
  - 3. Isolator Hangers:
    - a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
    - b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
  - 4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
  - 5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
  - 6. Adjust isolators to be free of isolation short circuits during normal operation.
  - 7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.



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G. Seismic Controls:

1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris or other obstructions.
2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
4. Equipment with Sheet Metal Housings:
  - a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
  - b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
  - c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
5. Concrete Housekeeping Pads:
  - a. Size in accordance with seismic design to meet anchor requirements.
  - b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
6. Seismic Restraint Systems:
  - a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
  - b. Install restraints within permissible angles in accordance with seismic design.
  - c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
  - d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.

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- e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

### 3.04 FIELD QUALITY CONTROL

- A. Inspect vibration isolation and/or seismic control components for damage and defects.
- B. Provide services of a manufacturer's authorized representative for vibration isolation systems and seismic controls to observe installation and assist in inspection and testing. Include manufacturer's detailed testing and inspection procedures and field reports with submittals.
- C. Vibration Isolation Systems:
  - 1. Verify isolator static deflections.
  - 2. Verify required clearance beneath vibration-isolated equipment support bases.
  - 3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.
- D. Seismic Controls:
  - 1. Verify snubbing element air gaps.
- E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.
- F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

### 3.05 ATTACHMENTS

- A. Statement of special inspections.

END OF SECTION 26 05 48

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SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Floor marking tape.
- G. Warning signs and labels.
- H. Field-painted identification of conduit.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- C. Section 26 05 73 - Power System Studies: Arc flash hazard warning labels.
- D. Section 26 27 26 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011 (Reaffirmed 2017).
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011 (Reaffirmed 2017).
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

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- E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

- 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

- B. Sequencing:

- 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
  - 2. Do not install identification products until final surface finishes and painting are complete.

#### 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

- B. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

- C. Samples:

- 1. Identification Nameplates: One of each type and color specified.
  - 2. Warning Signs and Labels: One of each type and legend specified.

- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of CEC.

- B. Conform to requirements of NFPA 70.

- C. Furnish products listed and classified by UL as suitable for the purpose specified and shown.

#### 1.07 FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

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PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.
- B. Identification for Equipment:
  - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
    - a. Panelboards:
      - 1) Identify ampere rating.
      - 2) Identify voltage and phase.
      - 3) Identify power source and circuit number. Include location when not within sight of equipment.
      - 4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
      - 5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
      - 6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
  - 2. Service Equipment:
    - a. Use identification nameplate to identify each service disconnecting means.
    - b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.

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3. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
4. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
5. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
6. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
7. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
8. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
9. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
10. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
  - a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 09 91 23 and 09 91 13.
11. Available Fault Current Documentation: Comply with Section 26 05 73. Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
  - a. Service equipment.
  - b. Industrial control panels.
  - c. Motor control centers.
  - d. Elevator control panels.
  - e. Industrial machinery.

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12. Arc Flash Hazard Warning Labels: Comply with Section 26 05 73.
  13. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
  14. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
  15. Use warning labels to identify electrical hazards for equipment, compartments, and enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
  16. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.
- C. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
  2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
  3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
    - a. At each source and load connection.
    - b. Within boxes when more than one circuit is present.
    - c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
  4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.

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5. Use underground warning tape to identify direct buried cables.

D. Identification for Raceways:

1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
  - a. Maximum Intervals: 20 feet.
2. Use voltage markers, color-coded bands, or factory-painted conduits to identify systems other than normal power system for accessible conduits.
  - a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
    - 1) Vinyl Color Coding Electrical Tape: Comply with Section 26 05 19.
    - 2) Other Owner required color coding systems.
3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
5. Use underground warning tape to identify underground raceways.
6. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.

E. Identification for Boxes:

1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color coded boxes to identify systems other than normal power system.
3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.. Install on back side of box cover.
  - a. For exposed boxes in public areas, use only identification labels.
4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal



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with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

F. Identification for Devices:

1. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.
2. Factory Pre-Marked Wallplates: Comply with Section 26 27 26.
3. Use identification label to identify fire alarm system devices.
  - a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
4. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
  - a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
5. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
6. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

G. Identification for Luminaires:

1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

H. Buried Electrical Lines: Underground warning tapes.

I. Communication Cabinets: Nameplates.

J. Conduit: Conduit markers.

K. Control Device Station: Labels.

L. Electrical Distribution and Control Equipment Enclosures: Nameplates.

2.02 MANUFACTURERS

A. Brady Corporation: [www.bradycorp.com](http://www.bradycorp.com).

B. Seton Identification Products: [www.seton.com/aec](http://www.seton.com/aec).

C. HellermannTyton: [www.hellermannntyton.com](http://www.hellermannntyton.com).

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- D. E-Z Code by T&B.
- E. Pan-Code by Panduit.
- F. Or approved equal.

## 2.03 IDENTIFICATION NAMEPLATES AND LABELS

### A. Identification Nameplates:

1. Manufacturers:
  - a. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
  - b. Kolbi Pipe Marker Co: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).
  - c. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
  - d. Or approved equal.
2. Materials:
  - a. Indoor Clean, Dry Locations: Use plastic nameplates.
  - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
  - a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

### B. Identification Labels:

1. Manufacturers:
  - a. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).

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- b. Brother International Corporation: [www.brother-usa.com/#sle](http://www.brother-usa.com/#sle).
  - c. Panduit Corp: [www.panduit.com/#sle](http://www.panduit.com/#sle).
  - d. Or approved equal.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
- a. Use only for indoor locations.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
- 1. Minimum Size: 1 inch by 2.5 inches.
  - 2. Legend:
    - a. System designation where applicable:
      - 1) Emergency Power System: Identify with text "EMERGENCY".
    - b. Equipment designation or other approved description.
    - c. Other information as indicated.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height:
    - a. System Designation: 1/2 inch.
    - b. Equipment Designation: 1/4 inch.
    - c. Other Information: 1/8 inch.
    - d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
  - 5. Color:
    - a. Normal Power System: White text on black background.
      - 1) 208Y/120 V, 3 Phase Equipment: White text on black background.
- D. Format for General Information and Operating Instructions:

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1. Minimum Size: 1 inch by 2.5 inches.
  2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 1/4 inch.
  5. Color: Black text on white background unless otherwise indicated.
    - a. Exceptions:
      - 1) Provide white text on red background for general information or operational instructions for emergency systems.
      - 2) Provide white text on red background for general information or operational instructions for fire alarm systems.
      - 3) Provide white text on black background for all other systems, unless noted otherwise.
- E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
  2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 1/2 inch.
  5. Color: Black text on yellow background unless otherwise indicated.
- F. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
  2. Legend: Power source and circuit number or other designation indicated.
    - a. Include voltage and phase for other than 120 V, single phase circuits.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 3/16 inch.
  5. Color: Black text on clear background.
- G. Format for Control Device Identification:

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1. Minimum Size: 3/8 inch by 1.5 inches.
  2. Legend: Load controlled or other designation indicated.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 3/16 inch.
  5. Color: Black text on clear background.
- H. Manufacturers:
1. Kolbi Pipe Marker Co.; Model: [www.kolbipipemarkers.com](http://www.kolbipipemarkers.com).
  2. Seton Identification Product; Model: [www.seton.com](http://www.seton.com).
  3. Or approved equal.
- I. Nameplates: Engraved three-layer laminated plastic, white letters on black background, unless noted otherwise on drawings or specifications.
- J. Locations:
1. Each electrical distribution and control equipment enclosure.
  2. Communication cabinets.
- K. Letter Size:
1. Use 1/8 inch letters for identifying individual equipment and loads.
  2. Use 1/4 inch letters for identifying grouped equipment and loads.
- L. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background. Use only for identification of individual wall switches and receptacles, control device stations.

## 2.04 WIRE AND CABLE MARKERS

- A. Manufacturers:
1. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
  2. Seton Identification Products: [www.seton.com](http://www.seton.com).
  3. HellermannTyton: [www.hellermanntyton.com/#sle](http://www.hellermanntyton.com/#sle).
  4. Panduit Corp: [www.panduit.com/#sle](http://www.panduit.com/#sle).
  5. Or approved equal.

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- B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, or plastic sleeve type markers suitable for the conductor or cable to be identified.
- C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- D. Legend: Power source and circuit number or other designation indicated.
- E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
  - 1. Do not use handwritten text.
- F. Minimum Text Height: 1/8 inch.
- G. Color: Black text on white background unless otherwise indicated.
- H. Description: Vinyl cloth type self-adhesive wire markers.
- I. Description: Cloth type wire markers.
- J. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, and junction boxes each load connection.
- K. Legend:
  - 1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
  - 2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on drawings.

## 2.05 VOLTAGE MARKERS

- A. Manufacturers:
  - 1. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
  - 2. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
  - 3. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 4. HellermannTyton: [www.hellermannntyton.com](http://www.hellermannntyton.com).
  - 5. Or approved equal.
- B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

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- C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- D. Minimum Size:
  - 1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
  - 2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
  - 3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
  - 4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.
- E. Legend:
  - 1. Markers for Voltage Identification: Highest voltage present.
  - 2. Markers for System Identification:
    - a. Emergency Power System: Text "EMERGENCY".
    - b. Other Systems: Type of service.
- F. Color: Black text on orange background unless otherwise indicated.
- G. Location: Furnish markers for each conduit longer than 6 feet.
- H. Spacing: 20 feet on center.

## 2.06 UNDERGROUND WARNING TAPE

- A. Manufacturers:
  - 1. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
  - 2. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
  - 3. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 4. HellermannTyton: [www.hellermannntyton.com](http://www.hellermannntyton.com).
  - 5. Or approve equal.
- B. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

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- D. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.
- E. Legend: Type of service, continuously repeated over full length of tape.
- F. Color:
  - 1. Tape for Buried Power Lines: Black text on red background.
  - 2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

## 2.07 FLOOR MARKING TAPE

- A. Manufacturers:
  - 1. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
  - 2. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
  - 3. Insite Solutions, LLC: [www.stop-painting.com/#sle](http://www.stop-painting.com/#sle).
  - 4. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 5. Or approved equal..
- B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlamine, 3 inches wide, with alternating black and white stripes.

## 2.08 WARNING SIGNS AND LABELS

- A. Manufacturers:
  - 1. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
  - 2. Clarion Safety Systems, LLC: [www.clarionsafety.com/#sle](http://www.clarionsafety.com/#sle).
  - 3. Insite Solutions, LLC: [www.stop-painting.com/#sle](http://www.stop-painting.com/#sle).
  - 4. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 5. Or approved equal.
- B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- C. Warning Signs:
  - 1. Materials:



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- a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
  - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
  2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
  3. Minimum Size: 7 by 10 inches unless otherwise indicated.
- D. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
    - a. Do not use labels designed to be completed using handwritten text.
  2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
  3. Minimum Size: 2 by 4 inches unless otherwise indicated.
- E. Floor Signs:
1. Materials: Use factory preprinted, self-adhesive vinyl, polyester, or rubber labels with protective overlamine; removable.
  2. Minimum Size: 17-inch diameter unless otherwise indicated.
- F. Description: 3 inch wide polyethylene tape, detectable type colored red with suitable warning legend describing buried electrical lines.
- G. Description: 4 inch wide plastic tape, detectable type colored red with suitable warning legend describing buried electrical lines.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.
- B. Degrease and clean surfaces to receive nameplates and labels.

### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.

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- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
  - 1. Surface-Mounted Equipment: Enclosure front.
  - 2. Flush-Mounted Equipment: Enclosure front.
  - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
  - 4. Elevated Equipment: Legible from the floor or working platform.
  - 5. Branch Devices: Adjacent to device.
  - 6. Interior Components: Legible from the point of access.
  - 7. Conduits: Legible from the floor.
  - 8. Boxes: Outside face of cover.
  - 9. Conductors and Cables: Legible from the point of access.
  - 10. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
  - 1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

### 3.03 FIELD QUALITY CONTROL

- A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

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END OF SECTION 26 05 53

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SECTION 26 05 73 - POWER SYSTEM STUDIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Requirements for Short-circuit study.
- B. Requirements for Protective device coordination study.
- C. Requirements for Arc flash and shock risk assessment.
  - 1. Includes arc flash hazard warning labels.
- D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 53 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.
- B. Section 26 21 00 - Low-Voltage Electrical Service Entrance.
  - 1. Includes Utility Company contact information.
- C. Section 26 24 13 - Switchboards.
- D. Section 26 24 16 - Panelboards.
- E. Section 26 28 13 - Fuses.
- F. Section 26 28 16.16 - Enclosed Switches.

1.03 REFERENCE STANDARDS

- A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011 (Reaffirmed 2017).
- B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants; 1993 (Reaffirmed 1999).
- C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata (2003).
- D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.

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- E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.
- F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).
- G. NEMA MG 1 - Motors and Generators; 2021.
- H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

- 1. Electrical Drawings: The electrical drawings indicate short circuit bracing and with stand values for electrical equipment and protective devices based on design information available during the design process. The available short circuit current from the serving electrical utility may or may not have been available to the engineer. The contractor shall perform their own short circuit and arc flash studies based on the information given to the contractor from the serving power utility company. If the values for equipment bracing resulting from the contractors studies are lower than what is shown on the drawings, the equipment ratings shall be lowered to the appropriate values and a credit shall be provided to the Owner.
- 2. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.
- 3. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
- 4. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Pre-Study Meeting: Conduct meeting with Owner to discuss system operating modes and conditions to be considered in studies.

C. Sequencing:

- 1. Submit study reports prior to or concurrent with product submittals.

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2. Do not order equipment until matching study reports and product submittals have both been evaluated by LP Consulting Engineers, Inc..
  3. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels (where applicable).
- D. Scheduling:
1. Arrange access to existing facility for data collection with Owner.
  2. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner and receive approval prior to proceeding.

#### 1.05 SUBMITTALS

- A. Study preparer's qualifications.
- B. Field testing agency's qualifications.
- C. Study reports, stamped or sealed and signed by study preparer.
- D. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
1. Include characteristic time-current trip curves for protective devices.
  2. Include impedance data for busway.
  3. Include impedance data for engine generators.
  4. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
  5. Include documentation of listed series ratings upon request.
  6. Identify modifications made in accordance with studies that:
    - a. Can be made at no additional cost to Owner.
    - b. As submitted will involve a change to the contract sum.
- E. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.
- F. Site-specific arc flash hazard warning labels.

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- G. Field quality control reports.
- H. Certification that field adjustable protective devices have been set in accordance with requirements of studies.
- I. Project Record Documents: Revise studies as required to reflect as-built conditions.
  - 1. Include hard copies with operation and maintenance data submittals.
  - 2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

#### 1.06 POWER SYSTEM STUDIES

- A. Scope of Studies to be provided by the Contractor:
  - 1. Perform analysis of new electrical distribution system as indicated on drawings and as required by these specifications.
  - 2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
  - 3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
    - a. Known Operating Modes:
      - 1) Utility as source.
      - 2) Generator as source.
      - 3) Utility/generator in parallel.
      - 4) Bus tie breaker open/close positions.
      - 5) Maintenance settings.
- B. General Study Requirements:
  - 1. Comply with NFPA 70.
  - 2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.
- C. Data Collection:

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1. The Contractor shall compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
  - a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
    - 1) Obtain up-to-date information from Utility Company.
    - 2) Utility Company: See Section 26 21 00 for Utility Company contact information.
    - 3) Utility Company: As indicated on drawings.
    - 4) Utility Company: As indicated on rawings.
      - (a) Point of Contact: As indicated on Drawings or as determined by contractor.
      - (b) Address: As indicated on Drawings or as determined by contractor..
      - (c) Phone: As indicated on Drawings or as determined by contractor.
      - (d) Email: As indicated on Drawings or as determined by contractor..
      - (e) Utility Company Project Reference Number: As indicated on Drawings or as determined by contractor.
  - b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
  - c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
  - d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
  - e. Protective Devices:
    - 1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response



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settings, and features (e.g. zone selective interlocking).

- 2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).

- f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.

- g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

2. Existing Installations:

- a. Provide the services of field testing agency or equipment manufacturer's representative to perform field data collection.

- b. Collect data on existing electrical distribution system necessary for completion of studies, including field verification of available existing data (e.g. construction documents, previous studies). Include actual settings for field-adjustable devices.

- c. Available Existing Data:

- 1) Short circuit ratings of all existing electrical distribution equipment.

- 2) Previous short circuit studies for existing electrical distribution system if available.

- 3) One line diagram for existing electrical distribution system.

- 4) Available short circuit current at point of connection for all existing electric utility services.

D. Short-Circuit Study:

1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.

2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:

- a. Maximum utility fault currents.

- b. Maximum motor contribution.

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- c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
  - 3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.
- E. Protective Device Coordination Study:
- 1. Comply with applicable portions of IEEE 242 and IEEE 399.
  - 2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
  - 3. Analyze protective devices and associated settings for suitable margins between time-current curves to provide adequate protection for equipment and conductors while achieving full selective coordination.
- F. Arc Flash and Shock Risk Assessment:
- 1. Comply with NFPA 70E.
  - 2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
    - a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
    - b. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 using single phase bolted fault current, yielding conservative results.
  - 3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.
  - 4. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
    - a. Maximum and minimum utility fault currents.
    - b. Maximum and minimum motor contribution.

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- c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

G. Study Reports:

1. General Requirements:

- a. Identify date of study and study preparer.
- b. Identify study methodology and software product(s) used.
- c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
- d. Identify base used for per unit values.
- e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
- f. Include conclusions and recommendations.

2. Short-Circuit Study:

- a. For each scenario, identify at each bus location:
  - 1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
  - 2) Fault point X/R ratio.
  - 3) Associated equipment short circuit current ratings.
- b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.

3. Protective Device Coordination Study:

- a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
- b. For each graph include (where applicable):
  - 1) Partial single-line diagram identifying the portion of the system illustrated.
  - 2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the

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source, plotted up to the maximum available fault current at the associated bus.

- 3) Conductors: Damage curves.
- 4) Transformers: Inrush points and damage curves.
- 5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
- 6) Motors: Full load current, starting curves, and damage curves.
- 7) Capacitors: Full load current and damage curves.
- c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
  - 1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
  - 2) Include ground fault pickup and delay.
  - 3) Include fuse ratings.
  - 4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.
- d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.
4. Arc Flash and Shock Risk Assessment:
  - a. For the worst case for each scenario, identify at each bus location:
    - 1) Calculated incident energy and associated working distance.
    - 2) Calculated arc flash boundary.
    - 3) Bolted fault current.
    - 4) Arcing fault current.
    - 5) Clearing time.
    - 6) Arc gap distance.
  - b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

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- c. Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 8 calories per sq cm.

#### 1.07 QUALITY ASSURANCE

- A. Study Preparer Qualifications: Professional electrical engineer licensed in California and with minimum five years experience in the preparation of studies of similar type and complexity using specified computer software.
  - 1. Study preparer may be employed by manufacturer of electrical distribution equipment.
  - 2. Study preparer may be employed by field testing agency.
  - 3. Acceptable Study Preparers:
    - a. Equipment manufacturers.
    - b. Contractor staff licensed electrical engineer.
    - c. Contractor hired consulting licensed electrical engineer.
- B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.
  - 1. Field Supervisor: Certified electrical testing technician; NETA ETT Level III.
  - 2. Acceptable Testing Agencies:
    - a. Equipment manufacturer.
    - b. Qualified Contractor employed certified testing technician.
- C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
  - 1. Products:
    - a. EasyPower LLC: [www.easypower.com/#sle](http://www.easypower.com/#sle).
    - b. ETAP/Operation Technology, Inc: [www.etap.com/#sle](http://www.etap.com/#sle).
    - c. Power Analytics Corporation: [www.poweranalytics.com/#sle](http://www.poweranalytics.com/#sle).
    - d. SKM Systems Analysis, Inc: [www.skm.com/#sle](http://www.skm.com/#sle).

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- D. Responsibility: Provide all project-related data needed by study preparer, including equipment, wire sizes, insulation types, conduit types, and actual circuit lengths.

## PART 2 PRODUCTS

### 2.01 ARC FLASH HAZARD WARNING LABELS

- A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
1. Materials: Comply with Section 26 05 53.
  2. Minimum Size: 4 by 6 inches.
  3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
    - a. Include orange header that reads "WARNING" unless otherwise indicated.
    - b. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
    - c. Include the following information:
      - 1) Arc flash boundary.
      - 2) Available incident energy and corresponding working distance.
      - 3) Site-specific PPE (personnel protective equipment) requirements.
      - 4) Nominal system voltage.
      - 5) Limited approach boundary.
      - 6) Restricted approach boundary.
      - 7) Equipment identification.
      - 8) Study preparer, report reference, and date calculations were performed.

## PART 3 EXECUTION

### 3.01 INSTALLATION

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- A. Install arc flash warning labels in accordance with Section 26 05 53.

### 3.02 FIELD QUALITY CONTROL

- A. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Adjust equipment and protective devices for compliance with studies and recommended settings.
- D. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from studies. Obtain direction before proceeding.
- E. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

### 3.03 CLOSEOUT ACTIVITIES

- A. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.
  - 1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of eight hours of training.
  - 3. Instructor: Representative of entity performing study.
  - 4. Location: At project site.

END OF SECTION 26 05 73

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SECTION 26 05 83 - WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 05 33.13 - Conduit for Electrical Systems.
- D. Section 26 05 33.16 - Boxes for Electrical Systems.
- E. Section 26 27 26 - Wiring Devices.
- F. Section 26 28 16.16 - Enclosed Switches.

1.03 REFERENCE STANDARDS

- A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).
- B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
  - 2. Determine connection locations and requirements.
- B. Sequencing:
  - 1. Install rough-in of electrical connections before installation of equipment is required.
  - 2. Make electrical connections before required start-up of equipment.

1.05 SUBMITTALS



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- A. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

### PART 2 PRODUCTS

#### 2.01 MATERIALS

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
  - 1. Colors: Comply with NEMA WD 1.
  - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
  - 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
  - 4. Product: As noted on drawings or as required for the application.
- B. Disconnect Switches: As described and in individual equipment sections.
- C. Wiring Devices: As specified in Section 26 07 26.
- D. Flexible Conduit: As specified in Section 26 05 33.13.
- E. Wire and Cable: As specified in Section 26 05 19.
- F. Boxes: As specified in Section 26 05 33.16.

#### 2.02 EQUIPMENT CONNECTIONS

- A. Connection Types and Ratings::

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1. Electrical Connection: Flexible conduit, metallic or liquid tight flexible conduit as required by the application.
2. Electrical Connection: Cord and plug (Verify NEMA configuration and rating with equipment installer at jobsite).
3. Provide field-installed disconnect switch.
4. Voltage: Verify with equipment nameplate.
5. Load rating: Verify with equipment nameplate.
6. FLA: Verify with equipment nameplate.
7. WSA: Verify with equipment nameplate.
8. Branch Circuit: Verify with equipment nameplate.
9. Location: As indicated on drawings. Verify with equipment installer at jobsite.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

#### 3.02 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

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- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
- J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

END OF SECTION 26 05 83

## COMMISSIONING FOR ELECTRICAL

### SECTION 26 08 00 COMMISSIONING FOR ELECTRICAL

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. The provisions of Division 26 sections, Basic Electrical Requirements apply to work specified in this Section.
- C. The Work of this Section is supplemental to and does not supersede any other requirements of the Contract Documents.

##### 1.2 SUMMARY

- A. The commissioning process is described in Section 01 91 00 Commissioning.
- B. Provide all labor and materials required to complete the commissioning of those Division 26 systems and equipment identified as Commissioning Systems and Equipment in Section 01 91 00 Commissioning.
- C. Related Sections include:
  - 1. Section 01 91 00 Commissioning.
  - 2. All Sections of Division 26.

##### 1.3 SUBMITTALS

- A. Refer to Section 01 91 00 Commissioning.

#### PART 2 PRODUCTS

##### 2.1 TEST EQUIPMENT

- A. Refer to Section 01 91 00 Commissioning.

#### PART 3 EXECUTION

##### 3.1 COMMISSIONING RESPONSIBILITIES – COMMISSIONING PROVIDER

- A. Refer to Section 01 91 00 Commissioning.

##### 3.2 COMMISSIONING RESPONSIBILITIES – SUBCONTRACTOR

## COMMISSIONING FOR ELECTRICAL

- A. Refer to Section 01 91 00 Commissioning.

### 3.3 MEETINGS

- A. Refer to Section 01 91 00 Commissioning.

### 3.4 INSTALLATION, CHECK-OUT, START-UP, AND PREFUNCTIONAL CHECKLISTS

- A. Refer to Section 01 91 00 Commissioning.

### 3.5 FUNCTIONAL TESTING

- A. Refer to Section 01 91 00 Commissioning.

### 3.6 INTEGRATED SYSTEMS TESTING

- A. Refer to Section 01 91 00 Commissioning.

### 3.7 TRAINING

- A. Refer to Section 01 91 00 Commissioning.

END OF SECTION 26 08 00

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SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Occupancy sensors.
- B. Outdoor motion sensors.
- C. Time switches.
- D. In-wall time switches.
- E. In-wall interval timers.
- F. Outdoor photo controls.
- G. Daylighting controls.
- H. Lighting contactors.
- I. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems
- C. Section 26 05 33.16 - Boxes for Electrical Systems.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 05 73 - Power System Studies.
- F. Section 26 27 26 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.
  - 1. Includes finish requirements for wall controls specified in this section.
  - 2. Includes accessory receptacles, switches, dimmers and wall plates, to match lighting controls specified in this section.
- G. Section 26 28 13 - Fuses.
- H. Section 26 51 00 - Interior Lighting.
- I. Section 26 56 00 - Exterior Lighting.

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1.03 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices; current edition.
- B. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2017.
- C. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2020.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- E. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
- F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- G. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2020.
- H. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
- I. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2017.
- J. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).
- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.
- M. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.
- N. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.
- O. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.
- P. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.
- Q. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.

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- R. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters; Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation.  
Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
5. Notify the Architect and/or the Electrical Engineer of Record of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install lighting control devices until final surface finishes and painting are complete.

#### 1.05 SUBMITTALS

A. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

B. Shop Drawings:

1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.



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2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.
- C. Samples:
  1. Occupancy Sensors: One for each type and color specified.
  2. In-Wall Time Switches: One for each type and color specified.
  3. In-Wall Interval Timers: One for each type and color specified.
  4. Daylighting Control Photo Sensors: One for each type and color specified.
- D. Field Quality Control Reports.
- E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Operation and Maintenance Data: Include detailed information on device programming and setup.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. Extra Locking Receptacle-Mounted Outdoor Photo Controls: Five percent of total quantity installed for each type, but not less than two of each type.
  2. Electronic Trip Circuit Breakers: Provide one portable test set.
  3. Indicating Lights: Two of each different type.
- H. Project Record Documents: Record actual installed locations and settings for lighting control devices.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of CEC 2007.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

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- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

#### 1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

#### 1.09 WARRANTY

- A. Provide five year manufacturer warranty for all occupancy sensors.
- B. Provide five year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.
- C. Provide two year manufacturer warranty for all daylighting controls.

### PART 2 PRODUCTS

#### 2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

- A. General Requirements
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
  2. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.
  3. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

#### 2.02 OCCUPANCY SENSORS

- A. Manufacturers:
1. Hubbell Incorporated: [www.hubbell.com/#sle](http://www.hubbell.com/#sle).
  2. Intermatic, Inc; \_\_\_\_\_: [www.intermatic.com/#sle](http://www.intermatic.com/#sle).
  3. Lutron Electronics Company, Inc: [www.lutron.com/#sle](http://www.lutron.com/#sle).

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4. RAB Lighting, Inc; \_\_\_\_\_: [www.rablighting.com/#sle](http://www.rablighting.com/#sle).
5. Or approved equal..
6. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy Sensors:

1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
2. Sensor Technology:
  - a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
  - b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
  - c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
  - d. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing technologies.
3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.

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7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
  8. Sensitivity: Field adjustable.
  9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
  10. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
  11. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
  12. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.
  13. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.
  14. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
  15. Wireless Sensors:
    - a. RF Range: 30 feet through typical construction materials.
    - b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
    - c. Power: Battery-operated with minimum ten-year battery life.
- C. Wall Switch Occupancy Sensors:
1. All Wall Switch Occupancy Sensors:
    - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
    - b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.

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- c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
  - d. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
  - e. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
  - f. Provide selectable audible alert to notify occupant of impending load turn-off.
  - g. Finish: Match finishes specified for wiring devices in Section 26 27 26, unless otherwise indicated.
  - h. Provide vandal resistant lenses for passive infrared (PIR) and dual technology wall switch occupancy sensors where indicated.
2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
- a. Products:
    - 1) Lutron Maestro Series; [www.lutron.com/#sle](http://www.lutron.com/#sle).
    - 2) As indicated on drawings.
    - 3) Or approved equal.
3. Ultrasonic Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 400 square feet.
- a. Products:
    - 1) As indicated on drawings..
    - 2) Or approved equal..
4. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
- a. Products:
    - 1) Lutron Maestro Series; [www.lutron.com/#sle](http://www.lutron.com/#sle).
    - 2) As indicated on drawings.

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3) Or approved equal.

D. Wall Dimmer Occupancy Sensors:

1. General Requirements:

- a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
- b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
- c. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
- d. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
- e. Provide field adjustable dimming preset for occupied state.
- f. Provide fade-to-off operation to notify occupant of impending load turn-off.
- g. Finish: Match finishes specified for wiring devices in Section 26 27 26, unless otherwise indicated.

2. Passive Infrared (PIR) Wall Dimmer Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

a. Products:

- 1) Lutron Maestro C.L Sensor Dimmer Series; [www.lutron.com/#sle](http://www.lutron.com/#sle).
- 2) Lutron Maestro Occupancy Sensor Dimmer Series;  
[www.lutron.com/#sle](http://www.lutron.com/#sle).
- 3) Lutron Maestro 0-10V Dimmer Sensor Series;  
[www.lutron.com/#sle](http://www.lutron.com/#sle).
- 4) Or approved equal.

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E. Ceiling Mounted Occupancy Sensors:

1. All Ceiling Mounted Occupancy Sensors:
  - a. Description: Low profile occupancy sensors designed for ceiling installation.
  - b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
  - c. Provide field selectable setting for disabling LED motion detector visual indicator.
  - d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
  - e. Finish: White unless otherwise indicated.
2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
  - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
    - 1) Products:
      - (a) Lutron LOS-CIR Series; [www.lutron.com/#sle](http://www.lutron.com/#sle).
      - (b) Lutron Radio Powr Savr Wireless Sensors; [www.lutron.com/#sle](http://www.lutron.com/#sle).
      - (c) Or approved equal.
    - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
      - 1) Products:
        - (a) Lutron LOS-CIR Series; [www.lutron.com/#sle](http://www.lutron.com/#sle).
        - (b)
  3. Ultrasonic Ceiling Mounted Occupancy Sensors:
    - a. Standard Range Sensors: Capable of detecting motion within an area of 500 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

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1) Products:

(a) Lutron LOS-CUS Series; [www.lutron.com/#sle](http://www.lutron.com/#sle).

(b) Or approved equal.

- b. Medium Range Sensors: Capable of detecting motion within an area of 1,000 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

1) Products:

(a) Lutron LOS-CUS Series; [www.lutron.com/#sle](http://www.lutron.com/#sle).

(b) Or approved equal.

- c. Extended Range Sensors: Capable of detecting motion within an area of 2,000 square feet at a mounting height of 9 feet.

1) Products:

(a) Lutron LOS-CUS Series; [www.lutron.com/#sle](http://www.lutron.com/#sle).

(b) Or approved equal.

4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:

- a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

1) Products:

(a) Lutron LOS-CDT Series; [www.lutron.com/#sle](http://www.lutron.com/#sle).

(b) Or approved equal.

- b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

1) Products:

(a) Lutron LOS-CDT Series; [www.lutron.com/#sle](http://www.lutron.com/#sle).

(b) Or approved equal.



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5. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:

- a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

- 1) Products:

- (a) As indicated on drawings.

- (b) Or approved equal.

- b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet.

- 1) Products:

- (a) As indicated on drawings.

- (b) Or approved equal.

F. Directional Occupancy Sensors:

- 1. All Directional Occupancy Sensors: Designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.

- a. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.

- b. Provide field selectable setting for disabling LED motion detector visual indicator.

- c. Finish: White unless otherwise indicated.

- 2. Passive Infrared (PIR) Directional Occupancy Sensors:

- a. Standard Range Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 10 feet.

- 1) Products:

- (a) Lutron LOS-WIR Series; [www.lutron.com/#sle](http://www.lutron.com/#sle).

- (b) Lutron Radio Powr Savr Wireless Sensors; [www.lutron.com/#sle](http://www.lutron.com/#sle).

- (c) Or approved equal.

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- b. Long Range Sensors: Capable of detecting motion within a distance of 80 feet at a mounting height of 10 feet.
  - 1) Products:
    - (a) Lutron Radio Powr Savr Wireless Sensors;  
[www.lutron.com/#sle](http://www.lutron.com/#sle).
    - (b) Or approved equal.
  - c. High Bay Sensors: Capable of detecting motion within a distance of 50 feet at a mounting height of 30 feet.
    - 1) Products:
      - (a) As indicated on drawings.
      - (b) Or approved equal.
      - (c) Substitutions: See Section 01 60 00 - Product Requirements.
- 3. Passive Infrared/Ultrasonic Dual Technology Directional Occupancy Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 10 feet.
  - a. Products:
    - 1) Lutron LOS-WDT Series; [www.lutron.com/#sle](http://www.lutron.com/#sle).
    - 2) Or approved equal.
- G. Luminaire Mounted Occupancy Sensors: Designed for direct luminaire installation and control, suitable for use with specified luminaires.
  - 1. Fluorescent High Bay Luminaire Mounted Occupancy Sensors: Passive infrared (PIR) type with a field of view of 360 degrees unless otherwise indicated.
    - a. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
    - b. Finish: White unless otherwise indicated.
    - c. Circular Coverage Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 20 feet.
      - 1) Products:

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- (a) As indicated on drawings.
    - (b) Or approved equal.
  - d. Linear Aisle Coverage Sensors: Capable of detecting motion within an area of 20 feet wide by 60 feet long at a mounting height of 40 feet.
    - 1) Products:
      - (a) As indicated on drawings.
      - (b) Or approved equal.
  - e. Accessories:
    - 1) Provide mounting bracket for lowering occupancy sensor such that luminaire does not block sensor field of view where required.
- H. Power Packs for Low Voltage Occupancy Sensors:
  - 1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
  - 2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
  - 3. Input Supply Voltage: Dual rated for 120/277 V ac.
  - 4. Load Rating: As required to control the load indicated on drawings.
    - (a) \_\_\_\_\_.
- I. Power Packs for Wireless Occupancy Sensors:
  - 1. Description: Plenum rated, self-contained relay compatible with specified wireless occupancy sensors for switching of line voltage loads.
  - 2. Input Supply Voltage: Dual rated for 120/277 V ac.
  - 3. Load Rating: As required to control the load indicated on drawings.
  - 4. Provide auxiliary contact closure output where indicated.
  - 5. Rated Life of Relay: One million cycles.
  - 6. Products:

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- a. Lutron PowPak Relay Module; [www.lutron.com/#sle](http://www.lutron.com/#sle).
- b. Or approved equal.

J. Accessories:

- 1. Provide heavy duty coated steel wire protective guards compatible with specified occupancy sensors where indicated on plans.

K. OUTDOOR MOTION SENSORS

- 1. Manufacturers:
  - a. Hubbell Lighting, Inc: [www.hubbelllighting.com/#sle](http://www.hubbelllighting.com/#sle).
  - b. RAB Lighting, Inc; \_\_\_\_\_: [www.rablighting.com/#sle](http://www.rablighting.com/#sle).
  - c. Or approved equal.
  - d. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
- 2. Description: Factory-assembled wet location listed device suitable for wall or ceiling/eave mounting, with integral swivel for field adjustment of coverage, capable of detecting motion for automatic control of load indicated.
- 3. Sensor Technology: Passive Infrared (PIR) designed to detect occupancy by sensing movement of thermal energy between zones.
- 4. Operation: Unless otherwise indicated, motion sensor to turn load on when motion is detected and to turn load off when no motion is detected during an adjustable turn-off delay time interval.
- 5. Turn-Off Delay: Field adjustable, with time delay settings available up to 15 minutes.
- 6. Integral Photocell: For dusk to dawn operation.
- 7. Manual Override: Activated by switching power off to unit and then back on.
- 8. Load Rating: 1,000 W incandescent and fluorescent load at 120 V ac.
- 9. Coverage: Capable of detecting motion within a distance of 50 feet at a mounting height of 8 feet, with a field of view of 270 degrees.
- 10. Finish: Color to be selected by architect.

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11. Provide integral lamp holders suitable for two 150 watt PAR 38 lamps.

L. TIME SWITCHES

1. Manufacturers:

- a. Intermatic, Inc: [www.intermatic.com/#sle](http://www.intermatic.com/#sle).
- b. Tork, a division of NSI Industries LLC: [www.tork.com/#sle](http://www.tork.com/#sle).
- c.
- d. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2. Digital Electronic Time Switches:

- a. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
- b. Program Capability:
  - 1) 24-Hour Time Switches: Single channel, with same schedule for each day of the week and skip-a-day feature to omit selected days.
  - 2) 7-Day Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days.
  - 3) Astronomic Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
- c. Schedule Capacity: Not less than 16 programmable on/off operations.
- d. Provide automatic daylight savings time and leap year compensation.
- e. Provide power outage backup to retain programming and maintain clock.
- f. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
- g. Provide remote photocell input with light level adjustment.

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- h. Input Supply Voltage: As indicated on the drawings.
  - i. Output Switch Configuration: As required to control the load indicated on drawings.
  - j. Output Switch Contact Ratings: As required to control the load indicated on drawings.
  - k. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:
    - 1) Indoor clean, dry locations: Type 1.
    - 2) Outdoor locations: Type 3R.
  - l. Provide flush-mounted unit where indicated, where mounted in public areas, or where mounted adjacent to flush-mounted equipment.
3. Electromechanical Time Switches:
- a. Description: Factory-assembled controller with motor-operated timing dial mechanism and adjustable trippers for setting on/off operations, listed and labeled as complying with UL 917.
  - b. Program Capability:
    - 1) 24-Hour Time Switches: With same schedule for each day of the week and skip-a-day feature to omit selected days.
    - 2) 7-Day Time Switches: Capable of different schedule for each day of the week.
    - 3) Astronomic Time Switches: With same schedule for each day of the week and skip-a-day feature to omit selected days with automatic adjustment for seasonal changes in sunrise and sunset times.
  - c. Schedule Capacity:
    - 1) 24-Hour Time Switches: Accommodating not less than 12 pairs of selected on/off operations per day.
    - 2) 7-Day Time Switches: Accommodating not less than two pairs of selected on/off operations per day.
    - 3) Astronomic Time Switches: Capable of turning load on at sunset and off at either sunrise or selected fixed time.

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- d. Provide spring reserve backup to maintain clock during power outage.
- e. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
- f. Input Supply Voltage: As indicated on the drawings.
- g. Output Switch Configuration: As required to control the load indicated on drawings.
- h. Output Switch Contact Ratings: As required to control the load indicated on drawings.
- i. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:
  - 1) Indoor clean, dry locations: Type 1.
  - 2) Outdoor locations: Type 3R.
- j. Provide flush-mounted unit where indicated, where mounted in public areas, or where mounted adjacent to flush-mounted equipment.

M. IN-WALL TIME SWITCHES

- 1. Manufacturers:
  - a. Intermatic, Inc: [www.intermatic.com/#sle](http://www.intermatic.com/#sle).
  - b. Tork, a division of NSI Industries LLC: [www.tork.com/#sle](http://www.tork.com/#sle).
  - c. Or approved equal.
  - d. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
- 2. Digital Electronic In-Wall Time Switches:
  - a. Description: Factory-assembled solid state programmable controller with LCD display, suitable for mounting in standard wall box, and listed and labeled as complying with UL 916 or UL 917.
  - b. Program Capability:
    - 1) 7-Day Time Switches: Capable of different schedule for each day of the week.
    - 2) Astronomic Time Switches: Capable of different schedule for each day of the week and field-configurable astronomic feature to

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automatically adjust for seasonal changes in sunrise and sunset times.

- c. Schedule Capacity: Not less than 40 programmable on/off operations.
- d. Provide automatic daylight savings time compensation.
- e. Provide power outage backup to retain programming and maintain clock.
- f. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
- g. Switch Configuration: Suitable for use in either SPST or 3-way application.
- h. Contact Ratings: As required to control the load indicated on drawings.

3. Electromechanical In-Wall Time Switches:

- a. Description: Factory-assembled controller with motor-operated timing dial mechanism and adjustable trippers for setting on/off operations, suitable for mounting in standard wall box, and listed and labeled as complying with UL 917.
- b. Program Capability: 24-hour time switch with same schedule for each day of the week.
- c. Schedule Capacity: Accommodating not less than 24 selected on/off operations per day.
- d. Manual override: Capable of permanently overriding current schedule.
- e. Switch Configuration: SPST.
- f. Contact Ratings: As required to control the load indicated on drawings.

N. IN-WALL INTERVAL TIMERS

1. Manufacturers:

- a. Intermatic, Inc: [www.intermatic.com/#sle](http://www.intermatic.com/#sle).
- b. Tork, a division of NSI Industries LLC: [www.tork.com/#sle](http://www.tork.com/#sle).
- c. Or approved equal.



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- d. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2. Digital Electronic In-Wall Interval Timers:

- a. Description: Factory-assembled solid state programmable controller with LCD display, suitable for mounting in standard wall box, and listed and labeled as complying with UL 916 or UL 917.
- b. Program Capability: Designed to turn load off at end of preset time interval.
- c. Time Interval: Field selectable range of presets available up to 12 hours.
- d. Provide field selectable audible and visual indication to warn that end of interval operation is about to turn off load.
- e. Provide power outage backup to retain programming and maintain clock.
- f. Manual override: Capable of both turning load off and resetting timer to original preset time interval.
- g. Switch Configuration: Suitable for use in either SPST or 3-way application.
- h. Contact Ratings: As required to control the load indicated on drawings.

3. Spring Wound In-Wall Interval Timers:

- a. Description: Factory-assembled controller with mechanical spring wound timing mechanism requiring no electricity to operate; suitable for mounting in standard wall box; rotary control operator with matching wall plate factory marked with time interval units; listed and labeled as complying with UL 916 or UL 917.
- b. Program Capability: Designed to turn load off at end of preset time interval.
- c. Time Interval: User selectable from zero up to 15 minutes.
- d. Manual override: Provide hold feature to disable timer for constant on operation.
- e. Switch Configuration: SPST.

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- f. Contact Ratings: As required to control the load indicated on drawings.

O. OUTDOOR PHOTO CONTROLS

1. Manufacturers:

- a. Intermatic, Inc; \_\_\_\_: [www.intermatic.com/#sle](http://www.intermatic.com/#sle).
- b. Tork, a division of NSI Industries LLC; \_\_\_\_: [www.tork.com/#sle](http://www.tork.com/#sle).
- c. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2. Stem-Mounted Outdoor Photo Controls:

- a. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
- b. Housing: Weatherproof, impact resistant polycarbonate.
- c. Photo Sensor: Cadmium sulfide.
- d. Provide external sliding shield for field adjustment of light level activation.
- e. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
- f. Voltage: As required to control the load indicated on the drawings.
- g. Failure Mode: Fails to the on position.
- h. Load Rating: As required to control the load indicated on the drawings.
- i. Provide accessory wall-mounting bracket where indicated or as required to complete installation.

3. Locking Receptacle-Mounted Outdoor Photo Controls

- a. Description: Plug-in locking type photo control unit complying with ANSI C136.10 for mounting on a compatible receptacle, listed and labeled as complying with UL 773.
- b. Housing: Weatherproof, impact resistant UV stabilized polypropylene, color to be selected.

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- c. Photo Sensor: Cadmium sulfide.
- d. Light Level Activation: 1 to 3 footcandles turn-on and 1.5 to 1 turn-off to turn-on ratio with instant turn-on and delayed turn-off.
- e. Voltage: As required to control the load indicated on the drawings.
- f. Failure Mode: Fails to the on position.
- g. Load Rating: As required to control the load indicated on the drawings.
- h. Surge Protection: 160 joule metal oxide varistor.
- i. Provide the following accessories where indicated or as required to complete installation:
  - 1) Receptacle: Complying with ANSI C136.10.
  - 2) Mounting Bracket.
  - 3) Shorting Cap: Suitable for replacing locking photo control to complete circuit.

4. Button Type Outdoor Photo Controls

- a. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.
- b. Housing: Weather resistant polycarbonate.
- c. Photo Sensor: Cadmium sulfide.
- d. Light Level Activation: 1 to 3 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
- e. Voltage: As required to control the load indicated on the drawings.
- f. Failure Mode: Fails to the on position.
- g. Load Rating: As required to control the load indicated on the drawings.

P. DAYLIGHTING CONTROLS

- 1. Manufacturers:

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- a. Hubbell Control Solutions:  
[www.hubbell.com/hubbellcontrolsolutions/en/#sle](http://www.hubbell.com/hubbellcontrolsolutions/en/#sle).
  - b. Lutron Electronics Company, Inc: [www.lutron.com/#sle](http://www.lutron.com/#sle).
  - c. Sensor Switch Inc: [www.sensorswitch.com/#sle](http://www.sensorswitch.com/#sle).
  - d. WattStopper: [www.wattstopper.com/#sle](http://www.wattstopper.com/#sle).
  - e. Or approved equal.
  - f. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
2. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.
3. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
- a. Sensor Type: Filtered silicon photo diode.
  - b. Sensor Range:
    - 1) Indoor Photo Sensors: 5 to 100 footcandles.
    - 2) Outdoor Photo Sensors: 5 to 250 footcandles.
    - 3) Atrium Photo Sensors: 200 to 2,500 footcandles.
    - 4) Skylight Photo Sensors: 1,000 to 6,000 footcandles.
    - 5) Open Loop Photo Sensors: 3 to 6,000 footcandles.
  - c. Finish: White unless otherwise indicated.
4. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
5. Wireless Daylighting Control Photo Sensors:
- a. RF Range: 30 feet through typical construction materials.

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- b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI)  
Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
  - c. Power: Battery-operated with minimum ten-year battery life.
  - d. Products:
    - 1) Lutron Radio Powr Savr Wireless Sensors: [www.lutron.com/#sle](http://www.lutron.com/#sle).
    - 2) Or approved equal.
6. Dimming Photo Sensors: Photo sensor units with integral controller compatible with specified dimming ballasts, for direct continuous dimming of up to 50 ballasts.
7. Daylighting Control Switching Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors, for switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
- a. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
  - b. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
  - c. Control Capability:
    - 1) Single Zone Switching Modules: Capable of controlling one programmable channel.
    - 2) Multi-Zone Switching Modules: Capable of controlling up to three separately programmable channels.
- Q. Daylighting Control Switching Modules for Wireless Sensors:
- 1. Description: Plenum rated, self-contained relay compatible with specified wireless photo sensors for switching of line voltage loads in response to changes in measured light levels according to selected settings.
  - 2. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.

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3. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
  4. Control Capability: Capable of controlling one programmable channel.
  5. Input Supply Voltage: Dual rated for 120/277 V ac.
  6. Load Rating: As required to control the load indicated on drawings.
  7. Provide auxiliary contact closure output where indicated.
  8. Rated Life of Relay: One million cycles.
  9. Products:
    - a. Lutron PowPak Relay Module; [www.lutron.com/#sle](http://www.lutron.com/#sle).
    - b. Or approved equal.
  10. Daylighting Control Dimming Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors and with specified dimming ballasts, for both continuous dimming of compatible dimming ballasts and switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
    - a. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
    - b. Load to be turned off when available daylight is sufficient to fully dim the load, after the selected time delay.
    - c. Control Capability: Capable of controlling up to three separately programmable channels, with up to 50 ballasts per channel.
    - d. Dimming and Fade Rates: Adjustable from 5 to 60 seconds.
    - e. Cut-Off Delay: Selectable and adjustable from 0 to 20 minutes.
    - f. Output Voltage: Compatible with specified dimming ballasts.
- R. Daylighting Control Dimming Modules for Wireless Sensors:
1. Description: Plenum rated control unit compatible with specified wireless photo sensors and with specified dimming ballasts, for continuous dimming of compatible dimming ballasts in response to changes in measured light levels according to selected settings.

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2. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
3. Load to be turned off when available daylight is sufficient to fully dim the load, after the selected time delay.
4. Control Capability: Capable of controlling up to 32 ballasts with up to two separately programmable daylighting zones.
5. Products:
  - a. Lutron PowPak Dimming Module; [www.lutron.com/#sle](http://www.lutron.com/#sle).
  - b. Or approved equal.
6. Power Packs for Low Voltage Daylighting Control Modules:
  - a. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
  - b. Input Supply Voltage: Dual rated for 120/277 V ac.
7. Load Ratings: As required to control the load indicated on drawings.
8. Accessories:
  - a. Where indicated, provide compatible accessory wall switches for manual override control.
9. Where indicated, provide compatible accessory wireless controls for manual override control.
  - a. Products:
    - 1) Lutron Pico Wireless Controls; [www.lutron.com/#sle](http://www.lutron.com/#sle).
    - 2) Or approved equal.

S. LIGHTING CONTACTORS

1. Manufacturers:
  - a. ABB/GE: [www.geindustrial.com/#sle](http://www.geindustrial.com/#sle).

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- b. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
  - c. Rockwell Automation Inc; Allen-Bradley Products:  
[ab.rockwellautomation.com/#sle](http://ab.rockwellautomation.com/#sle).
  - d. Schneider Electric; Square D Products: [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).
  - e. Siemens Industry, Inc: [www.usa.siemens.com/#sle](http://www.usa.siemens.com/#sle).
  - f. Or approved equal.
2. Description: Magnetic lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on the drawings.
3. Combination Contactors: NEMA ICS 2, Class A combination controllers with magnetic contactor(s) and externally operable disconnect.
- a. Disconnects: Circuit breaker type.
    - 1) Disconnect Switches: Fusible type unless otherwise indicated.
    - 2) Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
    - 3) Provide auxiliary interlock for disconnection of external control power sources where applicable.
4. Short Circuit Current Rating:
- a. Provide contactors with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
5. Enclosures:
- a. Comply with NEMA ICS 6.
  - b. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - 1) Indoor Clean, Dry Locations: Type 1 or Type 12.
    - 2) Outdoor Locations: Type 3R or Type 4.



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- c. Finish: Manufacturer's standard unless otherwise indicated.

T. ACCESSORIES

1. Auxiliary Contacts:
  - a. Comply with NEMA ICS 5.
  - b. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each lighting contactor, minimum.
2. Pilot Devices:
  - a. Comply with NEMA ICS 5; heavy-duty type.
  - b. Nominal Size: 30 mm.
  - c. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
  - d. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
  - e. Indicating Lights: Push-to-test type unless otherwise indicated.
  - f. Provide LED lamp source for indicating lights and illuminated devices.
3. Control and Timing Relays:
  - a. Comply with NEMA ICS 5.
  - b. Provide number and type of relays indicated or required to perform necessary functions.
  - c. Timing Relays: Electronic or pneumatic as indicated.
    - 1) Adjustable Timing Range: As indicated on drawings.
4. Fire-Rated Device Enclosures:
  - a. Manufacturers:
    - 1) Fire Rated Product Specialties Corp: [www.frpsonline.com/#sle](http://www.frpsonline.com/#sle).
    - 2) Or approved equal.

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- b. Provide as required to preserve fire resistance rating of building elements.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with CEC 2019.
- C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
- F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.
- G. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

#### 3.03 INSTALLATION

- A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Perform work in a neat and workmanlike manner in accordance with NECA 1, including mounting heights specified in that standard unless otherwise indicated
- C. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of lighting control devices provided under this section.
  - 1. Mounting Heights: Unless otherwise indicated, as follows:

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- a. Wall Switch Occupancy Sensors: 48 inches above finished floor to top of box CEC 1117B.6(5).
  - b. In-Wall Time Switches: 48 inches above finished floor to top of box CEC 1117B.6(5).
  - c. In-Wall Interval Timers: 48 inches above finished floor to top of box CEC 1117B.6(5).
  - d. Wall Toggle Switches: 48 inches above finished floor to top of box CEC 1117B.6(5).
2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
  3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect and/or Owner's Representative to obtain direction prior to proceeding with work.
- D. Install lighting control devices in accordance with manufacturer's instructions.
- E. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- F. Install lighting control devices plumb and level, and held securely in place.
- G. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 27 26.
- H. Provide required supports in accordance with Section 26 05 29.
- I. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- J. Identify lighting control devices in accordance with Section 26 05 53.
- K. Occupancy Sensor Locations:
1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed

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devices.

2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
- L. Outdoor Photo Control Locations:
1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
  2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.
- M. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.
- N. Daylighting Control Photo Sensor Locations:
1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for proper control of respective room or area based on manufacturer's recommendations for installed devices.
  2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
  3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.
- O. Combination Enclosed Lighting Contactors:
1. Except where indicated to be mounted adjacent to the equipment they supply, mount lighting contactors such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
  2. Provide fuses complying with Section 26 28 13 for fusible switches as indicated.

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- P. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.
- Q. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.
- R. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.
- S. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.
- T. Where indicated or required, provide cabinet or enclosure in accordance with Section 26 05 33.16 for mounting of lighting control device system components.

#### 3.04 FIELD QUALITY CONTROL

- A. Inspect each lighting control device for damage and defects.
- B. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
- C. Test time switches to verify proper operation.
- D. Test outdoor photo controls to verify proper operation, including time delays where applicable.
- E. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.
- F. Correct wiring deficiencies and replace damaged or defective lighting control devices.

#### 3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by manufacturer.

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- C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.
- D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.
- E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Owner's Representative.. Record settings in written report to be included with submittals.
- F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by LP Consulting Engineers, Inc..
- G. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Ownere's Representative.

### 3.06 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

### 3.07 COMMISSIONING

- A. See Section 26 08 00 for commisioning requirements.

### 3.08 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of lighting control devices to District Representative, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's (Owner's) personnel on operation, adjustment, programming, and maintenance of lighting control devices.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours of training.
  - 3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.

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4. Location: At project site.

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SECTION 26 21 00 - LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- D. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- E. Section 26 05 33.13 - Conduit for Electrical Systems.
- F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 24 13 - Switchboards: Service entrance equipment.
  - 1. Includes utility metering transformer compartment.
  - 2. Includes non-utility electrical metering.
- H. Section 26 24 16 - Panelboards: Service entrance equipment.
- I. Section 26 28 16.16 - Enclosed Switches: Service entrance equipment.
- J. Section 31 23 33-Trenching and backfilling.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Allowances:
  - 1. See Section 01 21 00 - Allowances, for allowances affecting this section.
  - 2. Include cash allowance for Utility Company charges associated with providing service.
- B. Unit Prices:
  - 1. See Section 01 22 00 - Unit Prices, for additional unit price requirements.
  - 2. Primary feed:



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- a. Basis of Measurement: By the lineal foot, for each configuration.
  - b. Basis of Payment: Includes all work designated to be provided by Contractor in "Division of Responsibility" under Part 2 article "Electrical Service Requirements" below, including purchase, delivery, and installation.
3. Secondary:
- a. Basis of Measurement: By the lineal foot, for each configuration.
  - b. Basis of Payment: Includes all work designated to be provided by in "Division of Responsibility" under Part 2 article "Electrical Service Requirements" below, including purchase, delivery, and installation.
4. Transformer Pad/Vault:
- a. Basis of Measurement: Per unit, for each type.
  - b. Basis of Payment: Includes purchase, delivery, and installation.

#### 1.04 DEFINITIONS

- A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

#### 1.05 REFERENCE STANDARDS

- A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### 1.06 ADMINISTRATIVE REQUIREMENTS

- A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.
- B. Coordination:
  - 1. Verify the following with Utility Company representative:
    - a. Utility Company requirements, including division of responsibility.
    - b. Exact location and details of utility point of connection.

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- c. Utility easement requirements.
- d. Utility Company charges associated with providing service.
- e. Available short circuit current at the point of connection.
- 2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
- 3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
- 4. Coordinate the work with other installers to provide communication lines required for Utility Company meters.
- 5. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.
- D. Utility Company charges associated with providing permanent service to be paid by Contractor and reimbursed by Owner.
- E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.
- F. Scheduling:
  - 1. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner (Owner).
  - 2. Arrange for inspections necessary to obtain Utility Company approval of installation.

#### 1.07 SUBMITTALS

- A. Utility Company letter of availability for providing electrical service to project.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.

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- C. Shop Drawings: Include dimensioned plan views and sections indicating locations and arrangement of Utility Company and service entrance equipment, metering provisions, required clearances, and proposed service routing.
  - 1. Obtain Utility company approval of shop drawings prior to submittal.
- D. Drawings prepared by Utility Company.
- E. Project Record Documents: Record actual locations of equipment and installed service routing.

#### 1.08 QUALITY ASSURANCE

- A. Comply with the following:
  - 1. IEEE C2 (National Electrical Safety Code).
  - 2. NFPA 70 (National Electrical Code).
  - 3. The requirements of the Utility Company.
  - 4. The requirements of the local authorities having jurisdiction.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Products: Listed, classified, and labeled as suitable for the purpose intended.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation (including outdoor rated products which are not weatherproof until completely and properly installed). Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

### PART 2 PRODUCTS

#### 2.01 ELECTRICAL SERVICE REQUIREMENTS

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- A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.
- B. Electrical Service Characteristics:
  - 1. Service Type: Underground or Overhead as indicated on drawings.
  - 2. Service Voltage: As indicated on the drawings.
  - 3. Service Size: As indicated on the drawings.
- C. Utility Company: As indicated on drawings, to be Contractor verified.
  - 1. Point of Contact: Determined by Contractor.
- D. Division of Responsibility:
  - 1. Pad-Mounted Utility Transformers:
    - a. Transformer Vaults and Pads: Furnished and installed by Contractor per Utility Company requirements.
    - b. Transformers: Furnished and installed by Utility Company.
    - c. Transformer Grounding Provisions: Furnished and installed by Contractor per Utility Company requirements.
    - d. Transformer Protective Bollards: Furnished and installed by Contractor per Utility Company requirements.
    - e. Primary:
      - 1) Trenching and Backfilling: Provided by Contractor.
      - 2) Conduits: Furnished and installed by Contractor.
      - 3) Conductors: Furnished and installed by Utility Company unless noted otherwise..
    - f. Secondary:
      - 1) Trenching and Backfilling: Provided by Contractor.
      - 2) Conduits: Furnished and installed by Contractor.
      - 3) Conductors: Furnished and installed by Contractor, unless noted otherwise (Service Point at transformer).

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2. Pole-Mounted Utility Transformers:
  - a. Utility Poles: Furnished and installed by Utility Company.
  - b. Transformers: Furnished and installed by Utility Company.
  - c. Transformer Grounding Provisions: Furnished and installed by Utility Company.
  - d. Primary: Furnished and installed by Utility Company.
  - e. Secondary - Underground Service:
    - 1) Conduits: Furnished and installed by Contractor.
    - 2) Conductors: Furnished and installed by Contractor (Service Point at utility pole).
  - f. Secondary - Overhead Service:
    - 1) Conduits/Service Masts: Furnished and installed by Contractor.
    - 2) Conductors: Furnished and installed by Contractor (Service Point at service mast).
3. Terminations at Service Point: Provided by Utility Company.
4. Metering Provisions:
  - a. Meter Bases: Furnished and installed by Contractor per Utility Company requirements.
  - b. Metering Transformer Cabinets: Furnished and installed by Contractor per Utility Company requirements.
  - c. Metering Compartments in Service Entrance Equipment: Furnished and installed by Contractor per Utility Company requirements.
  - d. Metering Transformers: Furnished and installed by Utility Company.
  - e. Conduits Between Metering Transformers and Meters: Furnished and installed by Contractor per Utility Company requirements.
  - f. Wiring Between Metering Transformers and Meters: Furnished and installed by Utility Company.
  - g. Communications Conduits for Meters: Furnished and installed by Contractor per Utility Company requirements.

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- E. Products Furnished by : Comply with Utility Company requirements.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.02 PREPARATION

- A. Verify and mark locations of existing underground utilities.

#### 3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions and Utility Company requirements.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances and required maintenance access.
- D. Provide required protective bollards in accordance with Utility Company requirements.
- E. Provide required support and attachment components in accordance with Section 26 05 29.
- F. Provide grounding and bonding for service entrance equipment in accordance with Section 26 05 26.
- G. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 05 53.

#### 3.04 PROTECTION

- A. Protect installed equipment from subsequent construction operations.

END OF SECTION 26 21 00

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SECTION 26 24 13 - SWITCHBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Switchboards and Distribution Panel.
- B. Overcurrent protective devices for switchboards.
- C. Switchboard and Distribution Panel accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
  - 1. Includes requirements for the seismic qualification of equipment specified in this section.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
- F. Section 26 21 00 - Low-Voltage Electrical Service Entrance.
  - 1. Includes Utility Company contact information.
- G. Section 26 28 13 - Fuses: Fuses for fusible switches.
  - 1. Includes requirements for spare fuses and spare fuse cabinets.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendment (2017).
- B. ANSI C39.1 - American National Standard Requirements for Electrical Analog Indicating Instruments; 1981 (R1992).
- C. IEEE C12.1 - American National Standard Code for Electricity Metering; Institute of Electrical and Electronic Engineers; 1988.

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- D. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- F. NECA 400 - Standard for Installing and Maintaining Switchboards; 2007.
- G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- H. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.
- I. NEMA PB 2 - Deadfront Distribution Switchboards; 2011.
- J. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; 2013.
- K. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
- L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- N. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.
- O. UL 891 - Switchboards; Current Edition, Including All Revisions.
- P. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.



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4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
5. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Service Entrance Switchboards:

1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
3. Obtain Utility Company approval of switchboard prior to fabrication.
4. Preinstallation Meeting: Convene one week prior to commencing work of this section to review requirements with Utility Company representative.
5. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- B. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- C. Manufacturer's equipment seismic qualification certification.
- D. Service Entrance Switchboards: Include documentation of Utility Company approval of switchboard.
- E. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. Enclosure Keys: Two of each different key.
  2. Electronic Trip Circuit Breakers: Provide one portable test set.

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## 1.06 QUALITY ASSURANCE

- A. Conform to requirements of CEC.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.
- B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.
- C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

## 1.08 FIELD CONDITIONS

- A. Maintain field conditions within required service conditions during and after installation.

# PART 2 PRODUCTS

## 2.01 MANUFACTURERS

- A. Switchboards:
  - 1. ABB: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
  - 2. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
  - 3. Schneider Electric: [www.se.com/#sle](http://www.se.com/#sle).
  - 4. Siemens Industry, Inc: [www.new.siemens.com/#sle](http://www.new.siemens.com/#sle).
  - 5. Source Limitations: Provide switchboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

## 2.02 DISTRIBUTION PANEL

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- A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.
- D. Front-Connected Switchboards:
  - 1. Main Device(s): Individually-mounted.
  - 2. Feeder Devices: Panel/group-mounted.
  - 3. Arrangement: Front accessible only (not rear accessible), rear aligned.
  - 4. Gutter Access: Bolted covers.
- E. Rear-Connected Switchboards:
  - 1. Main Device(s): Individually-mounted.
  - 2. Feeder Devices: Individually-mounted.
  - 3. Compartmentalization: Provide barriered compartments for each overcurrent protective device, distribution bus, and rear cable connection area.
  - 4. Arrangement: Rear accessible, front and rear aligned.
  - 5. Rear Access: Bolted covers.
- F. Service Entrance Switchboards:
  - 1. Listed and labeled as suitable for use as service equipment according to UL 869A.
  - 2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
  - 3. Comply with Utility Company requirements for electrical service.
  - 4. Utility Metering Provisions: Provide separate barriered compartment complying with Utility Company requirements where indicated or where required by Utility Company. Include hinged sealable door and provisions

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for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.

5. See Section 26 21 00 for additional requirements.
- G. Service Conditions:
1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
    - a. Altitude: Less than 6,600 feet.
    - b. Ambient Temperature:
      - 1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.
      - 2) Switchboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.
  2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- H. Short Circuit Current Rating:
1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
  2. Minimum Rating: 65,000 rms symmetrical amperes.
  3. Listed series ratings are not acceptable.
- I. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- J. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.
- K. Bussing: Sized in accordance with UL 891 temperature rise requirements.
1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
  2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.

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3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
  4. Phase and Neutral Bus Material: Copper.
  5. Ground Bus Material: Copper.
- L. Conductor Terminations: Suitable for use with the conductors to be installed.
1. Line Conductor Terminations:
    - a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
    - b. Main and Neutral Lug Type: Mechanical.
  2. Load Conductor Terminations:
    - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
    - b. Lug Type:
      - 1) Provide mechanical lugs.
- M. Enclosures:
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
    - b. Outdoor Locations: Type 3R.
  2. Finish: Manufacturer's standard unless otherwise indicated.
  3. Outdoor Enclosures:
    - a. Enclosure Type: Non-walk-in type unless otherwise indicated.
    - b. Color: Manufacturer's standard.
    - c. Access Doors: Lockable, with all locks keyed alike.
- N. Future Provisions:
1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

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2. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.
  3. Where designated spaces for future device provisions are not indicated, include provisions for minimum of 4 device(s) rated at 225 amperes.
  4. Arrange and equip through bus and ground bus to accommodate future installation of additional switchboard sections.
- O. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided, list switchboards as a complete assembly including surge protective device.
- P. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
1. Where overcurrent protective devices equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
  2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
    - a. Use zero sequence ground fault detection method unless otherwise indicated.
    - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
- Q. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.
- R. Owner Metering:
1. Provide microprocessor-based digital electrical metering system including all instrument transformers, wiring, and connections necessary for measurements specified.
  2. Measured Parameters:
    - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
    - b. Current (Amps): For each phase and neutral.
    - c. Frequency (Hz).

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- d. Real power (kW): For each phase, 3-phase total.
  - e. Reactive power (kVAR): For each phase, 3-phase total.
  - f. Apparent power (kVA): For each phase, 3-phase total.
  - g. Power factor.
3. Meter Accuracy: Plus/minus 1.0 percent.
- S. Description: NEMA PB 2 switchboard with electrical ratings and configurations as indicated on plans.

## 2.03 OVERCURRENT PROTECTIVE DEVICES

### A. Circuit Breakers:

#### 1. Interrupting Capacity:

- a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
- b. Provide fully rated systems. Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
- c. Series Rated Systems are not acceptable.

#### 2. Molded Case Circuit Breakers:

- a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
- b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
- c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
  - 1) Provide the following field-adjustable trip response settings:
    - (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
    - (b) Long time delay.

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- (c) Short time pickup and delay.
    - (d) Instantaneous pickup.
    - (e) Ground fault pickup and delay where ground fault protection is indicated.
  - d. Provide the following features and accessories where indicated or where required to complete installation:
    - 1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    - 2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
3. Insulated Case Circuit Breakers:
- a. Description: Quick-make, quick-break, trip-free circuit breakers with two-step stored energy closing mechanism; standard 80 percent rated unless otherwise indicated; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
  - b. Construction:
    - 1) Provide fixed-mount circuit breakers unless otherwise indicated.
  - c. Trip Units: Solid state, microprocessor-based, true rms sensing.
    - 1) Provide the following field-adjustable trip response settings:
      - (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
      - (b) Long time delay.
      - (c) Short time pickup and delay.
      - (d) Instantaneous pickup.
      - (e) Ground fault pickup and delay where ground fault protection is indicated.
  - d. Provide the following features and accessories where indicated or where required to complete installation:
    - 1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.



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## 2.04 SOURCE QUALITY CONTROL

- A. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
  - 1. Dielectric tests.
  - 2. Mechanical operation tests.
  - 3. Grounding of instrument transformer cases test.
  - 4. Electrical operation and control wiring tests, including polarity and sequence tests.
  - 5. Ground-fault sensing equipment test.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive switchboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Install switchboards plumb and level.
- G. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad.

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- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Install all field-installed devices, components, and accessories.
- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 26 05 73.
- L. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- M. Provide filler plates to cover unused spaces in switchboards.
- N. Identify switchboards in accordance with Section 26 05 53.

### 3.03 FIELD QUALITY CONTROL

- A. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
- B. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.
- C. Inspect and test in accordance with NETA ATS, except Section 4.
- D. Perform inspections and tests listed in NETA ATS, Section 7.1.
- E. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 100 amperes. Tests listed as optional are not required.
- F. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
  - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
- G. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.
- H. Test shunt trips to verify proper operation.

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- I. Correct deficiencies and replace damaged or defective switchboards or associated components.

### 3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of switchboard covers and doors.

### 3.05 CLEANING

- A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred surfaces to match original factory finish.

### 3.06 CLOSEOUT ACTIVITIES

- A. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated devices.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours of training.
  - 3. Instructor: Manufacturer's authorized representative.
  - 4. Location: At project site.

### 3.07 PROTECTION

- A. Protect installed switchboards from subsequent construction operations.

END OF SECTION 26 24 13

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SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Lighting and appliance panelboards.
- B. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
  - 1. Includes requirements for the seismic qualification of equipment specified in this section.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
- G. Section 26 28 13 - Fuses: Fuses for fusible switches and spare fuse cabinets.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendment (2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
- F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

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- G. NEMA PB 1 - Panelboards; 2011.
- H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.
- I. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- L. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- M. UL 67 - Panelboards; Current Edition, Including All Revisions.
- N. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.
- O. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- P. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.
- Q. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- R. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.
- S. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

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3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
  1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
  2. Include wiring diagrams showing all factory and field connections.
  3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
  4. Include documentation of listed series ratings upon request.
  5. Identify mounting conditions required for equipment seismic qualification.
- C. Manufacturer's equipment seismic qualification certification.
- D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.
- E. Field Quality Control Test Reports.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

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- G. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- I. Maintenance Materials: Furnish the following for Owner's (Owner's) use in maintenance of project.
  - 1. Panelboard Keys: Two of each different key.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of CEC.
- B. Conform to requirements of NFPA 70.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

#### 1.08 FIELD CONDITIONS

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
  - 1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
- B. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
- C. Schneider Electric; Square D Products
- D. Siemens Industry, Inc: [www.usa.siemens.com/#sle](http://www.usa.siemens.com/#sle).
- E. Or approved equivalent subject to substitution process
- F. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Seismic Qualification: Provide panelboards and associated components suitable for application under the seismic design criteria specified in Section 26 05 48 where required. Include certification of compliance with submittals.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet.
  - 2. Ambient Temperature:
    - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- D. Short Circuit Current Rating:
  - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
  - 2. Listed series ratings are not acceptable, except where pre-approved by the Owner and LP Consulting Engineers, Inc.
  - 3. Label equipment utilizing series ratings as required by NFPA 70 where permitted.



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- E. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- F. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- G. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- H. Bussing: Sized in accordance with UL 67 temperature rise requirements.
  - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
  - 2. Provide 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.
  - 3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
  - 4. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
- J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
  - 2. Boxes: Galvanized steel unless otherwise indicated.
    - a. Provide wiring gutters sized to accommodate the conductors to be installed.
    - b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
    - c. Provide removable end walls for NEMA Type 1 enclosures.

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- d. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
- 3. Fronts:
  - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
  - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
  - c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
- 4. Lockable Doors: All locks keyed alike unless otherwise indicated. Provide door-in-door construction.
- K. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- L. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
  - 1. Ampere Rating: Not less than ampere rating of panelboard bus.
  - 2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
  - 3. Coil Voltage: As required for connection to control system indicated.
- M. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
  - 1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
  - 2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
    - a. Use zero sequence ground fault detection method unless otherwise indicated.
    - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.

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- c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.
- N. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- O. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.
- P. Provide the following features and accessories where indicated or where required to complete installation:
  - 1. Feed-through lugs.
  - 2. Sub-feed lugs.

## 2.03 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
  - 1. Main and Neutral Lug Material: Suitable for terminating aluminum or copper conductors. .
  - 2. Main and Neutral Lug Type: Mechanical.
    - a. Provide an individual terminal or lug for each neutral wire.
- C. Bussing:
  - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
  - 2. Phase and Neutral Bus Material: Copper.
  - 3. Ground Bus Material: Copper.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
  - 1. Provide surface-mounted or flush-mounted enclosures as indicated.

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2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  3. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  4. Provide clear plastic circuit directory holder mounted on inside of door.
- F. Provide column-width panelboards with accessory column-width cable trough and pullbox where indicated.
- G. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
- H. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard ; provide insulated ground bus where scheduled.
- I. Minimum Integrated Short Circuit Rating: As indicated or as required by the short circuit study.
1. 240 Volt Panelboards: 10,000 amperes rms symmetrical.
- J. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
1. Type SWD for lighting circuits.
  2. Type HACR for air conditioning equipment circuits.
  3. Class A ground fault interrupter circuit breakers where scheduled.
  4. Do not use tandem circuit breakers.
- K. Enclosure: NEMA PB 1, Type 1.
- L. Cabinet Box: 6 inches deep, 20 inches wide for 240 volt and less panelboards, 20 inches wide for 480 volt panelboards.
- M. Cabinet Front: Flush cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
- N. Special Features:
1. Provide blocking clips or lock-off devices on circuit breakers as indicated on the drawings.

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2. Provide barriered space for mounting contactors and control devices with a hinged door and lock, where shown or required.
3. Provide neutral bars with terminal for all active, spare, and inactive circuits.
4. Provide feed-thru lugs or sub-feed lugs for 2 and 3 section panels.
5. Equip bus bars for panelboard with main lugs, main fused switch, or main circuit breaker, capacity as required or as indicated.
6. Provide special features such as split bus, lighting contactors, extra-wide gutters as required or as indicated.
7. Provide panels with individual branch circuit power metering where noted on plans for connections to Facility Energy Management System. Provide Square D type NFMVP, NQMVP or approved equal.

#### 2.04 SOURCE QUALITY CONTROL

- A. Factory test panelboards according to NEMA PB 1.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Provide required seismic controls in accordance with Section 26 05 48.

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- G. Install panelboards plumb and when recessed, flush with wall finishes. Provide all backing for equipment support. Fasten all free-standing equipment to concrete slab. Mounting bolts on floor mounted panels shall extend into pads only and shall not be in direct contact with building structural members.
- H. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- I. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- J. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- K. Provide grounding and bonding in accordance with Section 26 05 26.
  - 1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
  - 2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.
- L. Install all field-installed branch devices, components, and accessories.
- M. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- N. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- O. Set field-adjustable circuit breaker tripping function settings as indicated.
- P. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- Q. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.
- R. Install panelboards plumb. Install recessed panelboards flush with wall finishes.
- S. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
- T. Provide filler plates to cover unused spaces in panelboards.

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- U. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
  - 1. Emergency and night lighting circuits.
  - 2. Fire detection and alarm circuits.
  - 3. Communications equipment circuits.
  - 4. Intrusion detection and access control system circuits.
  - 5. Video surveillance system circuits.
- V. Identify panelboards in accordance with Section 26 05 53.
- W. Provide computer-generated circuit directory card for each lighting and appliance panelboard and each power distribution panelboard provided with a door, clearly and specifically indicating the loads served. Identify spares and spaces.
- X. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- Y. Provide engraved plastic nameplates under the provisions of Section 26 05 53.
- Z. Provide arc flash warning labels in accordance with NFPA 70.
- AA. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
  - 1. Minimum spare conduits: 6 empty 1 inch.
- BB. Ground and bond panelboard enclosure according to Section 26 05 26.

### 3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 100 amperes.. Tests listed as optional are not required.
- C. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
  - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

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- D. Test GFCI circuit breakers to verify proper operation.
- E. Test AFCI circuit breakers to verify proper operation.
- F. Test shunt trips to verify proper operation.
- G. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.
- H. Correct deficiencies and replace damaged or defective panelboards or associated components.
- I. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.

#### 3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

#### 3.05 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 24 16



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SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Wall plates and covers.
- E. Floor box service fittings.
- F. Access floor boxes.
- G. Occupancy sensors

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- D. Section 26 05 33.16 - Boxes for Electrical Systems.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 05 83 - Wiring Connections: Cords and plugs for equipment.
- G. Section 26 09 23 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

1.03 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h, with Amendments (2017).
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2014g, with Amendment (2017).

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- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
- I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- L. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.
- M. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.
- N. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
  - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
  - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
  - 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.

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5. Notify the Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

## 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1. Wall Dimmers: Include derating information for ganged multiple devices.
2. Surge Protection Receptacles: Include surge current rating, voltage protection rating (VPR) for each protection mode, and diagnostics information.

- B. Samples: One for each type and color of device and wall plate specified.

- C. Certificates for Surge Protection Receptacles: Manufacturer's documentation of listing for compliance with UL 1449.

- D. Field Quality Control Test Reports.

- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

- F. Operation and Maintenance Data:

1. Wall Dimmers: Include information on operation and setting of presets.
2. GFCI Receptacles: Include information on status indicators.
3. Surge Protection Receptacles: Include information on status indicators.

- G. Project Record Documents: Record actual installed locations of wiring devices.

- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
2. Extra Keys for Locking Switches: Two of each type.
3. Extra Surge Protection Receptacles: Two of each type.

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4. Extra Wall Plates: One of each style, size, and finish.
5. Extra Flush Floor Service Fittings: Two of each type.

#### 1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- D. Products: Listed, classified, and labeled as suitable for the purpose intended.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.
- B. Products: Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Cooper Wiring Devices: [www.cooperwiringdevices.com](http://www.cooperwiringdevices.com).
- B. GE Industrial: [www.geindustrial.com](http://www.geindustrial.com).
- C. Leviton Manufacturing, Inc: [www.leviton.com](http://www.leviton.com).
- D. Pass & Seymore.
- E. Hubbell.
- F. Bryant.
- G. Arrow-Hart.
- H. Or approved equal.

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## 2.02 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather-resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations. Receptacles to be clearly identified as weather resistant as required by CEC.
- D. Provide tamper resistant receptacles for receptacles installed in dwelling units.
- E. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- F. Provide GFCI protection for receptacles installed in kitchens.
- G. Provide GFCI protection for receptacles serving electric drinking fountains.
- H. Provide isolated ground receptacles for receptacles serving computers and electronic cash registers.
- I. Unless noted otherwise, do not use combination switch/receptacle devices.
- J. For flush floor service fittings, use tile rings for installations in tile floors.
- K. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

## 2.03 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.
- C. Wiring Devices Installed in Finished Spaces: White with white nylon wall plate.
- D. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.
- E. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.
- F. Isolated Ground Convenience Receptacles: Orange.
- G. Surge Protection Receptacles: Blue.
- H. Wiring Devices Connected to Emergency Power: Red with red nylon wall plate.

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- I. Clock Hanger Receptacles: Brown with stainless steel wall plate.
- J. Above-Floor Service Fittings: Gray wiring devices with satin aluminum housing.
- K. Flush Floor Box Service Fittings: Gray wiring devices with aluminum cover and ring/flange.
- L. Access Floor Boxes: Gray wiring devices with gray steel cover with insert to match floor covering.

#### 2.04 ALL WIRING DEVICES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

#### 2.05 WALL SWITCHES

- A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable FS W-S-896; types as indicated on the drawings.
  - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
  - 1. Products:
    - a. Single-pole: Hubbell #1221-I, Bryant #4901-GI, Pass & Seymour #20AC1-I.
    - b. Double-pole: Hubbell #1222-I, Brant #4902-GI, Pass & Seymour #20AC2-I.
    - c. Three-way: Hubbell #1223-I, Bryant #4903-GI, Pass & Seymour #20AC3-I.
    - d. Four-way: Hubbell #1224-I, Bryant #4904-GI, Pass & Seymour #20AC4-I.
- C. Lighted Wall Switches: Industrial specification grade, 20 A, 120/277 V with illuminated standard toggle type switch actuator and maintained contacts; illuminated with load off; single pole single throw, double pole single throw,

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three way, or four way as indicated on the drawings.

- D. Pilot Light Wall Switches: Industrial specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts; illuminated with load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
  - 1. Products:
    - a. Hubbell #1221-PLR, Bryant #4901-PLR, Pass & Seymour #20AC1-PLR.
    - b. Or approved equal.
    - c. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Locking Wall Switches: Industrial specification grade, 20 A, 120/277 V with barrel type keyed switch actuator and maintained contacts; switches keyed alike; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
- F. Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with toggle type three position switch actuator and momentary contacts; single pole double throw, off with switch actuator in center position.
- G. Locking Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277V with lever type keyed three position switch actuator and momentary contacts; switches keyed alike; single pole double throw, off with switch actuator in center position.
- H. Wall Switches: Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
  - 1. Body and Handle: white plastic with toggle handle.
  - 2. Indicator Light: Lighted handle type switch; red handle.
  - 3. Locator Light: Lighted handle type switch; red color handle.
  - 4. Ratings:
    - a. Voltage: 120 and 277 volts, AC.
    - b. Current: 20 amperes.
- I. Switch Types: Single pole, double pole, and 3-way.

## 2.06 WALL DIMMERS

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- A. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.
- B. Control: Slide control type with separate on/off switch.
- C. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:
  - 1. Magnetic Low-Voltage: 600 VA.
  - 2. Electronic Low-Voltage: 400 VA.
  - 3. LED: 600 VA
- D. Provide locator light, illuminated with load off.
- E. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.
- F. Incandescent Wall Dimmers: Semiconductor dimmer for incandescent lamps, Type as indicated on drawings, complying with NEMA WD 6 and WD 1.
  - 1. Body and Handle: white plastic with linear slide control.
  - 2. Voltage: 120 and 277 volts.
  - 3. Power Rating: 600 watts.
- G. LED Wall Dimmers: NEMA WD 1, Type II semiconductor dimmer for LED lamps.
  - 1. Power rating to match load shown on the drawings.
  - 2. Voltage as required for controlled LED fixtures.
- H. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

## 2.07 RECEPTACLES

- A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498 and where applicable FS W-C-596; types as indicated on the drawings.



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1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
  2. NEMA configurations specified are according to NEMA WD 6.
  3. Hospital Grade Receptacles: Listed as complying with UL 498 Supplement SD, with green dot hospital grade mark on device face.
- B. Convenience Receptacles:
1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
  2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
  3. Isolated Ground Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, with ground contacts isolated from mounting strap; isolated ground triangle mark on device face; single or duplex as indicated on the drawings.
  4. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
  5. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
  6. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
  7. Illuminated Convenience Receptacles: Hospital grade, 20A, 125V, NEMA 5-20R; illuminated face or indicator light to indicate power is being supplied to receptacle; single or duplex as indicated on the drawings.
- C. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.

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- a. Provide test and reset buttons of same color as device.
  2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
  3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
  4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
  5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
- D. USB Charging Devices:
1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
    - a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
    - b. Charging Capacity - Four-Port Devices: 4.2 A, minimum.
  2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.
  3. USB Charging Noncombination Devices: Four-port (Type A); rectangular decorator style.
- E. Surge Protection Receptacles:
1. Surge Protection Receptacles - General Requirements: Listed and labeled as complying with UL 1449, Type 2 or 3.
    - a. Energy Dissipation: Not less than 240 J per mode.
    - b. Protected Modes: L-N, L-G, N-G.
    - c. UL 1449 Voltage Protection Rating (VPR): Not more than 700 V for L-N, L-G modes and 1200 V for N-G mode.

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d. Diagnostics:

- 1) Visual Notification: Provide indicator light to report functional status of surge protection.
  - 2) Audible Notification: Provide switchable audible alarm to report that surge protection is not functional.
2. Standard Surge Protection Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
  3. Isolated Ground Surge Protection Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, with ground contacts isolated from mounting strap.
- F. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.
1. Standard Locking Convenience Receptacles: Single, 20A, 125V, NEMA L5-20R.
- G. Clock Hanger Receptacles: Single, 15A, 125V, NEMA 5-15R.
- H. Special Purpose Receptacle Outlet: .20A, 250V, 3 pole, 4 wire, 3 phase grounding, single: NEMA 15-20R; black (Hubbell 8420).
- I. Special Purpose Receptacle Outlet: 20A, 125/250V, 3 pole, 4 wire, 1 phase grounding, single: NEMA 14-20R; black (Hubbell 8410).
- J. Special Purpose Receptacle Outlet: 30A, 125V, 2 pole, 3 wire grounding, single; NEMA 5-30R; black (Hubbell 9308).
- K. Special Purpose Receptacle Outlet: 30A, 250V, 2 pole, 3 wire grounding, single; NEMA 6-30R; black (Hubbell 9330).
- L. Special Purpose Receptacle Outlet: 30A, 250V, 3 pole, 4 wire, 3 phase, grounding, single; NEMA 15-30R; black (Hubbell 8430A).
- M. Special Purpose Receptacle Outlet: 30A, 125/250V, 3 pole, 4 wire, 1 phase grounding, single; NEMA 14-30 R; black (Hubbell 9430A).
- N. Special Purpose Receptacle Outlet: 30A, 250V, 2 pole, 3 wire, 1 phase grounding, single, twist-lock; NEMA L6-30R; black (Hubbell 2620).
- O. Special Purpose Receptacle Outlet: 30A, 250V, 3 pole, 4 wire, 3 phase, grounding, single, twist-lock; NEMA L15-30R; black (Hubbell 2720).

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- P. Special Purpose Receptacle Outlet: 50A, 250V, 2 pole, 3 wire, 1 phase, grounding, single; NEMA 6-50R; black (Hubbell 9367).
- Q. Special Purpose Receptacle Outlet: 50A, 250V, 2 pole, 3 wire, 1 phase, grounding, single, twist-lock; black (Hubbell 25505), with wall plate per NFPA 56A. Portable x-ray receptacle.
- R. Special Purpose Receptacle Outlet: 20A, 250V, 2 pole, 3 wire, 1 phase, grounding, single, twist-lock; NEMA L6-20R; black (Hubbell 2320).
- S. Special Purpose Receptacle Outlet: 50A, 125/250V, 3 pole, 4 wire, 1 phase, grounding, single; NEMA 14-50R; black (Hubbell 9450A).
- T. Special Receptacle: 20A, 4 pole, 5 wire, 3 phase Y, 120/208V; NEMA L21-20; black (Hubbell 2510).
- U. Special Receptacle: 30A, 4 pole, 5 wire, 3 phase Y, 120/208V; NEMA L21-30; black (Hubbell 2810).
- V. Special Purpose Receptacle Outlet: 15A, 125V, 2 pole, 3 wire, isolated ground, duplex; NEMA 5-15R; orange (Hubbell IG-5262).
- W. Special Purpose Receptacle Outlet: 20A, 125V, 2 pole, 3 wire, isolated ground, duplex; NEMA 5029R; orange (Hubbell IG-5362).
- X. Special Purpose Receptacle Outlet: 30A, 125V, 2 pole, 3 wire, 1 phase, grounding, single, twist-lock; NEMA L5-30R; black (Hubbell 2610).
- Y. Special Purpose Receptacle Outlet: 20A, 125V, 2 pole, 3 wire, single, twist-lock; NEMA L5-20R; black.
- Z. Special Receptacle Outlet: 30A, 250V, 2 pole, 3 wire, 1 phase grounding, single, twist lock, isolated ground; NEMA L6-30R; orange (Hubbell IG-2620).
- AA. Special Receptacle Outlet: 30A, 4 pole, 5 wire, 3 phase Y, 277/408V; NEMA L22-30, black.
- BB. Special Receptacle Outlet: 60A, 3 pole, 4 wire, 3 phase, 480V; watertight pin and sleeve type; red, Hubbell 460R7W with BB601W 15 degree angle back box.
- CC. Special Receptacle Outlet: 60A, 250V, 3 pole, 4 wire, 3 phase, grounding, single; NEMA 15-60R; black.

1. Manufacturers

- a. Bryant; Model 8460.

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- b. Hubbell; Model 8460A.
- c. Pass & Seymour; Model 5760-BL.
- d. Or approved equal.

DD. Other receptacle types as indicated on the drawings and/or as required for connection of designated equipment.

## 2.08 WALL PLATES AND COVERS

- A. Wall Plates: Comply with UL 514D.
  - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
  - 2. Size: Standard.
  - 3. Screws: Metal with slotted heads finished to match wall plate finish.
  - 4. Provide screwless wallplates with concealed mounting hardware where indicated.
- B. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- D. Brass Wall Plates: Brushed satin finish, factory-coated to inhibit oxidation.
- E. Aluminum Wall Plates: Smooth satin finish, clear anodized, factory-coated to inhibit oxidation.
- F. Chrome Wall Plates: Smooth finish, chrome plated steel.
- G. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- H. Pre-marked Wall Plates: Factory labeled as indicated; hot stamped for nylon wall plates and engraved for metal wall plates.
- I. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.
- J. Weatherproof Covers for Wet or Damp Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

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- K. Decorative Cover Plates: white, nylon, verify color with architect .
- L. Jumbo Cover Plates: Ivory, nylon, verify color with architect.
- M. Weatherproof Cover Plates: Gasketed cast metal with hinged.
- N. Inmate Areas: In Correctional Facilities
  - 1. Minimum Level Device Plate: Type 430 stainless steel, flush, satin finish, approximately 20 gauge.
    - a. Hollow Metal Jamb Posts: Arrow-Hart #T-1650; Bryant, Stainless Steel.
  - 2. Medium Level Device Plate: Stainless steel; Type 430.
  - 3. Maximum Level Device Plate:
    - a. Back Plate: Cold rolled steel; 10 gauge, prime painted.
    - b. Cover Plate: Steel; 10 gauge, prime painted.
    - c. Fasteners: Minimum for security fasteners.
    - d. Manufacturers: Hubbell, Fail-Safe, Mark.
    - e. Cast Metal Plate for Surface Type Boxes: Corrosive resistant, cast ferrous metal, designed for the application.
    - f. Plastic Device Plates: Not permitted.
    - g. Device Plates Installed in Housing Units: Patient Cells, Holding Cells, and Receiving Tanks shall be maximum level device plates.
    - h. Device Plates Installed In Mechanical Rooms, Electrical Rooms, Control Rooms and areas 12 feet or more above finished floor shall be minimum level device plates.
    - i. Device plates installed in other areas shall be Medium level device plates.

## 2.09 FLOOR BOX SERVICE FITTINGS

- A. Description: Service fittings compatible with floor boxes provided under Section 26 05 33.16 with components, adapters, and trims required for complete installation.
- B. Above-Floor Service Fittings:

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1. Single Service Pedestal Convenience Receptacles:
    - a. Configuration: One standard convenience duplex receptacle.
  2. Single Service Pedestal Communications Outlets:
    - a. Configuration: One 1 inch bushed opening.
  3. Single Service Pedestal Furniture Feed:
    - a. Configuration: One 3/4 inch knockout.
  4. Dual Service Pedestal Combination Outlets:
    - a. Configuration:
      - 1) Power: One standard convenience duplex receptacle.
      - 2) Communications: One 1 inch bushed opening.
    - b. Provide barrier to separate line and low voltage compartments.
- C. Flush Floor Service Fittings:
1. Single Service Flush Convenience Receptacles:
    - a. Cover: Rectangular.
    - b. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).
  2. Single Service Flush Communications Outlets:
    - a. Cover: Rectangular.
  3. Single Service Flush Furniture Feed:
    - a. Cover: Rectangular.
    - b. Configuration: One 2-1/8 inch by 3/4 inch combination threaded opening(s).
  4. Dual Service Flush Combination Outlets:
    - a. Cover: Rectangular.
    - b. Configuration:
      - 1) Power: One standard convenience duplex receptacle(s) with duplex flap opening(s).

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5. Dual Service Flush Furniture Feed:
  - a. Cover: Rectangular.
  - b. Configuration:
    - 1) Power: One 2-1/8 inch by 3/4 inch combination threaded opening(s).
    - 2) Communications: One 2-1/8 inch by 1 inch combination threaded opening(s).
6. Accessories:
  - a. Tile Rings: Finish to match covers; configuration as required to accommodate specified covers.
  - b. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

## 2.10 ACCESS FLOOR BOXES

- A. Manufacturers - Access Floor Boxes with Pre-wired Connectors for Manufactured Wiring Systems:
  1. AFC Cable Systems Inc: [www.afcweb.com/#sle](http://www.afcweb.com/#sle).
  2. RELOC Wiring Solutions, a brand of Acuity Brands, Inc: [www.relocwiring.com/#sle](http://www.relocwiring.com/#sle).
  3. Wiremold, a brand of Legrand North America, Inc: [www.legrand.us/#sle](http://www.legrand.us/#sle).
  4. Or approved equal.
  5. Source Limitations: Provide access floor boxes with pre-wired connectors produced by the same manufacturer as the manufactured wiring system used for this project.
- B. Access floor boxes with pre-wired connectors for manufactured wiring systems are permitted only where manufactured wiring systems are permitted as specified in Section 26 05 19.
- C. Configuration:
  1. Power: Two standard convenience duplex receptacle(s) unless noted otherwise on drawings.

## PART 3 EXECUTION



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### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that floor boxes are adjusted properly.
- F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- G. Verify that openings in access floor are in proper locations.
- H. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

### 3.03 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, except for mounting heights specified in those standards.
- B. Perform work in a neat and workmanlike manner in accordance with NECA 1, except for mounting heights specified in that standard.
- C. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.
  - 1. Mounting Heights: Unless otherwise indicated, as follows:
    - a. Wall Switches: 48 inches above finished floor to top of box CEC 1117B.6(5).
    - b. Wall Dimmers: 48 inches above finished floor to top of box CEC 1117B.6(5).

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- c. Receptacles: 18 inches above finished floor or 6 inches above counter.
- 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
- 3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
- 4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Owner to obtain direction prior to proceeding with work.
- 5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- D. Install wiring devices in accordance with manufacturer's instructions.
- E. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- F. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- G. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- H. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- I. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.
- J. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- K. Unless otherwise indicated, GFCI receptacles may be connected to provide feed-through protection to downstream devices. Label such devices to indicate they are protected by upstream GFCI protection.
- L. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

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- M. Install securely, in a neat and workmanlike manner, as specified in NECA 1.
- N. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- O. Install wall switches with OFF position down.
- P. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- Q. Do not share neutral conductor on branch circuits.
- R. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on right.
- S. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- T. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- U. Identify wiring devices in accordance with Section 26 05 53.
- V. Install identification label for wall switches and wall dimmers in accordance with Section 26 05 26 indicating load served when controlling loads that are not visible from the control location or multiple wall switches or wall dimmers are installed at one location.
- W. Install identification label for all receptacles in accordance with Section 26 05 26 indicating serving branch circuit.
- X. Install receptacles with grounding pole on bottom.
- Y. Connect wiring device grounding terminal to outlet box with bonding jumper.
- Z. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- AA. Connect wiring devices by wrapping conductor around screw terminal.
- BB. Use jumbo size plates for outlets installed in masonry walls.
- CC. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- DD. Install protective rings on active flush cover service fittings.

### 3.04 CONSTRUCTION

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A. Interface with Other Work

1. Coordinate locations of outlet boxes to obtain mounting heights specified unless otherwise indicated on drawings. All dimensions are to the center of the item.
  2. Install convenience receptacle four inches above backsplash of counters or four inches above counter if no backsplash. Mount horizontal where indicated
  3. Install electric water cooler outlet boxes centered behind unit, behind electric water cooler cover. Coordinate with equipment installer.
- B. Locate wall switches on the strike side of door with edge of wall plate three inches from edge of door frame. Where locations are indicated otherwise, notify the Electrical Engineer of Record to obtain direction prior to proceeding with work.

3.05 FIELD QUALITY CONTROL

A. Site Test

1. Test under provisions of Section 01 45 00.
  2. Operate each wall switch, wall dimmer and fan speed control with circuit energized and verify proper operation.
  3. Test each receptacle to verify operation and proper polarity.
  4. Verify that each receptacle is energized.
  5. Test each GFCI receptacle for proper tripping operation and proper polarity.
  6. Inspect each surge protection receptacle to verify surge protection is active.
- B. Inspect each wiring device for damage and defects.
- C. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.06 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Owner's Representative.

3.07 CLEANING

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- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26 27 26

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SECTION 26 28 13 - FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fuses.
- B. Spare fuse cabinet.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 26 05 73 - Power System Studies: Additional criteria for the selection of protective devices specified in this section.
- D. Section 26 24 13 - Switchboards: Fusible switches.
- E. Section 26 24 16 - Panelboards: Fusible switches.
- F. Section 26 28 16.16 - Enclosed Switches: Fusible switches.

1.03 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.
- D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.
- E. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses; Current Edition, Including All Revisions.
- F. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.
- G. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

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- H. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses; Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
  - a. Fusible Enclosed Switches: See Section 26 28 16.16.
2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
3. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
1. Spare Fuse Cabinet: Include dimensions.
- B. Maintenance Materials: Furnish the following for Owner's (Owner's) use in maintenance of project.
1. Extra Fuses: Three set(s) of three for each type and size installed.
  2. Fuse Pullers: One set(s) compatible with each type and size installed.
  3. Spare Fuse Cabinet Keys: Two.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of CEC.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience and with service facilities within 100 miles of Project.

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- D. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Cooper Bussmann
- B. Ferraz Shawmut, Inc
- C. Littelfuse
- D. Gould
- E. Or approved equal.

### 2.02 APPLICATIONS

- A. Service Entrance:
  - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
  - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- B. Feeders:
  - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
  - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- C. General Purpose Branch Circuits: Class RK1, time-delay.
- D. Individual Motor Branch Circuits: Class RK1, time-delay.
- E. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.
- F. Primary Protection for Control Transformers: Class CC, time-delay.
- G. HVAC equipment: Provide fuses, size, type, and ratings in accordance with equipment nameplate data to be field verified by contractor.

### 2.03 FUSES

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.



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- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.
  - 1. Class RK1, Time-Delay Fuses:
    - a. Products:
      - 1) Bussmann, "Low-Peak"; 250V KTN-RK and 600V LPS-RK.
      - 2) Littlefuse, "Little-Peak" 250V LLN-RK and 600V LLS-RK.
      - 3) Gould "AMPTRAP II" 250V A2D-R and 600V A6D-R.
  - 2. Class RK1, Fast-Acting, Non-Time-Delay Fuses:
    - a. Products:
      - 1) Bussmann "Limitron", 250V KTN-RK and 600V KTS-RK..
      - 2) Littlefuse 250V RLN-R and 600V RLS-R.
      - 3) Gould "AMPTRAP" 250V A2K-R and 600V A6K-R..
  - 3. Class RK5, Time-Delay Fuses:
    - a. Products:
      - 1) Bussmann "Fusetron" 250V FRN-RK and 600V FRS-RK.
      - 2) Littlefuse "SLO-BLO" 250V FLN-R and 600V FLS-R.
      - 3) Gould "TRI-ONIC" 250V TR-R and 600V TRS-R.
  - 4. Class RK5, Fast-Acting, Non-Time-Delay Fuses:
    - a. Products:
      - 1) Bussmann 300V "T-Tron" JJN, 600V "Limitron" JKS.
- H. Class J Fuses: Comply with UL 248-8.

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1. Class J, Fast-Acting, Non-Time-Delay Fuses:
  - a. Products:
    - 1) Bussmann 300V JJN, 600V JKS.
- I. Class L Fuses: Comply with UL 248-10.
  1. Class L, Time-Delay Fuses:
    - a. Products:
      - 1) Bussmann "Hi-Cap" 600V, 601-6000A, Type KRP-C.
      - 2) Littlefuse "HI-INT" 600V, 601-6000A, Type KLP-C.
      - 3) Gould "AMPTRAP" 600V, 200-600A, Type A4BY.
  2. Class L, Fast-Acting, Non-Time-Delay Fuses:
    - a. Products:
      - 1) Bussmann 300V KTN-R, 600V KTS-R.
- J. Class T Fuses: Comply with UL 248-15.
  1. Products:
    - a. Bussmann 300V JJN, 600V JJS.
- K. Class CC Fuses: Comply with UL 248-4.
  1. Class CC, Time-Delay Fuses:
    - a. Products:
      - 1) Bussmann 600V LP-CC.
  2. Class CC, Fast-Acting, Non-Time-Delay Fuses:
    - a. Products:
      - 1) Bussmann 600v, KTK-R.
- L. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- M. Provide the following accessories where indicated or where required to complete installation:

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1. Fuseholders: Compatible with indicated fuses.
2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

#### 2.04 SPARE FUSE CABINET

- A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.
- B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.
- C. Doors: Hinged, with hasp for Owner's (Owner's) padlock.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that mounting surfaces are ready to receive spare fuse cabinet.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.02 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.
- C. Install spare fuse cabinet in convenient location in main electrical room unless otherwise indicated on drawings.
- D. Identify spare fuse cabinet in accordance with Section 26 05 53.
- E. Provide identification nameplate for spare fuse cabinet in accordance with Section 26 05 53.

END OF SECTION 26 28 13

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SECTION 26 28 16.16 - ENCLOSED SWITCHES

PART 2 PRODUCTS

1.01 MANUFACTURERS

- A. ABB/GE: [www.geindustrial.com/#sle](http://www.geindustrial.com/#sle).
- B. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).
- D. Siemens Industry, Inc: [www.usa.siemens.com/#sle](http://www.usa.siemens.com/#sle).
- E. Cutler-Hammer.
- F. Or approved equal.
- G. Source Limitations: Provide enclosed switches and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

1.02 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Seismic Qualification: Provide enclosed safety switches suitable for application under the seismic design criteria specified in Section 26 05 48 where required. Include certification of compliance with submittals.
- D. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet.
  - 2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
- E. Horsepower Rating: Suitable for connected load.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Short Circuit Current Rating:

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1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
2. Minimum Ratings:
  - a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
  - b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
  - c. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.
- H. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- I. Provide with switch blade contact position that is visible when the cover is open.
- J. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
  1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
- K. Conductor Terminations: Suitable for use with the conductors to be installed.
- L. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
- M. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- N. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
    - c. Wash down and corrosive Locations: Type 4X.

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2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
- O. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- P. Heavy Duty Switches:
  1. Comply with NEMA KS 1.
  2. Conductor Terminations:
    - a. Provide mechanical lugs.
    - b. Provide compression lugs where indicated.
    - c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
    - a. Provide means for locking handle in the ON position where indicated.
- Q. Provide the following features and accessories where indicated or where required to complete installation:
  1. Hubs: As required for environment type; sized to accept conduits to be installed.
  2. Integral fuse pullers.
  3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.
  4. Viewing Window: Positioned over switch blades for visual confirmation of contact position with door closed.
  5. Interlocked Receptacle: Integral pre-wired three phase, three wire, grounded type receptacle interlocked with switch mechanism to prevent insertion or removal of plug with switch in the ON position and to prevent switch from being placed in the ON position without matching plug inserted. Provide receptacle configuration as required to accept plug as indicated on the drawings.

PART 3 EXECUTION

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2.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

2.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 26 05 29.
- E. Provide required seismic controls in accordance with Section 26 05 48.
- F. Install enclosed switches plumb.
- G. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.
- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Identify enclosed switches in accordance with Section 26 05 53.

2.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- C. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

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2.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

2.05 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 28 16.16



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SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Drivers.
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 33.16 - Boxes for Electrical Systems.
- D. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 09 23 - Lighting Control Devices.
  - 1. Includes automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.
  - 2. Includes lighting contactors.
- G. Section 26 27 26 - Wiring Devices: Manual wall switches and wall dimmers.
- H. Section 26 56 00 - Exterior Lighting.

1.03 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices; current edition.
- B. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006.
- C. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

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- D. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).
- E. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.
- F. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.
- G. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.
- H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- I. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.
- J. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.
- K. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2020.
- L. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012 (Reaffirmed 2018).
- M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. UL 844 - Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.
- P. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- Q. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- R. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

- 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of

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supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect and/or Owner of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

#### 1.05 SUBMITTALS

A. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution.
3. Provide shop drawings for continuous row luminaires.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
  - a. Include estimated useful life, calculated based on IES LM-80 test data.
  - b. Include IES LM-79 test report upon request.
2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
3. Drivers: Include wiring diagrams and list of compatible lamp configurations.

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4. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
- C. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.
- D. Samples:
  1. Provide one sample(s) of each specified luminaire where indicated.
  2. Provide one sample(s) of each custom luminaire.
  3. Provide one sample(s) of each luminaire proposed for substitution upon request.
  4. Provide one sample(s) of each product finish illustrating color and texture upon request.
- E. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.
- F. Field quality control reports.
- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- H. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- I. Maintenance Materials: Furnish the following for Owner's (Owner's) use in maintenance of project.
  1. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
  2. Extra LED Drivers: Two percent of total quantity installed for each type, but not less than one of each type.
- J. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of CEC, and ICBO.

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- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Conform to requirements of NFPA 70 and NFPA 101.
- D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

#### 1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

#### 1.09 WARRANTY

- A. Provide 3-year manufacturer warranty for LED luminaires, including drivers.
- B. Provide 5-year pro-rata warranty for batteries for emergency lighting units.
- C. Provide 10-year pro-rata warranty for batteries for self-powered exit signs.
- D. Provide 3-year full warranty for fluorescent emergency power supply units.
- E. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS - LUMINAIRES

- A. Furnish products as indicated in Lighting Fixture Schedule included on the Drawings
  - 1. General: Lighting fixtures as hereinafter specified are identified by type as noted on drawings. Fixture specifications are based on construction and

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performance. Manufacturer's catalog numbers are of general nature and indicate the level of quality required, but do not necessarily reflect complete options and accessories required. Approval shall be based on description and specification of fixture as well as catalog number indicated. Verify fixture voltage requirements with circuitry shown on drawings and provide appropriate equipment.

## 2.02 OWNER-FURNISHED PRODUCTS

- A. New Products: As indicated on drawings.
- B. Existing Products: As indicated on drawings.

## 2.03 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.

## 2.04 LUMINAIRES

- A. Manufacturers:
  - 1. Acuity Brands, Inc: [www.acuitybrands.com/#sle](http://www.acuitybrands.com/#sle).
  - 2. Alloy LED; [www.alloyled.com/#sle](http://www.alloyled.com/#sle).
  - 3. Cooper Lighting, a division of Cooper Industries:  
[www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
  - 4. Electro-Matic Visual, Inc; [www.empvisual.com/#sle](http://www.empvisual.com/#sle).
  - 5. Hubbell Lighting, Inc: [www.hubbelllighting.com/#sle](http://www.hubbelllighting.com/#sle).
  - 6. Lutron Electronics Company, Inc; \_\_\_\_\_: [www.lutron.com/#sle](http://www.lutron.com/#sle).
  - 7. Philips Lighting North America Corporation;  
[www.lightingproducts.philips.com/#sle](http://www.lightingproducts.philips.com/#sle).
  - 8. Other manufacturers as indicated in the fixture schedule on the drawings.
  - 9. Or approved equal.
- B. Provide products that comply with requirements of NFPA 70.
- C. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- D. Provide products listed, classified, and labeled as suitable for the purpose intended.

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- E. Provide products complying with Federal Energy Management Program (FEMP) requirements.
- F. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, drivers, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- G. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- H. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- I. Recessed Luminaires:
  - 1. Ceiling Compatibility: Comply with NEMA LE 4.
  - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
  - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- J. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.
- K. LED Luminaires:
  - 1. Components: UL 8750 recognized or listed as applicable.
  - 2. Tested in accordance with IES LM-79 and IES LM-80.
  - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
- L. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
  - 1. LED Tape - General Requirements:
    - a. Listed.
    - b. Designed for field cutting in accordance with listing.
    - c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.
  - 2. White LED Tape:

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- a. Correlated Color Temperature (CCT): 3500 K unless otherwise indicated.
- b. Color Rendering Index (CRI): Not less than 90.
- M. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.
- N. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

## 2.05 EMERGENCY LIGHTING UNITS

- A. Manufacturers:
  - 1. Acuity Brands, Inc: [www.acuitybrands.com/#sle](http://www.acuitybrands.com/#sle).
  - 2. Cooper Lighting, a division of Cooper Industries: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
  - 3. Hubbell Lighting, Inc: [www.hubbelllighting.com/#sle](http://www.hubbelllighting.com/#sle).
  - 4. Or approved equal.
- B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- C. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- D. Battery:
  - 1. Sealed maintenance-free lead calcium unless otherwise indicated.
  - 2. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- F. Provide low-voltage disconnect to prevent battery damage from deep discharge.



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- G. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.
- H. Where indicated, provide units with integral time delay to maintain emergency illumination for 15 minutes after restoration of normal power source.
- I. Accessories:
  - 1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
  - 2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
  - 3. Provide compatible accessory wire guards where indicated.
  - 4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

## 2.06 EXIT SIGNS

- A. Description: Exit signs and similar signs for special purpose applications such as area of refuge/rescue assistance.
- B. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
  - 1. Number of Faces: Single- or double-face as indicated or as required for installed location.
  - 2. Directional Arrows: As indicated or as required for installed location.
- C. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.
  - 1. Manufacturers:
    - a. Acuity Brands, Inc: [www.acuitybrands.com/#sle](http://www.acuitybrands.com/#sle).
    - b. Cooper Lighting, a division of Cooper Industries;; [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
    - c. Hubbell Lighting, Inc: [www.hubbellighting.com/#sle](http://www.hubbellighting.com/#sle).
    - d. Philips Lighting North America Corporation; [www.lightingproducts.philips.com/#sle](http://www.lightingproducts.philips.com/#sle).

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e. Or approved equal.

D. Accessories:

1. Provide compatible accessory high-impact polycarbonate vandal shields where indicated.
2. Provide compatible accessory wire guards where indicated.

E. Manufacturers: Furnish products as indicated in Lighting Fixture Schedule included on the Drawings

F. Exit Signs: Exit sign fixture suitable for use as emergency lighting unit.

1. Provide fixtures complying with NFPA 101.
2. Lamps: LED.
3. Directional Arrows: Universal type for field adjustment.
4. Mounting: Universal, for field selection.
5. Battery: 6 or 12 volt, nickel-cadmium type, with 1.5 hour capacity.
6. Battery Charger: Dual-rate type, with sufficient capacity to recharge discharged battery to full charge within twelve hours.
7. Lamps: Manufacturer's standard.

## 2.07 BALLASTS AND DRIVERS

A. Manufacturers:

1. Alloy LED; [www.alloyled.com/#sle](http://www.alloyled.com/#sle).
2. General Electric Company/GE Lighting: [www.gelighting.com/#sle](http://www.gelighting.com/#sle).
3. Lutron Electronics Company, Inc; \_\_\_\_\_: [www.lutron.com/#sle](http://www.lutron.com/#sle).
4. OSRAM Sylvania, Inc: [www.osram.us/ds/#sle](http://www.osram.us/ds/#sle).
5. Philips Lighting North America Corporation;  
[www.usa.lighting.philips.com/#sle](http://www.usa.lighting.philips.com/#sle).
6. Or approved equal.
7. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

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B. Ballasts/Drivers - General Requirements:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

C. Dimmable LED Drivers - Network-Connected: Comply with Section 26 09 23.

2.08 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.
- C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.
- D. Provide wire guards for lighting fixtures and equipment where indicated on the drawings.
- E. Tube Guards for Linear Fluorescent Lamps: Provide clear virgin polycarbonate sleeves with endcaps where indicated.
  1. Product: As indicated in the Fixture Schedule on the drawings.
- F. Fire-Rated Luminaire Enclosures:
  1. Manufacturers:
    - a. Fire Rated Product Specialties Corp: [www.frpsonline.com/#sle](http://www.frpsonline.com/#sle).
    - b. Specialty Products & Insulation (SPI); SafeLite: [www.spi-co.com/#sle](http://www.spi-co.com/#sle).
    - c. Or approved equal.
  2. Provide as required to preserve fire resistance rating of building elements.

2.09 SPARE PARTS

- A. The Contractor shall furnish to the Owner at the completion of the project, a minimum of 5 percent spare LED driver assemblies and light engines for each LED fixture type. LED drivers shall be turned over to the Owner's Representative in their manufacturer's protective packaging. LED drivers not in their protective packaging will not be acceptable.

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PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install products in accordance with manufacturer's instructions.
- D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Provide required seismic controls in accordance with Section 26 05 48.
- G. Provide seismic sway bracing restraints when an installed suspended luminaire's distance from the nearest permanent object (structural, mechanical, etc.) is less than 0.707 of the total suspension cable (stem) length.
- H. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- I. Suspended Ceiling Mounted Luminaires:
  - 1. Do not use ceiling tiles to bear weight of luminaires.

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2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
4. Secure pendant-mounted luminaires to building structure.
5. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

J. Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.
2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
4. Install recessed luminaires to permit removal from below.
5. Install clips to secure recessed grid supported luminaires in place. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.

K. Suspended Luminaires:

1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
4. Install canopies tight to mounting surface.
5. Unless otherwise indicated, support pendants from swivel hangers.
6. Provide seismic sway bracing where indicated or as required by the application.

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- L. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- M. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).
- N. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- O. Support luminaires larger than 2 x 4 foot size independent of ceiling framing.
- P. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- Q. Exposed Grid Ceilings: Support surface mounted luminaires in grid ceiling directly from building structure.
- R. Install wall mounted luminaires and exit signs at height as indicated on Drawings.
- S. Install accessories furnished with each luminaire.
- T. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within fixture; use flexible conduit.
- U. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- V. Bond products and metal accessories to branch circuit equipment grounding conductor.
- W. Install specified lamps in each exit sign and luminaire.
- X. Emergency Lighting Units:
  - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
  - 2. Install lock-on device on branch circuit breaker serving units.
- Y. Exit Signs:
  - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

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2. Install lock-on device on branch circuit breaker serving units.
3. Install pendant exit signs at height indicated. Where not indicated, mount 90 inches above finished floor in space over door frame where applicable
- Z. Remote Drivers: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.
- AA. Identify luminaires connected to emergency power system in accordance with Section 26 05 53.
- BB. Install lamps in each luminaire.

### 3.04 FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by LP Consulting Engineers, Inc..
- E. Re-lamp luminaires that have failed lamps at substantial completion.

### 3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by LP Consulting Engineers, Inc.. Secure locking fittings in place.
- B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by LP Consulting Engineers, Inc. or authority having jurisdiction.
- C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by LP Consulting Engineers, Inc. or authority having jurisdiction.
- D. Aim and adjust fixtures as indicated and/or as directed by the Architect or Electrical Engineer of Record.

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- E. Position exit sign directional arrows as indicated.

### 3.06 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosures.
- D. Clean finishes and touch up damage.
- E. Clean photometric control surfaces as recommended by manufacturer.

### 3.07 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of luminaires to LP Consulting Engineers, Inc. or designated representative, and correct deficiencies or make adjustments as directed.
- B. Just prior to Substantial Completion, replace all lamps that have failed.

### 3.08 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

### 3.09 SCHEDULE - SEE DRAWINGS

END OF SECTION 265100 26 51 00



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SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires.
- B. Ballasts and Drivers.
- C. Luminaire accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 33.16 - Boxes for Electrical Systems.
- E. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- F. Section 26 09 23 - Lighting Control Devices.
  - 1. Includes automatic controls for lighting including outdoor motion sensors, time switches, and outdoor photo controls.
  - 2. Includes lighting contactors.
- G. Section 26 28 13 - Fuses.
- H. Section 26 51 00 - Interior Lighting.

1.03 REFERENCE STANDARDS

- A. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2017.
- B. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).
- C. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.
- D. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

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- E. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.
- F. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.
- G. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.
- H. IES RP-8 - Recommended Practice: Lighting Roadway and Parking Facilities; 2021.
- I. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- J. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).
- K. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2020.
- L. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012 (Reaffirmed 2018).
- M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. UL 844 - Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.
- O. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- P. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Notify Architect and/or District Representative of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.
- B. Coordination: Furnish bolt templates and pole mounting accessories to installer of pole foundations.

#### 1.05 SUBMITTALS

- A. Shop Drawings:

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1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
  2. Provide photometric calculations where luminaires are proposed for substitution.
  3. Provide structural calculations for each pole proposed for substitution.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
1. LED Luminaires:
    - a. Include estimated useful life, calculated based on IES LM-80 test data.
    - b. Include IES LM-79 test report upon request.
  2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
  3. LED Retrofit Luminaire Conversion Kits: Include list of compatible luminaires and/or criteria for compatibility.
- C. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.
- D. Samples:
1. Provide one sample(s) of each specified luminaire where indicated.
  2. Provide one sample(s) of each luminaire proposed for substitution upon request.
  3. Provide one sample of each product finish illustrating color and texture upon request.
- E. Field Quality Control Reports.
1. Include test report indicating measured illumination levels.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and

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starting of product.

- G. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- H. Maintenance Materials: Furnish the following for Owner's (Owner's) use in maintenance of project.
  - 1. Extra Fuses: Five percent of total quantity installed for each type, but not less than two of each type.
  - 2. Touch-Up Paint: 2 gallons, to match color of pole finish.
- I. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of CEC.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

#### 1.08 WARRANTY

- A. Provide 2-year manufacturer warranty for all LED luminaires, including drivers.

### PART 2 PRODUCTS

#### 2.01 LUMINAIRE TYPES

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- A. Furnish products as indicated in luminaire schedule included on the drawings.

## 2.02 LUMINAIRES

A. Manufacturers:

1. Acuity Brands, Inc: [www.acuitybrands.com/#sle](http://www.acuitybrands.com/#sle).
2. Alloy LED; [www.alloyled.com/#sle](http://www.alloyled.com/#sle).
3. Cooper Lighting, a division of Cooper Industries:  
[www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
4. Electro-Matic Visual, Inc; [www.empvisual.com/#sle](http://www.empvisual.com/#sle).
5. Hubbell Lighting, Inc: [www.hubbellighting.com/#sle](http://www.hubbellighting.com/#sle).
6. Philips Lighting North America Corporation;  
[www.lightingproducts.philips.com/#sle](http://www.lightingproducts.philips.com/#sle).
7. Or approved equal.

- B. Provide products that comply with requirements of NFPA 70.

- C. Provide products that are listed and labeled as complying with UL 1598, where applicable.

- D. Provide products listed, classified, and labeled as suitable for the purpose intended.

- E. Provide products complying with Federal Energy Management Program (FEMP) requirements.

- F. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

- G. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

- H. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

- I. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

- J. Recessed Luminaires:

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1. Ceiling Compatibility: Comply with NEMA LE 4.
  2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
  3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- K. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.
- L. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.
- M. LED Luminaires:
1. Components: UL 8750 recognized or listed as applicable.
  2. Tested in accordance with IES LM-79 and IES LM-80.
  3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
- N. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
1. LED Tape - General Requirements:
    - a. Listed.
    - b. Designed for field cutting in accordance with listing.
    - c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.
  2. White LED Tape:
    - a. Correlated Color Temperature (CCT): 4000 K unless otherwise indicated.
    - b. Color Rendering Index (CRI): Not less than 90.
- O. Exposed Hardware: Stainless steel.
- P. Finish: To be verified with the architect by contractor prior to ordering.

## 2.03 BALLASTS AND DRIVERS

- A. Manufacturers:

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1. General Electric Company/GE Lighting: [www.gelighting.com/#sle](http://www.gelighting.com/#sle).
  2. OSRAM Sylvania, Inc: [www.osram.us/ds/#sle](http://www.osram.us/ds/#sle).
  3. Philips Lighting North America Corporation;  
[www.usa.lighting.philips.com/#sle](http://www.usa.lighting.philips.com/#sle).
  4. Or approved equal.
  5. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
  6. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.
- B. Ballasts/Drivers - General Requirements:
1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
  2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
  3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.
- C. Dimmable LED Drivers:
1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
  2. Control Compatibility: Fully compatible with the dimming controls to be installed.

## 2.04 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.
- C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

## PART 3 EXECUTION

### 3.01 EXAMINATION

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- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

### 3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install products in accordance with manufacturer's instructions.
- D. Install luminaires in accordance with NECA/IESNA 501.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Provide required seismic controls in accordance with Section 26 05 48.
- G. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- H. Recessed Luminaires:
  - 1. Install trims tight to mounting surface with no visible light leakage.
  - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
  - 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- I. Suspended Luminaires:



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1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
  2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
  3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
  4. Install canopies tight to mounting surface.
  5. Unless otherwise indicated, support pendants from swivel hangers.
- J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- K. Pole-Mounted Luminaires:
1. Maintain the following minimum clearances:
    - a. Comply with IEEE C2.
    - b. Comply with utility company requirements.
  2. Grounding:
    - a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
    - b. Provide supplementary ground rod electrode as specified in Section 26 05 26 at each pole bonded to grounding system as indicated.
  3. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
  4. Install non-breakaway in-line fuse holders and fuses complying with Section 26 28 13 in pole handhole or transformer base for each ungrounded conductor.
- L. Install accessories furnished with each luminaire.
- M. Bond products and metal accessories to branch circuit equipment grounding conductor.
- N. Install lamps in each luminaire.
- O. Bond luminaires, metal accessories, and metal poles to branch circuit equipment grounding conductor. Provide supplementary grounding electrode at each pole.

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### 3.04 FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by LP Consulting Engineers, Inc..
- D. Measure illumination levels at night with calibrated meters to verify compliance with performance requirements. Record test results in written report to be included with submittals.
- E. Measure illumination levels to verify conformance with performance requirements. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

### 3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by LP Consulting Engineers, Inc.. Secure locking fittings in place.
- B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by LP Consulting Engineers, Inc..

### 3.06 CLEANING

- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosure.
- D. Clean finishes and touch up damage.

### 3.07 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of luminaires to LP Consulting Engineers, Inc., and correct deficiencies or make adjustments as directed.
- B. Just prior to Substantial Completion, replace all lamps, ballasts and drivers that have failed.

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3.08 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 26 56 00

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SECTION 27 00 00 - COMMUNICATIONS ADMINISTRATION

PART 1 - GENERAL

1.01 SUMMARY

- A. The work outlined in this specification section is the general administrative overview for all communications systems installed under Division 27 and Division 28.

1.02 SCOPE

- A. Submittals
- B. Contractor Installation Shop Drawings
- C. Warranty, Testing, and Commissioning
- D. Contractor Record Closeout Documents

1.03 RELATED REQUIREMENTS

- A. Division 27, Communications
  - 1. Section 27 05 00 – Common Work Results for Communications
  - 2. Section 27 13 00 – Communications Backbone Cabling
  - 3. Section 27 15 00 – Communications Horizontal Cabling
  - 4. Section 27 51 23 – Intercommunications Program Systems
  - 5. Section 27 53 13 - Clocks

1.04 CODES AND STANDARDS

- A. The installed system shall confirm to all California State Codes
  - 1. 2022 California Building Code (CBC)
  - 2. 2022 California Electrical Code (CEC)
  - 3. 2022 California Fire Code (CFC)
  - 4. All equipment connected to the Fire Alarm system shall have California State Fire Marshall listing(s).
- B. National Codes
  - 1. 2022 NFPA 72 – National Fire Alarm Code
  - 2. 2022 NFPA 101 – Life Safety Code
  - 3. Americans with Disabilities Act (ADA)
  - 4. Local building codes

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- C. The installed system shall confirm to all California State Codes
  - 1. 2022 California Building Code (CBC)
  - 2. 2022 California Electrical Code (CEC)
  - 3. 2022 California Fire Code (CFC)
  - 4. All equipment connected to the Fire Alarm system shall have California State Fire Marshall listing(s).
- D. National Codes
  - 1. 2022 NFPA 72 – National Fire Alarm Code
  - 2. 2022 NFPA 101 – Life Safety Code
  - 3. Americans with Disabilities Act (ADA)
  - 4. Local building codes
- E. All requirements by the authority having jurisdiction (AHJ)
- F. Telecommunications Industry Association Standards (TIA)
  - 1. TIA 526-7: Single Mode Fiber Standards
  - 2. TIA 526-17: Multi Mode Fiber Standards
  - 3. TIA-568-D.1: Commercial Building Telecommunications Cabling Standards.
  - 4. TIA-568-C.2: Balanced Twisted-Pair Telecommunications Cabling and Components Standards.
  - 5. TIA-569-E: Telecommunications Pathways and Spaces.
  - 6. TIA-606-C: Administration Standard for Telecommunications Infrastructure.
  - 7. TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) Requirements for Customer Premises.
- G. Audio-Visual and Integrated Experience Association (AVIXA)
  - 1. A102.01.2017: Audio Coverage Uniformity in Listener Areas (ACU)
  - 2. 10:2013 Audio-Visual System Performance Verification
  - 3. F501.01:2015: Cable Labeling for Audio-Visual Systems
  - 4. V201.01: Projected Image System Contrast Ratio
  - 5. F502.02:2018: Rack Building for Audio-Visual Systems
  - 6. A103.01: Sound System Spectral Balance
  - 7. A104.01: Sound System Dynamic Range

## PART 2 - PRODUCTS

2.01 N/A

## PART 3 - EXECUTION

3.01 SUBMITTALS

- A. Products Material Submittal:

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1. Product data and manufacturer's installation instructions for information, communications, and technology systems electronically in PDF and XLS format, as required. The PDF shall include bookmarks for each section of the submittal.
2. A Microsoft Excel spreadsheet listing each item submitted as a separate row. The spreadsheet shall, at a minimum, contain the following columns:
  - a. Submittal #,
  - b. Item # (tied to PDF cut sheet)
  - c. Spec section submitted
  - d. Drawing sheet referenced
  - e. Manufacturer
  - f. Part number
  - g. Description

B. Products Material substitutions

1. If the Contractor desires to use any other brand or manufacturer of equal quality and utility to that specified, they shall make application to the Owner/Architect/Engineer in writing, and shall submit samples, if requested. Such application constitutes a recommendation that the Contractor:
  - a. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.
  - b. Will provide the same warranty for equal as for specified product.
  - c. Will coordinate installation and make other changes, which may be required for work to be complete in all respects.
  - d. Waives claims for additional costs, which may subsequently become apparent.
  - e. The Architect/Designer/Engineer will determine whether or not the proposed material is equal in quality and utility to the material specified, and their decision shall be final.
  - f. Requests for equal materials will only be considered when offered by the Contractor as required by this section.

- C. Whenever in the Contract Documents any materials, products, processes, or articles are indicated or specified by the name brand of the manufacturer, or by patent or proprietary names, such specifications shall be deemed to be a measure of quality and utility or a standard and shall be deemed to be followed by the words, "or equal." It is the intent of this article to comply with Public Contract Code Section 3400.

3.02 CONTRACTOR INSTALLATION SHOP DRAWINGS

A. Contractor installation "Shop Drawings" requirements

1. The Contractor Installation Shop Drawings represent the level of system design to be provided to the Owner/Architect/Engineer. Contractor shall provide all additional system design work required, including:
  - a. Conduit layout and sizing.
  - b. Wire and cable layout and sizing.
  - c. Point-to-point wiring and equipment hook-up information.

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- d. Equipment mounting details.
    - 1) Design of equipment cabinets, including front rack elevations with accurate equipment rack unit spacing and equipment schedules.
    - 2) MDF / IDF room wall elevations for all systems, junction boxes, wall mounted equipment, power outlets etc., mounted on each wall.
    - 3) MDF / IDF room top view to show placement of equipment racks or cabinets, including required 36" clearance from mounted equipment.
  - e. Other detailed design work required.
  - f. Contractor's design shall conform to all applicable codes and ordinances. All electrical design, including the sizing and placement of conduit, raceways and conductors, shall be in accordance with CEC: California Electrical Code, current version, unless local codes establish more stringent requirements.
  - g. Contractor's design work is subject to review and approval by the Owner/Architect/Engineer, Project Construction Manager.
- 2. It shall be understood that the drawings, details, and one-lines provided with the design package are diagrammatic and/or performance based. Data presented on design drawings are as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification, of all dimensions, routing, etc., by the contractor is required.
  - 3. Drawings are provided to show the intent of the design and specification and to assist the contractor in submitting a bid. Contractor is directed to make field surveys as part of his work prior to submitting systems installation shop drawings. The contractor shall make allowance in the proposal to cover whatever work is required to comply with the intent of the design and provide a fully functioning complete, operable, and integrated system.
  - 4. In case of doubt of work intended, it is the responsibility of the Contractor to request instructions from the Owner/Architect/Engineer prior to bid. The contractor shall be responsible for installing a complete, operable, integrated and functioning system to the Owners satisfaction.
  - 5. Installation of the systems shall not be started until detailed contractor furnished shop drawings (in AutoCAD 2020 or similar professional drawing format) and product submittals have been approved by the designer and/or architect and if (a. Applicable, approved by the Division of the State Architect).
  - 6. Any and all design and/or installation discrepancies, change orders, (including labor, materials, and shipping) incurred without contractor shop drawings or after contractor shop drawings have been approved shall be the sole responsibility of the contractor.
  - 7. Any work performed without approved contractor furnished shop drawings and submittals shall not be allowed. If work performed prior to approve shop drawings, contractor will do so at their own risk.

3.03 WARRANTY, TESTING, AND COMMISSIONING

A. Warranty:

- 1. All components, parts, and installation supplied by the contractor shall be guaranteed against defects in materials and workmanship for one (1) year from

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date of Notice of Completion or system acceptance, whichever falls later. Labor to repair, reprogram, or replace components shall be furnished by the contractor at no charge during the warranty period.

2. All warranty work of a minor nature shall be performed during hours when site and/or buildings are not occupied, Monday through Friday. Major warranty work, defined as, affecting more than 15% of the system, causing complete operator workstation or server failure, or work involving life safety shall be responded to within four (4) hours. Major warranty work shall be performed regardless of normal work hours or days until corrected.
3. All fiber optic data installs shall carry a Limited Lifetime warranty. This will require the contractor to certify their installers to the manufactures guidelines and submit their certifications with bid documents for the project.
4. Copper (Cat6/Cat6A) network cabling installs for this project shall carry a Limited Lifetime warranty. This will require the contractor to certify their installers to the manufactures guidelines and submit their certifications with bid documents for the project.

3.04 CONTRACTOR RECORD CLOSEOUT DOCUMENTS

- A. The Contractor shall provide, at the completion of the project, Project Record Documents and furnish to the Owner one (1) Electronic Copy set of record drawings. The Contractor Record Closeout Documents shall be prepared in such a manner that each ASI, RFI, CCD, PCO is noted and clouded on the Contractor Record Closeout Documents.
- B. The Contractor shall provide an electronic copy of the field redline drawings in PDF format.
- C. The electronic Contractor Record Closeout Documents shall follow the following standards:
  1. Delivered as an electronic set of documents on a CD-R or a memory stick clearly labeled with Job Number, Bid Number and Name of Project.
  2. Drawing standards, such as line-types, line-weights, fonts and symbols shall be consistent with the bid set documents.
  3. Include text "Record Drawing" or "As Built" on all sheets.
  4. Include all revision deltas and clouds on all sheets.
  5. AutoCAD files shall adhere to the following standards:
    - a. Full drawing package in AutoCAD (AutoCAD 2020 or most current version), executable .dwg format
    - b. Include all fonts and plotting line-weights
    - c. Include all cross references
- D. The Contractor shall prepare and provide a complete Electronic Cable Book (PDF format), submitted on CD or electronically, as documentation. This cable book shall consist of the following with each section bookmarked within the PDF file:
  1. Title of project
  2. Index page detailing the sections



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3. Site plans (Record set redlined drawings on original full-size bid set plans, hard and soft copy)
4. The drawings shall depict, at a minimum, the following conditions:
  - a. Division 27 systems as applicable
- E. Final inspection will not be made until drawings are received and approved. Record Drawings shall include "As-Built" one-line and wiring diagrams, with terminations identified, wire color coding schedule, pull box locations, and conduit routing plans.
- F. Warranty certificates and documentation.
  1. One (1) Year workmanship warranty
  2. Limited Lifetime manufacturer warranty for Fiber Optic plant.
  3. Limited Lifetime manufacturer warranty for Cat6/Cat6A copper plant.

END OF 27 00 00

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SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. The work of this Section consists of basic materials and methods for all communications, technology, security, access control pathways work included under Division 27 and Division 28. Additional specification requirements for electrical work are specified under other sections of Division 26 and where those requirements differ from the requirements of this section, the more stringent shall govern.

1.03 RELATED REQUIREMENTS

- A. Division 01 00 00 specifications, General Requirements
- B. Division 26 specification sections, as applicable
- C. Division 27 specification sections, as applicable
- D. Division 28 specification sections, as applicable

1.04 CODES AND STANDARDS

- A. See specification section 27 00 00 for requirements

PART 2 - PRODUCTS

2.01 GENERAL

- A. All products used on this project shall bear the label and be approved by Underwriters Laboratories "UL" unless otherwise approved in writing by the Owner/Architect/Engineer.
- B. Any modification that voids the equipment's UL listing is strictly prohibited (i.e. relocated or oversize knock-outs).
- C. Any modified new equipment that voids the UL listing shall be replaced by the Contactor (parts and labor) at their expense.
- D. All products shall be new and unused and shall be of manufacturer's current and standard production.

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- E. Where two or more equipment items of the same kind are provided, all shall be identical and provided by the same manufacturer.
- F. Drawings and specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory operation.
- G. Product Availability:
  - 1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
  - 2. Certain products specified may only be available through factory authorized dealers and distributors. Contractor shall verify his ability to procure the products specified prior to submitting a proposal.
  - 3. Equipment shortages, all equipment and material shall be ordered upon Owner/Architect/Engineer and design professional approval of product submittals and contractor shop drawings. The contractor shall immediately notify the Owner/Architect/Engineer of any long lead or backordered items so an alternate substitution may be reviewed for approval prior to ordering.

2.02 RACEWAYS

- A. Rigid Steel Metallic (GRC): Full weight with threaded fittings conforming to industry standards. Rigid steel conduit in contact with earth or in concrete slabs must be PVC wrapped.
  - 1. Rigid Steel Conduit: Protected inside and outside by galvanizing or sherardizing. By Triangle, Western Pipe & Tubing, Republic or approved equal. Risers and 90-degree elbows shall be wrapped with 3M Scotchwrap 51 PVC-based tape and 3M pipe primer (cover exposed threads and couplings).
- B. Electric metallic tubing (EMT): Protected inside and outside by galvanizing or sherardizing. Minimum diameter size for EMT is  $\frac{3}{4}$ " and maximum diameter is 4". Same manufacturers as for rigid steel conduit. All fittings by: Thomas & Betts, Steel City, Raco, OZ/Gedney, or approved equal.
- C. Flexible conduit: All Flex, American Flexible Conduit, or approved equal. Where exposed to weather use liquid-tight flexible conduit, type UA complete with waterproof fittings. American Flexible Conduit, Electri-Flex, Sealtite, Anaconda, or approved equal.
- D. PVC conduit: Schedule 40 polyvinyl chloride high density, high impact, type two with factory-made bends, couplings and fittings, as manufactured by Carlon, PW Pipe, Cantex, or approved equal. Use of PVC is subject to local utility company having jurisdiction.

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E. Raceway Fittings:

1. Rigid Steel Conduit (GRC): Fittings, such as couplings, connectors, conduit bodies, elbows, bends, etc., shall be subject to same requirements as for rigid steel conduit. Couplings and unions shall be threaded type, assembled with anti-corrosion, conductive anti-seize compound at joints, and made absolutely tight to exclude water. Unions shall be equal to Crouse-Hinds UNY, UNF or approved equal.
2. EMT: Fittings for indoor use: couplings and connectors 3/4" and larger shall be steel setscrew type or threaded compression type. 3/4" and larger, and all outdoor applications shall be compression type. All connectors must have insulated throats.
3. Flexible Metallic Conduit: Angle wedge type with insulated throat.
4. Bushings: Metallic insulated type. Weatherproof, liquid-tight, dust-tight installations with sealing ring and insulated throat, Crouse-Hinds, OZ/Gedney type "KR".
5. Expansion and Deflection Fittings: OZ/Gedney, Type "DX" or accepted equal.

F. All multi-channel non-metallic surface mounted raceways shall be three compartment 5500 Wiremold by Legrand or approved equal - color to be ivory or as selected by the Owner/Architect/Engineer. Provide all components necessary to complete the work.

1. 5500WC- Wire Clip to be installed every 24"

G. All small single or dual channel non-metallic surface mounted raceways shall be 2300 Wiremold by Legrand, type and size specified in the drawings or approved equal - color to be ivory or as selected by the Owner/Architect/Engineer. Provide all components necessary to complete the work.

1. Components include, but are not limited to:
  - a. Base
  - b. Cover
  - c. Surface mount box
  - d. Tee fitting
  - e. 90 flat elbow, inside, outside fittings
  - f. Entrance End Fitting
  - g. Blank End Fitting
  - h. Transition Fitting
  - i. Cross-over Fitting
  - j. Wire Clip to be installed every 24"

2.03 BOXES

- A. Galvanized one-piece or welded pressed steel type. Boxes for fixture shall not be less than 4" square and shall be equipped with fixture stud. Boxes shall be at least 2-1/8" deep, 4" square for 1 or 2 gang devices, with plaster rings and gang box with gang cover. Boxes mounted in wall or ceiling finished with gypsum board shall be furnished with plaster rings. Use screws and not nails to support outlet boxes. Boxes in unfinished

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areas, installed exposed, shall be cast metal type for switches and convenience outlets. Provide blank cover for all boxes without fixture or device.

- B. Interior Junction boxes, larger than 8" square, located indoors shall be NEMA rated, with hinged door and an Allen key type lock kit.
- C. Exterior Junction boxes, larger than 8" square, located outdoors, or in wet or damp locations shall be rated NEMA-3R, with hinged door and cylinder lock kit keyed to match the site's master key.
- D. Floor boxes shall be one-gang or multi-gang recessed, fully adjustable with lids and cover plates for respective tile or carpet floor finish. For "hard" floors such as tile or wood, the top of the cover shall be flush with the top of the finished floor. Receptacle covers shall have individual flip-lids with screw lock. Junction boxes shall have screwed on plugs.
  - 1. Grade level or below: Watertight and concrete-tight of cast iron construction, FSR FL series, Walker 880CS series or equal.
  - 2. Above grade level: Concrete-tight of stamped steel construction, FSR FL series, Walker 880S series or equal.
- E. Provide and install center pin Torx tamper-proof screws for all exterior boxes and conduit bodies (i.e. LB, SLB, RLB, etc.).

2.04 PULL LINE

- A. Furnish and install pull line in all new unused (empty) raceways / conduits.
- B. Furnish and install replacement pull lines in all raceways if new cables are pulled through them.
- C. All pull lines shall be:
  - 1. Permanently tagged with identification at both ends.
  - 2. Minimum 1/8" diameter, or larger if so, designated on plans, braided line of polypropylene or Jet-Line #232, or approved equal line of continuous fiber polyolefin. Minimum breaking strength of 1/8 in. line: 200 lbs.

2.05 PRECAST CONCRETE GROUND BOXES/HANDHOLES

- A. Ground boxes shall be size as indicated on the drawings. Design loads shall consist of live, dead, impact, hydrostatic and other loads. Live loads shall be for H-20 and/or H-20-S16-44, or as required, per A.A.S.H.O. standard specifications for highway bridges with revisions. Design loads shall be sixteen KIPS. Concrete shall be per ASTM-C-33-64. Lightweight concrete shall conform to ASTM-C-33-64T. Cement shall be Portland Cement meeting ASTM-C-150 Type II standards. Compressive strength shall be minimum 4,000 psi at 28 days.

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- B. Ground boxes shall be supplied with steel edging in order to make spot welding cover lid to enclosure an option.
- C. Ground boxes (48" x 30" or larger): Pre-cast high-density reinforced concrete with end and side knockouts, pulling-in irons. Minimum 4" wall thickness conforming to utility standards with spring assist traffic rated lids. Coordinate size of thin-wall knockouts with manufacturer for conduit entry. Acceptable manufacturers shall be Old Castle, Christy, Jensen or equal.
- D. Ground boxes (smaller than 48" X 30"): Pre-cast high-density reinforced concrete with end and side knockouts, and extension as required. Minimum 1-1/2" wall thickness. Acceptable manufacturers shall be Old Castle, Christy, Jensen or equal.
- E. Ground Box Covers: Large ground box covers conforming to utility standards with spring assist traffic rated lids shall be spring assisted traffic rated one or multi piece as required, steel checker plate, galvanized with anti-slip surface rated for parkway loading, with hold-down bolts. All boxes shall use H-20 rated traffic covers. No concrete covers shall be allowed.
  - 1. All Ground Box Covers shall be factory marked "Signal" unless drawings for marking/label indicates otherwise. Covers shall be provided with Penta Head hold down bolts.
- F. Utility ground boxes shall be per their requirements. Provide with ground rod as required.
- G. All conduits terminating in ground boxes shall be evenly spaced, squarely cut, and bell ends installed.
- H. All exterior conduits installed shall be color coded based on project standards. See project details.
- I. All new ground boxes shall be located using GPS points (decimal degrees) and documented on the As-Built drawings.

## 2.06 PENETRATIONS AND SLEEVES

- A. All penetrations through fire rated assemblies (walls, ceilings and floors) shall be made with materials and/or sleeves that meet or exceed the fire rating of the assembly.
  - 1. Approved products: Specified Technologies, Inc. EZ-Path series, sealants, putty and pads.
- B. All penetration through non-rated partitions shall be made with conduit sleeves (see Raceway/EMT above) and sealed with draft stop material.

## PART 3 - EXECUTION

### 3.01 PATHWAYS AND RACEWAY

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- A. EMT conduit may be used at following locations:
  - 1. In dry in-wall spaces.
  - 2. In partitions other than concrete or solid masonry.
  - 3. In exterior locations, except as noted in 3.01.B.
- B. Rigid steel conduit and fittings shall be used for vertical risers and on top of all roofs, overhangs, walkways and canopies.
- C. All raceways installed in interior exposed locations shall be surface mounted raceway (Wiremold) by Legrand.
- D. Provide flexible connections of short length (4 foot maximum) to equipment subject to vibration or movement and to all motors. Provide a separate bonding conductor in all flexible connections, except as provided for in CEC 250-91 (b) Ex1.
- E. Portable buildings shall have weather-proof flex transition from underground to building conduits for both high/low voltage systems.
- F. Install exposed conduit run neatly, parallel to or at right angles to structural members. Maintain a minimum of 12 inches of clearance from steam or hot water pipes. All installed unistrut / strut channel supports should allow for future conduit attachments. The width of unistrut / strut channel to match the width of the closest attached junction box. See drawing details for attachment requirements.
- G. Supports: Support conduit with two-hole straps or unistrut / strut channel where shown and/or specified. Coordinate supports with architectural details. Secure to wood structure by means of bolts or lag screws, to metal by means of shallow self-tapping screws, to concrete by means of insert or expansion bolts, to brickwork by means of expansion bolts, and to hollow masonry or stucco by means of toggle bolts. Straps, expanders and shields shall be steel or malleable iron.
- H. Spacing for all EMT and rigid steel conduit supports shall be as follows unless otherwise specified in drawing details:
  - 1. Surface conduits, roof mounted:
    - a. Spacing of supports shall comply with CEC Article 344, Table 344-30(B)(2) and 2022 CBC 1603A.
    - b. Construction of roof supports shall comply with roofing manufacturer's requirements.
    - c. Roof supports shall be securely fastened to the roof with a gluing system approved by the roof manufacturer.
    - d. Route conduits parallel with mechanical piping and along building lines.
    - e. Provide ground wire in conduits.
  - 2. Surface conduit spacing and supports and unless otherwise specified or shown on drawing details:
    - a. EMT – Size 3/4" to 1-1/2" – 4' maximum spacing (3 each supports per 10' conduit length) and 12" from each end of conduit at coupling, connector or 90-degree bend.

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- b. EMT – Size 2" to 4" – 4' maximum spacing (3 each supports per 10' conduit length) and 12" from end of conduit at coupling, connector or 90-degree bend.
  - c. Rigid steel – Size 3/4" to 1" – 4' maximum spacing (3 each supports per 10' conduit length) and 12" from each end of conduit at coupling, connector or 90-degree bend.
  - d. Rigid steel – Size 1-1/2" to 2" – 10' maximum spacing (1 each supports per 10' conduit length) and 12" from end of conduit at coupling, connector or 90-degree bend.
  - e. Rigid steel – Size 3" to 6" – 10' maximum spacing (1 each support per 10' conduit length) and 12" from end of conduit at coupling, connector or 90-degree bend.
- I. Do not install conduit in the "section" of concrete slabs, except for perpendicular penetrations. Refer to Structural Drawings for specific details.
- J. Conduits installed in contact with concrete or earth shall be:
- 1. Install PVC conduit in a 3" sand or fine earth (passed through 1/8 in. screen) envelope below ground. Provide a minimum of 3" of sand or fine earth at the bottom of the trench before laying conduits.
  - 2. Risers, sweeps, bends greater than 30 degrees, shall be PVC-wrapped, or rigid steel conduit with a minimum inside bend radius as follows unless otherwise specified:
- |                                    |  |
|------------------------------------|--|
| Conduit Size<br>(Inches - Nominal) | Minimum Bending Radius<br>(Times conduit size) |
| 2" and smaller                     | 6" Inch  |
| 2" – 4"                            | 24" Inch                                       |
- 3. When installing underground conduits to specified depth, depth shall be taken from the top of the conduit to the finished grade level. Unless otherwise specified, underground conduits shall be installed with top side not less than 24" below finished grade except that utility company primary conduit shall be 30" minimum below finished grade or as required to meet utility company standards. All conduits inside foundation line shall be not less than 2" below sub grade.
  - 4. The minimum size of conduits outside the foundation line shall be 1", 3/4" inside the foundation line.
  - 5. Place two 3" wide fluorescent orange non-biodegradable plastic tapes on both sides of trench at 12" below grade, labeled "CAUTION FIBER OPTIC LINE BURIED BELOW". Tape shall be continuous for full length of trench.
  - 6. Contractor shall install a #10 insulated wire at the same depth as the underground conduits. The #10 insulated wire shall be continuous for full length of trench and terminated on unistrut / strut channel at the riser or grounding strip at ground box.
- K. Above ground conduits shall have a minimum inside bend radius as follows unless otherwise specified:

Conduit Size	Minimum Bending Radius
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(Inches - Nominal)  
2" and smaller  
2" – 4"

(Times conduit size)  
6" Inch  
24" Inch

- L. If conduit is designated for low voltage use, no more than a total of 270 (3 ea. 90-degree bends, max.) degrees of conduit bend radius will be allowed between boxes.
- M. All junction boxes shall be connected to conduits using appropriate connecting hardware (i.e. box connectors)
- N. The use of conduit body LB, SLB or LBT fittings for information, communication, and technology systems is strictly prohibited.
- O. Clean, prepare, and paint all exposed conduit, junction boxes, unistrut, fittings and accessories except rooftop mounted rigid steel conduit to match the surface in which it is installed.

### 3.02 EXPANSION JOINTS

- A. Provide conduit expansion fitting in each conduit run, which is mechanically attached to separate structures to relieve strain caused by shift of one structure in relation to another.
- B. Provide conduit expansion fitting in each conduit run wherever it crosses expansion joint in structure to which it is attached.
- C. Provide expansion fittings where expansion and contraction are a consideration in long runs of exposed conduits (one inch [1"] or larger conduit in excess of one hundred feet [100']).

### 3.03 PROOFING

- A. Before pulling any conductors into a PVC conduit, the conduit shall be first be proofed by pulling through a mandrel of a diameter  $\frac{1}{4}$  in. smaller than the conduit inside dia., followed by a swab of the same diameter as the conduit inside diameter. Proofing will be done in the presence of Construction Manager for verification.

### 3.04 SURFACE MOUNTED RACEWAYS

- A. Surface mount non-metallic raceways shall be used as required to provide communications cabling services as shown on installation drawings.
- B. The Contractor will provide and install all surface mounted non-metallic type raceway and appropriate fittings to provide a safe and complete installation. All installation must meet manufacturers recommended installation procedures.
- C. All non-metallic raceway boxes, bases, covers and fittings shall be of the same manufacture.

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- D. Wire management clips shall be installed in all raceways (vertical and horizontal runs) on maximum of 24" on center spacing. If utilizing existing raceway for new wires, wire management clips shall be installed.
- E. The non-metallic raceway components shall meet all of the CEC applicable articles.
- F. Multiple channel surface mounted raceways shall be color-coded and marked with a permanent marker on the inside of the channel and across the entire length of the channel blue for data, telephone, and IPTV and red for power. These color-coded channels shall be installed consistently with the same relative position of color on the top and the bottom throughout the site in accordance with CEC Article 352-26.
- G. The non-metallic raceway may have a factory-applied adhesive for mounting to the substrate. The contractor shall not use the factory-applied adhesive, instead the Contractor shall fasten raceways every 16" on center to studs wherever possible utilizing appropriate fastening methods by the manufacturer. The contractor shall use pan head type screws, sized in accordance with the manufacturer installation instructions. In addition to the manufactures mounting instructions, mounting hardware and anchor types recommended for any raceway that shall be mounted to the building or structure.
  - 1. Sheet rock / drywall / wall board: by means of Easy Anchor, toggle bolt, other spread type anchor with load distribution, or approved equal.
  - 2. Concrete / cinder block / solid masonry: by means of expanding compression type lag, expanding compression type bolt, expanding compression type all tread with nuts, or approved equal.
  - 3. Tile / Stucco / hollow masonry: by means of toggle bolts or approved equal.
  - 4. Wood: by means of lags, pan head wood screws, or approved equal.
  - 5. Metal: by means of a clamp, self-tapping pan head screw, or approved equal.
- H. The raceway is to be manufactured of rigid PVC compounds. The cover shall have a matte texture.
- I. A full complement of fittings must be available including, but not limited to, extension boxes, 90-degree elbows, tees, inside corners, outside corners, fixture boxes, wire clips, and device boxes. All fittings must match the color of the raceway cover.
- J. The raceway and all system components must be UL Listed and exhibit non-flammable self-extinguishing characteristics.
- K. At locations where raceway is mounted below 48 inches from the finished floor the contractor shall install a device bracket every 30" on center throughout the entire length of the raceway system. Any unused slots on the device bracket shall have a blank plate installed.
- L. Do not use pulling means, including fish tape, cable or rope, which can damage the non-metallic surface raceway.

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- M. Raceway shall not have covers installed until fastening and cabling is approved by the inspector of record.

3.05 POWER AND COMMUNICATION POLE

- A. In areas with system furniture and/or office furniture is set up in open areas, the cables shall be routed through an existing power pole, or a contractor supplied and installed power pole from the ceiling space to the floor.
- B. Power pole shall be properly anchored to the ceiling and the floor using the recommended mounting instruction from the manufacture.
- C. Contractor may utilize an existing power pole provided fill capacities are not exceeded.
- D. Project manager or Owner/Architect/Engineer representative shall determine how system furniture areas will need to be fitted with a power pole device.
- E. In the event that a power pole is not in place to serve the specific systems furniture area, the contractor is required to provide and install one.
- F. Contractor shall obtain clarification if method of installation is unclear regarding how a power pole will be installed prior to submission of contractor's bid.
- G. Where cables pass through a hole in the pole, the contractor shall provide and install a grommet around the hole in the power pole to protect the wire and cable. The grommet will be fitted with either a plastic or rubber shutter device that provides a tight seal around the wire and cable. In addition, the contractor shall provide and install a spiral wrap type plastic device, which shall serve as a protected raceway from the power pole to the system furniture. The contractor shall then route the cables into the systems furniture raceways to the designated point of attachment at each drop location.
- H. The contractor will terminate the wire and/or cable on the device outlets, which will be installed in the appropriate manner for the type of furniture being installed.

3.06 FLOOR MONUMENTS

- A. Contractor shall provide and install approved floor monuments in those areas that cables are routed below the floor space and or require termination of a drop outlet in an open area that cannot be served either by a fixed wall or power pole.
- B. Contractor shall provide all necessary labor and materials to saw cut floor, core holes and patch substrates/surfaces necessary to accommodate the installation of a floor monument.
- C. Contractor shall provide and install a floor monument as specified in construction documents.

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- D. Where cables pass through a hole in the monument, the contractor shall provide and install a grommet around the hole in the power pole to protect the wire and cable. The grommet will be fitted with either a plastic or rubber shutter device that provides a tight seal around the wire and cable. In addition, the contractor shall provide and install a spiral wrap type plastic device, which shall serve as a protected raceway from the monument to the system furniture. The contractor shall then route the cables into the systems furniture raceways to the designated point of attachment at each drop location.
- E. The contractor shall then route the cables into the systems furniture raceways and/or office furniture setup in open areas to the designated point of attachment at each drop location. The contractor will then terminate these cables on device outlets which will then be installed in a high-profile box, which will be surface mounted to the underside of the work surface at each location.

3.07 EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES

- A. Excavating, backfilling and compacting for conduit, underground pull boxes, vaults and other underground electrical and low voltage utilities shall be performed in accordance with Specification Section 31 20 00 (Earth Moving) for Utilities and the Geotechnical Engineering Consultant.

3.08 CONDUIT CAPPING

- A. Cap conduits during construction with manufactured seals. Swab out conduits before wires are pulled in.
- B. Cap all empty conduits below grade and in pull boxes with manufacturer's caps to prevent entrance of debris, attach pull string to cap.

3.09 CONDUIT PENETRATIONS

- A. Penetrations through walls, ceilings, or floors.
  - 1. Wood, stucco, drywall, and hallow masonry
    - a. Scanning for structural members and wall studs:
      - 1) Contractor shall scan the wall for studs and metal using an electronic stud finder to avoid drilling through a structural member.
      - 2) If the contractor is unsure of the building's structural supports, the contractor shall notify the inspector of record and/or project manager to confirm the location before drilling.
    - b. Drilling
      - 1) A pilot hole not exceeding 3/8" diameter shall be drilled through the material for each penetration to confirm placement of penetration on both sides of the wall and before using an auger bit or hole saw to finalize penetration size.
      - 2) Final penetration sizes shall take into account the size of the conduit to be installed including box connectors if EMT and angular space requirements for fire or draft stopping.

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2. Concrete, brick, and solid masonry
  - a. X-ray scanning
    - 1) Contractor shall perform or hire out to have each location of each wall penetration x-rayed to confirm the locations of rebar and other structural steel supports.
    - 2) If the contractor is unsure of the building's structural supports, the contractor shall notify the inspector and/or project manager to confirm the location before drilling.
  - b. Core boring/ Drilling
    - 1) Contractor shall notify the inspector and/or project manager of the time the core boring/drilling will be performed.
    - 2) The contractor shall save all removed material from wall for inspection. Contractor shall take precautions to protect site property from water and debris created by core boring.
    - 3) Final penetration sizes shall take into account the size of the conduit to be installed including box connectors if EMT and angular space requirements for dry packing.
  - c. Filling angular space / dry packing
    - 1) Contractor shall fill the angular space between the conduit and the wall with structural grout. The grout shall be even and uniform all the way around the conduit with no gaps or voids.
- B. Where conduit passes through walls, ceilings, or floors with connection points to junction boxes or raceway mounted to the same wall as the penetration provide rigid steel or IMC conduit treaded on both ends and secured in place with locking rings on both sides. Bend radius requirements shall be maintained where penetrations are made through the back of raceways; junction boxes with adequate depth shall be installed in order to comply with this requirement.
- C. Where conduit passes through walls, ceilings, or floors with connection points to junction boxes or raceway not mounted to the same wall as the penetration provide EMT conduit and secured in place with unistrut / strut channel. Box connectors shall always be used to connect EMT to junction boxes and raceways.
- D. Where conduit passes through walls, ceilings, or floors with no connection points to junction boxes or raceway provide rigid steel or IMC conduit treaded on both ends and secured in place with locking rings and large reducing washers on both sides.
- E. Where conduit passes through finished walls or ceilings, provide steel escutcheon plates, chrome or painted, as directed. Conduit, which penetrate floor slabs, concrete or masonry walls shall be grouted and sealed watertight at penetrations.
- F. Fire stopping:
  1. Seal all conduit penetrations through fire rated walls and floors fire and smoke tight in conformance with 2022 CBC Sections 714 & 2022 CEC 300-21.

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- G. Draft stopping:
  - 1. All non-fire rated walls must be draft stopped and sealed. Submit method to be used for approval by inspector and/or project manager. Mineral wool is one product that may be used.
- H. Water stopping:
  - 1. All exterior penetrations shall be sealed watertight. The contractor shall use silicon rubber caulk or other approved methods and materials. Submit method and material with inspector and/or project manager.
- I. Provide 12" vertical and horizontal clearance for conduit risers through roofs. Coordinate with roof manufacturer to seal roof.

### 3.10 DEMOLITION

- A. Any existing equipment and cable noted to be removed on design plans or abandoned devices and conduit not being reused by this project shall be removed by the Contractor.
- B. Removed equipment shall be inventoried and turned over to the Owner/Architect/Engineer or disposed of per the project's instructions.
- C. Disturbed surfaces shall be repaired to match original surface condition and prepped for painting.
- D. Blank electrical plates colored or painted to match existing surfaces shall be installed over abandoned flush mounted device boxes.

### 3.11 BOXES

- A. Screws shall be used to attach boxes, and must be accurately placed for finish, independently and securely supported by adequate wood backing or by manufactured adjustable channel type heavy-duty box hangers. Boxes with metal box hangers shall be attached to metal studs. Box hangers shall be securely tied or welded (where permitted) to metal studs. Paint weld with rust inhibitor. Boxes installed in masonry tile or concrete block construction shall be secured with auxiliary plates, bars or clips and be grouted in place.
- B. Locate outlets at the following heights above floor to the center of the device or handle unless otherwise noted on Drawings, Specifications, 2022 CBC 11B-308 or as required to meet ADA handicap requirements.
  - 1. Convenience Outlets: 18" AFF (6" above counter or splash not to exceed 40" above finished floor).
  - 2. Telephone Outlets: 18" AFF (45 in. for wall phone).
- C. Install pull boxes as required in accessible spaces but do not install in finished areas unless approved by the Owner/Architect/Engineer.

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- D. Outlet boxes on opposite sides of wall requiring protected openings shall be separated by a horizontal distance of twenty-four (24") inches, Title 24 Part 2, 713.3.2 Exception #1.
- E. For sound control, separate outlets on opposite sides of walls 16" minimum. Where outlets are less than 16" or in sound rated walls, seal airtight with fire rated sheet putty pads. Fill gap between junction box and wall with acoustical sealant all around perimeter of junction box. Fill conduits larger than 1 1/4" with fire rated putty.
- F. Installation of conduit and outlet boxes in fire-resistive walls and partitions shall comply with Title 24, Part 2, Section 713.
- G. Installation of conduit and outlet boxes in fire-resistive floors, floor-ceiling or roof-ceiling assemblies shall comply with Title 24, Part 2, Section 713.

3.12 GROUNDING AND BONDING

- A. Ground fittings shall be UL approved for each application as installed, installed and connected to system in accordance with 2022 CEC Code requirements.
- B. Neutral conductors and non-current carrying parts of equipment at each installation shall be grounded in accordance with applicable code. Ground conductor shall be copper having a current capacity in accordance with CEC Section 250.
- C. All equipment cases, motor frames, etc. shall be completely grounded to satisfy requirements of CEC. Install bond wire in flexible conduit. Install copper bond wire, sized in accordance with CEC, in all nonmetallic raceways and bond to all metallic parts using approved fittings.
- D. Service ground conductor shall be connected to a "Ufer" encased ground and bonded to the cold-water pipe system.
- E. Ground resistance of made electrodes shall not exceed 25 ohms, per CEC Article 250-84. Perform ground resistance test prior to connection.
- F. All connections shall be made with solder less connectors or molded fusion-welding process. Solder less connections shall be made to conform to Code requirements or manufacturers requirements if more stringent.
- G. Provide ground wire in all rooftop conduits.

3.13 FIELD TESTING

- A. General: Perform field test in the presence of the Owner's Representative except as otherwise specified. Provide required labor, materials, equipment and connections to perform tests. Document results and submit them to the Owner's Representative. Repair or replace all defective work.

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- B. Perform Megger test on all grounding legs:
1. Notify the Owner/Architect/Engineer when installed cable is ready to be tested.
  2. Apply Megger tests. Supply labor, materials and test equipment required to perform continuity checks and Megger tests. Submit test data for approval.
  3. If any failure is detected, locate failure, determine cause and, as directed by the Owner/Architect/Engineer, replace or repair cable or conductor to satisfaction of the Owner/Architect/Engineer at no increase in Contract Sum.
  4. Subject feeder cables rated 600 volts AC to one (1) minute withstand test, or until stable reading is obtained with 1000-volt Megger. Provide written report of Megger test results. Test report to include all test conditions.
  5. Do not Megger test any cables after connecting test equipment, unless specifically directed to do so by the Owner/Architect/Engineer.

3.14 CLEANING, PATCHING, AND PAINTING

- A. Brush and clean work prior to concealing, painting and acceptance. Performed in stages if directed.
- B. Clean and repair soiled or damaged painted exposed work and match adjoining work before final acceptance.
- C. Remove debris from inside and outside of material, equipment and structures.
- D. All conduit, connectors, j-boxes, and accessories shall be painted white with primer.
- E. All mud-rings shall be color code painted for inspection.

3.15 CABLING INSTALLATION AND DISTRIBUTION

- A. Cable shall be routed in appropriate conduit by system type as outlined in details. Contractor is to contact Owner/Architect/Engineer representative when this requirement can't be met.
- B. Cable shall not be exposed at any point in the cable path. Contractor is to use appropriate pathway for the situation (i.e. above drop ceiling, inside wall, conduit, or non-metallic surface raceway).
- C. Cables shall be protected and sleeved with a conduit in locations where cables need to pass through walls, floors, or hard ceilings. Contractor shall install rigid steel or IMC conduit threaded on both ends and secured in place with locking rings and large reducing washers on both sides. Bend radius requirements shall be maintained where penetrations are made through the back of raceways; junction boxes with adequate depth shall be installed in order to comply with this requirement. The fire rating of the wall must be maintained during and after installation.
- D. At solid wall locations such as plaster, brick, concrete, cinder block, tile, reinforced concrete, Contractor will provide and install surface mounted non-metallic raceways or



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equivalent. The use of different series raceways is required at locations where cable fill capacities are exceeded.

- E. Cables will be run vertically inside the wall and into the ceiling space. Terminations on stud walls will be accomplished with cut-in type electrical boxes with a 1" conduit (flex or EMT) extended from the box within the wall to ceiling access space.
- F. Cables routed above drop ceilings shall be run in corridors wherever possible in order to avoid furniture and work areas so that access to the cables is unencumbered.
- G. The cables are to be as accessible as possible, placed above all other items in the ceiling, including ducts and supports.
- H. Service loops:
  - 1. Service loops in Ground boxes and J-boxes shall not be installed unless with prior written approval or to allow for the minimum bend radius specified by the manufacturer:
  - 2. Cables routed above drop ceilings shall be run in corridors wherever possible in order to avoid furniture and work areas so that access to the cables is unencumbered.
  - 3. Fiber feeder cable:
    - a. Shall be a minimum of 10' at all MDF and IDF locations.
    - b. Shall be routed around the perimeter of the ground box as cable exits and enters each side of the ground box. No visible service loop required. Cable shall be secured to the side of the ground box and not rest on the bottom of the box.
  - 4. Intercommunications feeder cables:
    - a. Shall be routed around the perimeter of the backboard in which it is terminated on.
    - b. Shall be routed around the perimeter of the ground box as cable exits and enters each side of the ground box. No visible service loop required. Cable shall be secured to the side of the ground box and not rest on the bottom of the box.
  - 5. Twisted Pair Category 6/6A cable:
    - a. Shall be a minimum of 6' at all MDF and IDF locations.
    - b. Shall be routed around the perimeter of the ground box as cable exits and enters each side of the ground box. No visible service loop required. Cable shall be secured to the side of the ground box and not rest on the bottom of the box.
    - c. Shall be a minimum of 9" behind each station location.
  - 6. Service loops, Intercommunications:
    - a. Horizontal cables:
      - 1) Shall be a minimum of 3' at all head end termination locations.
      - 2) Shall be a minimum of 12" behind each speaker.
      - 3) Feeder/Backbone cables shall be routed around the perimeter of the backboard in which it is terminated on.

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- I. The cables are to be as accessible as possible, placed above all other items in the ceiling, including ducts and supports.
- J. Do not use pulling means, including fish tape, cable or rope, which can damage the non-metallic surface raceway.
- K. Use pulling compound or lubricant, with prior Owner/Architect/Engineer approval, only when necessary.
- L. Pulling compound shall be a water base pulling lubricant that will not deteriorate cable or conduit.
- M. Cables shall not be pulled across sharp edges. If sharp edges are present a small sleeve, insulating insert, or grommet shall be installed to protect the cable.
- N. Cables shall be pulled free of sharp bends or kinks.
- O. Cables shall not be forced or jammed between metal parts, assemblies, etc.
- P. Cables shall not be pulled across access doors and pull box covers. Access to all equipment and systems shall be maintained.
- Q. Manufacturer's specifications for pulling stress and minimum bend radius shall not be exceeded on any cable.
- R. Install or replace pull-string after installing cable in any EMT, IMC, Rigid, or PVC conduits.
- S. A maximum fill capacity of 40% will be deemed acceptable for conduits and 75% of raceway and surface pathway. Contractor shall inform Owner/Architect/Engineer / Owner/Architect/Engineer representative in writing if this requirement cannot be met. If the Contractor fails to inform the Owner/Architect/Engineer or its representative, any labor involve in rerouting cables in such conduit or raceways shall be the sole responsibility of the Contractor.
- T. Cable shall be identified with a machine-printed tag identifying the system type, source or head end location, and destination location in all access points (i.e. junction boxes, ground boxes, MDF, IDF's, etc.) and as they enter or exit the conduit pathway.
- U. Contractor will assess whether or not the ceiling space is a plenum air return, which shall dictate the use of the listed plenum type or PVC type cable required in the materials specification section. Any cable installations that shall be pulled through underground conduit will require Outside Plant (OSP) cable. OSP cable are limited to a length of 50' inside a building.
- V. Power feeds of greater than 220 volts shall not be run parallel to UTP, Speaker or other system cables. Parallel runs of greater than 20 feet require a minimum separation

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distance of 3 feet, or 18 inches if cables are contained in a metallic conduit, which is grounded.

- W. All power feeds crossing the path of UTP, Speaker or other system cables at right angles shall be a minimum of 6 inches in distance from the UTP cables.
- X. There shall be a 6-inch separation between the cables and the light fixtures and motors. Contractor will notify the Owner/Architect/Engineer or it's representative in the event this requirement cannot be met.
- Y. All cable/cabling shall be kept 6 inches away from any heat source, i.e., HVAC ducting, steam valves, etc.
- Z. Fiber Optic cable/cables shall be identified with a tag identifying cable type, destination and origin, and date installed, every 30 feet when installed in open trays or suspension systems in ceilings.
- AA. Station Cable (UTP) or (STP) runs are not to exceed 290 feet.
- BB. Cable splicing at any point of any cable installed by the contractor is unacceptable without specific Owner/Architect/Engineer and designer approval.
- CC. No cabling is allowed to rest on any ceiling tile or suspension system unless specifically authorized by the Owner/Architect/Engineer. Strapping or mounting to any existing wires (e.g., lighting, ceiling grid, conduits, etc.) is not permitted.
- DD. Cables, regardless of classification, shall not be bundled in larger quantities than 24.
- EE. Cables bundled in quantities of 24 or larger shall be securely mounted to building structure (i.e. stud, beam, or other framing member.) with Contractor supplied cable tray unless otherwise specified on design drawings and details.
- FF. Cables bundled in quantities less than 24 shall be securely mounted to building structure (i.e. stud, beam, or other framing member.) with Contractor supplied J-hooks every 4 feet unless otherwise specified on design drawings and details.
- GG. Cables bundled in junction boxes shall be neatly routed and secured to box with Contractor supplied Velcro straps typically 4 per box.
- HH. Cables shall be securely supported to building structure (i.e. stud, beam, or other framing member.) within 12 inches of any conduit or raceway entrance or exit. Cable tray may be required if not noted on plans.
- II. Contractor will place all UTP, Speaker and other system cables in the ceiling area on Contractor supplied and installed wire hangers or in floor spaces and raceways. Cable tray may be required if noted on plans.

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- JJ. Insulation shall be removed to expose shielding and conductors/fibers to the exact length required by manufacturer for proper termination of plugs, pins and fiber terminations.
- KK. Wires and shielding shall not be nicked or damaged in any way upon termination of pins and closure of plug assembly.
- LL. Pins and plugs, upon termination, shall not be damaged in any way.

END OF SECTION

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SECTION 27 13 00 - COMMUNICATIONS BACKBONE CABLING

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies equipment, accessories, materials, installation, configuration and testing requirements for a complete and operable Communications Backbone Cabling system. The system shall provide highly reliable and high-performance data communication from main distribution frame (MDF) to each intermediate distribution frame (IDF) or end points requiring fiber optic cabling.

1.02 SCOPE

- A. The work will include but not be limited to the following objectives:
  - 1. For new construction – provide, coordinate, and install all required components and accessories as outlined in the design documents for a complete and operable system.
  - 2. For existing construction – provide, coordinate, and install all components and accessories as outlined in the design documents to modify the existing system while maintaining compliance and to seamlessly integrate the new components into the existing campus' system.
  - 3. Labor and Materials: The Contractor shall provide and pay for all labor, materials, equipment, tools, utilities, construction equipment and machinery, transportation and other facilities and services necessary for the proper execution, operation and completion of the Work.
  - 4. The Contractor shall furnish and install all new conduit/raceway and wire as indicated on the project drawings and/or as required to provide a turn-key system to the District.
  - 5. The Contractor shall terminate all strands of fiber at each fiber enclosure. All cables shall be installed with a minimum 10' service loops at MDF/IDF locations. Fiber will be terminated using LC type connectors.
  - 6. Service loops shall be secured to backboard or rear of cabinet using a pre-manufactured fiber optic wheel with Velcro straps. If installed at rear of cabinet, the wheel shall be placed at a height that will not interfere with equipment to be installed in the cabinet.
  - 7. If applicable, existing systems shall remain operable until new systems are accepted and approved by the District or its representative.
  - 8. The contractor shall complete all required project closeout documentation in a timely fashion.
  - 9. Testing of fiber and connections to insure a complete and operable end-to-end data connection using ANSI/TIA 568-C and ANSI/TIA/526-7 testing guidelines for multi-mode fiber.
  - 10. Fiber installs to carry Leviton Limited Lifetime warranty (see Division 27 05 00 for requirements)

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- B. VOICE COPPER BACKBONE- This work relates only to sites where the District has not activated a Voice over IP platform or if special circumstances requires an analog copper connection such as a fax machine, intercom connection tie-in, HVAC controller, etc. The work will include but not be limited to the following objectives:
1. MPOE
    - a. Backbone feeder cables shall be at a minimum Category 5, size and number of pairs as indicated in drawings and Scope of Work documents, but never less than 8 pairs.
    - b. All pairs are to be terminated as follows:
      - 1) At the MPOE end, on 66-blocks.
      - 2) At the MDF end, individual jack per pair, single pair per RJ45 port, housed in 4-port or larger surface mount quickport box.
  2. Buildings requiring an analog fax connection
    - a. backbone feeder cables shall be at a minimum Category 5, size and number of pairs as indicated in drawings and Scope of Work documents, but never less than 4 pairs.
    - b. All pairs are to be terminated as follows:
      - 1) At the IDF end, individual jack per pair, single pair per RJ45 port, housed in 4-port or larger surface mount quickport box.
      - 2) At the MDF end, individual jack per pair, single pair per RJ45 port, housed in 4-port or larger surface mount quickport box.
  3. Buildings requiring an analog tie-in to the intercommunications head end unit.
    - a. backbone feeder cables shall be at a minimum Category 5 SHIELDED cable, size and number of pairs as indicated in drawings and Scope of Work documents, but never less than 4 pairs.
    - b. All pairs are to be terminated as follows:
      - 1) At the IDF end, individual jack per pair, single pair per RJ45 port, housed in 4-port or larger surface mount quickport box.
      - 2) At the MDF end, individual jack per pair, single pair per RJ45 port, housed in 4-port or larger surface mount quickport box.

1.02 RELATED REQUIREMENTS

- A. Division 01 – General Requirements
- B. Division 27 - Communication
- C. Section 27 05 00 – Common Work Results for Communication Systems
- D. Section 27 15 00 – Communication Horizontal Cabling

1.03 INDUSTRY GUIDELINES AND STANDARDS

- A. ANSI/TIA-568-1.D: Commercial Building Telecommunications Cabling Standard.
- B. ANSI/TIA -568-C.2: Balanced Twisted-Pair Telecommunications Cabling and Components Standard.

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- C. ANSI/TIA -568-3.D: Optical Fiber Cabling Components Standard.
- D. ANSI/TIA/EIA-569-D: Telecommunications Pathways and Spaces.
- E. ANSI/TIA -568-0.D: Measurement of Optical Power Loss of Installed Fiber Optic Cable Plant
- F. ANSI/TIA -598-D: Optical Fiber Cable Color Coding.
- G. ANSI/TIA -606-C: Administration Standard for Telecommunications Infrastructure.
- H. ANSI/TIA -607-C: Generic Telecommunications Bonding and Grounding (Earthing) Requirements for Customer Premises.
- I. ANSI/TIA -758-B: Customer-Owned Outside Plant Telecommunications Infrastructure Standard.
- J. Fiber optic cable, wire and connectors shall be installed as indicated, in accordance with the manufacturer's written instructions, the applicable requirements of NEC and the National Electrical Contractors Association's "Standard of Installation", and in accordance with recognized industry practices to ensure that products serve the intended functions. As such, all of the following: National Fire Code (NFPA), National Electrical Code (NEC), California Electrical Code (CEC), California Building Code (CBC) & Local Codes shall be followed.

1.05 QUALIFICATIONS

- A. The contractor shall possess a California C7 or C10 license.
- B. The Contractor or Subcontractor shall be Leviton certified to provide and install cable plant with 5 years documented experience.
- C. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.

1.06 REFERENCES

- A. See Division 27.

1.07 SYSTEM REQUIREMENTS

- A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing data cable plan system.

1.08 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

- A. See section 27 00 00 for requirements.

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1.09 SUBMITTALS

- A. See section 27 00 00 for requirements.

PART 2 – PRODUCTS

2.01 DATA FIBER BACKBONE

- A. See Appendix at the end of this document for pre-approved materials.
- B. All products shall be new and unused and shall be of manufacturer's current and standard production.
- C. Contractor shall confirm all equipment part numbers with the District prior to ordering equipment and updating submittals as required.
- D. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory operation.
- E. Product Availability
  - 1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.

2.02 CONDUIT AND RACEWAY

- A. See division 27 05 00 for conduit and raceway requirements.

2.03 WIRE AND CABLE

- A. Refer to Appendix A for Pre-approved manufacturers and part numbers.
- B. Provide all new wire and cable required to install systems as indicated on design documents.
- C. Fiber optic cables shall be tight buffered laser optimized, 6 strands for Elementary Schools and 12 strands for Middle and High school. Any cable shall not exceed a .30" diameter.
  - 1. Fiber optic cable shall have a minimum effective modal bandwidth of 3500 MHz/Km. See Appendix at the end of this document for approved material.
- D. Fiber Optic connectors for multi-mode shall be industry standard LC type connectors. See Appendix at the end of this document for approved material.



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- E. MDF rack mount fiber optic enclosures (LIU) shall be as outlined in Appendix at the end of this document and completely loaded with Ceramic ferrule Duplex LC Packs unless listed otherwise in drawings and details or approved equal.
- F. Furnish one (1)-meter LC to LC duplex cross over fiber patch cord for every two terminations at IDF locations and one (2) meter LC to LC duplex cross over fiber patch cord for every two terminations at MDF location. The patch cords shall have connectors with ceramic ferrules. All patch cords shall be packaged with a factory performance certification report. Verify all lengths before ordering.

2.04 FIBER OPTIC CABLE MANAGEMENT RING

- A. Re-closable ring cable management device. Ring should be 24 inches in diameter for Copper Multipair, OSP, or Armored cable, and 12" diameter for Indoor fiber cable.
- B. Ring to be mounted on the backboard at the OSP fiber entrance as indicated. Six hook and loop style loops attached.
- C. Approved Products
  - 1. Leviton 24" Velcro fiber spool, 48900-OFR
  - 2. Leviton 12" Velcro fiber spool, 48900-IFR

2.05 PATCH CORDS

- A. See section 27 16 00 for requirements

2.06 LOW VOLTAGE ENCLOSURES AND PATHWAYS

- A. See section 27 05 00 for additional requirements.

PART 3 – EXECUTION

3.01 ACCEPTABLE INSTALLERS

- A. The cable plant system shall only be installed by Contractors who are qualified to install, service and maintain the cable plant system.
- B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience before the Bid Opening Date.

3.02 EXAMINATION

- A. The Contractor shall be required to visit the installation site(s) prior to bidding the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly

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the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to the District.

- B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

- A. The Contractor shall order all required parts and equipment upon receipt of approved product submittals.
- B. The Contractor shall verify the availability of power where required.

3.04 SHOP DRAWINGS

- A. See section 27 00 00 for requirements
- B. Submit drawings for review and approval by Project Manager.

3.05 INSTALLATION

- A. See 27 05 00 for additional routing requirements
- B. The cables will be routed to their respective Main Distribution Frame (MDF) or Intermediate Distribution Frame (IDF) utilizing the shortest path possible while maintaining right angles to the building structure.
- C. Contractor is required to adhere to the parameters in this section whether or not existing equipment has been placed by Contractor and/or others.
- D. Contractor will notify the District if any of the requirements cannot be met prior to bid.
- E. Voice copper backbone
  - 1. Terminations shall be T568B configuration unless otherwise specified.
  - 2. Labeling
    - a. Wiring termination locations shall be labeled to corresponding pairs at the MDF and IDF.
    - b. Cables shall be labeled no more than 3" back from each end of the termination point with a cable label that matches the patch panel labeling.
    - c. Contractor will provide tags, straps, and adhesive labels. These tags, straps, and adhesive labels shall be of high quality that will endure over time.
    - d. Handwritten labels are not acceptable.
    - e. Each pair shall have a unique label throughout the site. This would allow a cable management system to track each cable pair.
    - f. Labeling Scheme
      - 1) Closet labeling: 66-block or surface-mount quickport box shall be labeled with the destination MDF or IDF #, sequential feeder pair

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number only. The labeling itself shall be in a white background with black lettering.

F. Data Fiber Backbone

1. The District has standardized on materials that provide component quality and maintainability. Refer to the Appendix A at the end of this specification for pre-approved material.
2. Fiber Optics Cable Installation and Testing.
  - a. Service loops shall be secured to backboard or rear of cabinet using a pre-manufactured fiber optic wheel with Velcro straps. If installed at rear of cabinet, the wheel shall be placed at a height that will not interfere with equipment to be installed in the cabinet.
  - b. Fiber cables shall be securely mounted to the fiber enclosure using zip ties in at least two locations around the jacket to prevent cable twisting and movement. In addition, the Kevlar or strength member shall be bolted, tied, or securely fastened to the enclosure.
  - c. Fibers strands shall be neatly organized in the enclosure with individual bundled paths from each cable to the bulkheads in which they are mounted.
  - d. Fiber strands shall be made to rest in their final position without tension or stress of any kind.
  - e. All spare optical ports and connectors shall have a dust cap in place to protect from the environment.
  - f. Contractor shall provide and install blanks in unused spaces of the fiber enclosure.
  - g. All unused optical ports on the LIU shall have protective covers that prevents dust and particles to enter the port.
3. Fiber Optics Labeling
  - a. Fiber termination locations shall be labeled to corresponding fiber strands pairs at the MDF and IDF.
  - b. The labeling scheme shall be submitted by the contractor for District / District representative approval prior to installation.
  - c. Contractor is expected to provide tags, straps, and adhesive labels. These tags, straps, and adhesive labels shall be of high quality that will endure over time.
  - d. Handwritten labels are not acceptable.
  - e. Labeling requirements
    - 1) Cables shall be labeled approximately 12 inches back from the point where the cable enters the fiber enclosure with a cable label that identifies the origin and destination of the cable.
    - 2) Closet labeling; each connection shall be labeled denoting each strands number, origin and destination.
    - 3) The type (single-mode or multi-mode) of fiber optic cable used shall be clearly labeled on the fiber patch panel per drawn details.
    - 4) Color-coding shall conform to ANSI/TIA specifications.

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4. Fiber Optics Testing
  - a. All optical test equipment shall have current, traceable calibration certification.
  - b. If fiber is supplied to Contractor by the district shall be tested before installation, while still on the shipping reel, using an optical time domain reflectometer (OTDR). The test results shall be compared to the manufacturers test results. A discrepancy of more than 1 dB on any fiber in either window indicates possible shipping damage and the fiber shall be returned to the supplier. The test results shall be maintained in a file for future reference.
  - c. All fiber shall be tested after installation according to the Method A procedures described in ANST/TIA-568-C.
  - d. Power meter test equipment shall produce a machine generated test report containing the minimum of the following test information:
    - 1) Contractor's Name
    - 2) Operator's Name
    - 3) Customer's location
    - 4) Closet Location
    - 5) Cable ID
    - 6) Test Summary – i.e. Pass/Fail
    - 7) Date and Time of test
    - 8) Test Standard
    - 9) Equipment serial numbers
    - 10) Length in Feet
    - 11) Test direction – i.e. MDF to IDF=A-B / IDF to MDF=B-A
    - 12) Wavelength
    - 13) Optical loss in dB
    - 14) Optical loss limit
    - 15) Reference setting
    - 16) Reference setting date and time
    - 17) (Most bi-directional test sets will meet these criteria providing the operator enters the proper information. Contractor shall notify the project manager before testing if there is any question regarding this requirement)
  - e. In addition to power meter testing, OTDR testing is to be performed in any location where the fiber is not continuous, i.e. coupled LC connectors (soft splice), fusion splice, and mechanical splice. When testing with an OTDR the contractor shall utilize a test lead or launch cable a minimum of 100 meters in length and a trail test cable a minimum of 100 meters in length. The contractor shall set a marker at the start and end of the tested cable on each test result and the difference in loss between the two markers shall be noted on the test report. The results of these tests (printed OTDR result power meter attenuation results) shall be provided by the installer as documentation of the quality of installation and as a baseline for future troubleshooting. The results shall be compared to the pre-installation test results for significant changes.

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- f. The multi-mode cable shall comply with maximum individual fiber loss limits in accordance with ANSI/TIA-568-C Multimode, OM4.
- g. Aerial fiber cable mounting hardware shall be matched to the all dielectric self-supporting (ADSS) fiber cable exactly and be installed in accordance with mounting hardware and cabling manufacturers specifications.

3.06 WORKMANSHIP

- A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship. Contractors unfamiliar with the District's standards shall familiarize themselves with the District's standards and requirements prior to beginning work.
- B. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.
- C. Perform Work with persons experienced and qualified to produce workmanship specified.
- D. Maintain quality control over suppliers and Subcontractors.
- E. Quality of workmanship is considered important. The District's Project Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.

3.07 CABLE

- A. Design, layout, size, and plan new cable runs as required.
- B. All wire and cable passing thru metalwork shall be sleeved by an approved grommet or bushing.
- C. Conduit/raceway fill shall not exceed 40 percent of interior cross-sectional area.
- D. Identify all cables at terminations. Identification shall be made with an approved permanent label, machine generated 1/4" black letters on white tape (Brady or equal.)
- E. Underground cable shall be rated for use.
- F. Neatly dress and tie all cabling.

3.08 CONDUIT AND RACEWAY INSTALLATION

- A. Design, lay-out, size and plan new conduit and raceway systems as required.
- B. Install conduit and raceway in accordance with Section 27 05 00 requirements.

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3.09 PENETRATIONS, CUTTING AND PATCHING, DEMOLITION, PAINTING

- A. See section 27 05 00 for requirements

3.10 FIELD QUALITY CONTROL AND TESTING

- A. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify District of your readiness to perform the formal Test & Inspection of the complete system.
- B. Submit the Record Drawings (as-builts) to District for review prior to inspection.
- C. During the formal Test & Inspection (Commissioning) of the system, have personnel available with tools and equipment to inspect wiring, devices and system operation.
- D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.
- E. Notify District when ready to perform a re-inspection of the installation.

3.11 EQUIPMENT INSTALLATION CONFIGURATION AND TESTING

- A. See section 27 00 00 and 27 05 00 for requirements

3.12 AS-BUILT DRAWINGS AND TEST RESULTS

- A. See section 27 00 00 for requirements.

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APPENDIX-A  
(Unless Otherwise Specified on Construction Document Plan Sheets)

PATCH PANEL AND WIRE MANAGEMENT

DESCRIPTION	MANUFACTURER	PART NUMBER
48-Port Snap-in Patch Panel, 2U Wire management bar included	Leviton	49255-D48
Horizontal Cable Management	Leviton	49253-LPM

FIBER / COPPER MATERIAL

DESCRIPTION	MANUFACTURER	PART NUMBER
Leviton 2000i SDX Series fiber housing a) 19" rack mounted units completely loaded with Zirconia Ceramic LC fiber adapter plates	Leviton	1U = 5R1UH-S03 2U = 5R2UH-S06 4U = 5R4UH-S12
Fiber Wall Mount Enclosure	Leviton	5WMNT-01C
Leviton SDF fiber adapter plate	Leviton	5F100-2QL
12-strand OM4 LOMM 50um tight buffered plenum indoor/outdoor rated fiber (no loose tube)	Berk-Tek	PDP012FB3010/F5-I/O-C4(AQU)
4-pair or larger copper feeders		See Section 27 15 00

END OF APPENDIX A

END OF SECTION

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SECTION 27 15 00 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 GENERAL

1.01 SUMMARY

- A. This section defines equipment, materials, accessories, installation, configuration and testing requirements for a complete and operational Communications Horizontal Cabling system. The system shall provide reliable high-performance data communication from the Main Distribution Frame (MDF) / Equipment Room (ER), Intermediate Distribution Frame (IDF) / Telecommunication Room (TR) or equipment control points to area workstations and communications device locations.

1.02 SCOPE

- A. The work will include but not be limited to the following objectives:
1. For new construction – provide, coordinate, and install all required components and accessories as outlined in the design documents for a complete and operable system.
  2. For existing construction – provide, coordinate, and install all components and accessories as outlined in the design documents to modify the existing system while maintaining compliance and to seamlessly integrate the new components into the existing system.
  3. Labor and Materials: The Contractor shall provide and pay for all labor, materials, equipment, tools, utilities, construction equipment and machinery, transportation and other facilities and services necessary for the proper execution, operation and completion of the scope of work.
  4. The Contractor shall furnish and install all new conduit/raceway and wire as indicated on the project drawings and/or as required to provide a fully functional system to the Owner/Architect/Engineer.
  5. The Contractor shall install new Category 6A (Cat 6A) data cabling, station outlets at locations as indicated on drawings. Terminations will be ANSI/TIA standard T568B wiring configuration into RJ45 workstation data jacks.
  6. The Contractor shall set up a complete wire management system at each MDF / ER, IDF / TR, this includes wire management organizer(s). Contractor shall provide the following:
    - a. One (1) vertical wire manager for each equipment rack to be installed (height to match equipment rack overall units)
    - b. One (1) 1RU horizontal wire manager for each new Cat 6A patch panel
    - c. One (1) 1RU horizontal wire manager for each switch to be installed
  7. The Contractor is required to adhere to current industry standards when distributing and terminating cables:
    - a. All Cat 6A cables shall be secured to the rear cable management bar that is included with each of the patch panels.



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- b. At the rear of the patch panel, 50% of the cables shall enter the patch panel area from the right side and 50% of the cables enter from the left side. Cables shall be bundled in groups no larger than 25 cables. All bundled cabling shall be similar type per cable separation guidelines.
- 8. Prior to installation, If the length of the cable run appears to be exceeding 275' from station outlet to patch panel, the Contractor shall review requirement with Engineer.
- 9. If applicable, existing systems shall remain operable until new systems are accepted and approved by the Owner/Architect/Engineer or its representative.
- 10. All Category 6A (Cat 6A) installations shall carry Limited Lifetime warranty (see Division 27 for requirements).

1.03 RELATED REQUIREMENTS

- A. Division 01 specifications, General Requirements
- B. Division 26 specification sections, as applicable
- C. Division 27 specification sections, as applicable
- D. Division 28 specification sections, as applicable

1.04 CODES AND STANDARDS

- A. See specification section 27 00 00 for requirements

1.05 CONTRACTOR QUALIFICATIONS

- A. See specification section 27 00 00 for requirements

PART 2 PRODUCTS

2.01 GENERAL

- A. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.
- B. Contractor shall confirm all equipment part numbers with the Owner/Architect/Engineer prior to ordering equipment and updating submittals as required.
- C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the

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operation specified. Contractor shall provide all components needed for complete and satisfactory installation and operation.

D. Product Availability

1. Prior to submitting a project bid, the contractor shall determine product availability, delivery time, and shall include such considerations into the base bid for the communications systems scope of work as defined in the construction documents.

2.02 CONDUIT AND RACEWAY

- A. See specification section 27 05 00 for additional information and requirements

2.03 WIRE AND CABLE

- A. Provide all new wire and cable required to install systems as indicated on construction documents.
- B. Category 6A cable shall meet or exceed IEEE 802.3 for Gigabit Ethernet.
- C. Category 6A underground cable shall be rated for the application intended.
- D. Cable management system shall be installed to provide a complete management system.

2.04 PATCH CORDS

- A. See specification section 27 16 00 for additional information and requirements

2.05 LOW VOLTAGE ENCLOSURES AND PATHWAYS

- A. See specification section 27 05 00 for additional information and requirements

PART 3 EXECUTION

3.01 INSTALLATION

- A. The cables will be routed to their respective Main Distribution Frame (MDF) or Intermediate Distribution Frame (IDF), to Node Termination Point (NTP) utilizing the shortest path possible while maintaining right angles to the building structure.
- B. Data UTP:
  1. Data terminations shall be T568B configuration.
  2. Patch panels shall be installed in accordance with manufacturer's installation guidelines.
  3. Labeling
    - a. Handwritten labels are not acceptable.

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- b. Cables shall be labeled no more than 4" inches back from each end of the termination point with a cable label that matches the station outlet labeling.
  - c. Wiring termination locations shall be labeled to corresponding pairs at the MDF / ER, IDF / TR, and at each station outlet end.
  - d. Contractor will provide tags, straps, and adhesive labels. These tags, straps, and adhesive labels shall be of high quality that will endure over time.
4. Labeling Scheme
- a. Workstation labeling:
    - 1) The faceplate or surface block shall be labeled with the MDF / ER, or IDF / TR number (#), sequential station outlet number for the MDF / ER, or IDF / TR (ex. 1.1-09).
    - 2) The labeling itself shall be in a white background with black lettering.
  - b. MDF / IDF labeling:
    - 1) Patch panel shall be labeled with the sequential station outlet number to match station outlet labeling.
    - 2) The labeling itself shall be in a black background with white lettering.
  - c. Data UTP Testing
    - 1) All data UTP cable shall be tested after installation according to the procedures and acceptability criteria described in ANSI/TIA Standards for Category 6 or Category 6A cable and connecting hardware. Test at level IIIe compliance or higher.
    - 2) Data UTP cable shall meet or exceed requirements for 10Gbps for Cat6A.
    - 3) Test results will be submitted per Section 27 00 00.
- C. Manufacturer's specification for pulling stress and minimum bend radius shall not be exceeded on any Category cable.
- D. Station Cable (UTP) or (STP) runs shall not exceed 295' feet (90 meters) on the permanent link.
- 3.02 CABLE
- A. Design, layout, size, and plan new cable runs as required.
  - B. All wire and cable passing thru metalwork shall be sleeved by an approved grommet or bushing.
  - C. Conduit/raceway fill shall not exceed 40 percent of interior cross-sectional area.
  - D. Identify all cables at terminations. Identification shall be made with an approved permanent label, machine generated 1/4" black letters on white tape (Brady or equal.)
  - E. Underground cable shall be rated for use.
  - F. Neatly dress and secure / strap all cabling.

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3.03 WARRANTY, TESTING, AND COMMISSIONING

- A. Refer to Division 27 for requirements.

3.04 CONTRACTOR CLOSEOUT DOCUMENTS AND TEST RESULTS

- A. Refer to Division 27 for requirements.

END OF SECTION

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SECTION 27 16 00

CONNECTING CORDS

PART 1 – GENERAL

1.01 SUMMARY

- A. The Work of this Section shall consist of the labor, materials and equipment required for furnishing and installing telecommunications patch cables and equipment cords as part of a complete and functional telecommunications system.
- B. All items specified or included in this section shall be furnished and installed by Telecommunications Contractor, wired, and connected by Telecommunications Contractor and tested by Telecommunications Contractor, unless noted otherwise. "Contractor" as used herein shall mean Telecommunications Contractor or Telecommunications Contractor's sub-contractor.

1.02 SCOPE

- A. The work will include but not be limited to the following objectives:
  - 1. For new construction – provide, coordinate, and install all required components and accessories as outlined in the design documents for a complete and operable system.
  - 2. For existing construction – provide, coordinate, and install all components and accessories as outlined in the design documents to modify the existing system while maintaining compliance and to seamlessly integrate the new components into the existing campus' system.
  - 3. Contractor shall furnish and install all patch and equipment cords for both copper and fiber.
  - 4. Contractor to provide and install one patch cord at the MDF / IDF for each data drop installed. Each data drop installed shall be patched into an active port on the MDF / IDF data switch.
  - 5. Contractor shall, as scope dictates, coordinate with other trades for floor boxes, box covers, straps, above ceiling boxes and covers and all other requirements to install a complete and operable system.
  - 6. Labor and Materials: The Contractor shall provide and pay for all labor, materials, equipment, tools, transportation, and other services necessary for the proper execution, operation and completion of the work.
  - 7. Coordinate cord length, color, Category rating, Quantity, and plenum/non-plenum requirements in advance of ordering and installation.
  - 8. Some patch cords may require advance ordering for manufacturing lead time. Coordinate and place order at earliest opportunity. Manufacturing or procurement delays are the responsibility of the Contractor.
  - 9. The Contractor shall install patch cords at the MDF / IDFs to meet highest industry standards. This includes a complete wire management system as well as minimal patch cord slack as dictated further in this section.
  - 10. If applicable, existing systems shall remain operable until new systems are accepted and approved by the District or its representative.
  - 11. Contractor shall review with project manager proposed patch cord layout.

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12. Contractor shall install patch cords in the data switches as indicated on port assignment sheet. If a port assignment sheet has not been provided with the data switches the contractor shall notify the project manager at least 2 weeks prior to scheduled install date.
13. The contractor shall complete all required project closeout documentation in a timely fashion.

1.03 RELATED REQUIREMENTS

- A. Division 01 – General Requirements
- B. Division 27 - Communication
- C. Section 27 05 00 – Common Work Results for Communication Systems
- D. Section 27 11 00 – Equipment Rooms and Enclosures

1.04 INDUSTRY GUIDELINES AND STANDARDS

- A. ANSI/TIA-568-1.D: Commercial Building Telecommunications Cabling Standard.
- B. ANSI/TIA -568-C.2: Balanced Twisted-Pair Telecommunications Cabling and Components Standard.
- C. ANSI/TIA/EIA-569-D: Telecommunications Pathways and Spaces.
- D. ANSI/TIA -606-C: Administration Standard for Telecommunications Infrastructure.
- E. ANSI/TIA -607-C: Generic Telecommunications Bonding and Grounding (Earthing) Requirements for Customer Premises.
- F. ANSI/TIA -758-B: Customer-Owned Outside Plant Telecommunications Infrastructure Standard.

1.05 QUALIFICATIONS

- A. The contractor shall possess a California C7 or C10 license.
- B. The Contractor or Subcontractor shall be Leviton certified to provide and install cable plant with 5 years documented experience.
- C. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.

1.06 REFERENCES

- A. See Division 27 for requirements.

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1.07 SYSTEM REQUIREMENTS

- A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing data cable plan system.

1.08 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

- A. See section 27 00 00 for requirements.

1.09 SUBMITTALS

- A. See section 27 00 00 for requirements.

1.10 WARRANTY

- A. Refer to Division 01 Warranty section.
- B. See section 27 00 00 for additional requirements.

PART 2 – PRODUCTS

2.01 GENERAL

- A. See Appendix A at the end of this document for pre-approved materials.
- B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.
- C. Contractor shall confirm all equipment part numbers with the District prior to ordering equipment and updating submittals as required.
- D. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory installation and operation.
- E. Product Availability: Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.

2.02 COPPER PATCH AND EQUIPMENT CORDS

A. GENERAL

- 1. Patch cord plug shall be a Slimline connector with integrated snag-less plug design made of FCC compliant 94V-0 clear material without incorporating the use of a rubber molded over-boot.
- 2. Patch cords in Plenum areas shall be Plenum-rated.
- 3. Patch cords shall meet ANSI/TIA-1096-A requirements to include 50 micro inches of gold plating.

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4. The non-plenum patch cord jacket shall meet or exceed UL 444 CM rating and be RoHS compliant.
  5. The patch cords shall be available in standard 1, 2, 3, 5, 7 and 10 foot lengths. Custom lengths from 1' and above shall also be available.
- B. Standard copper patch cords for CAT6A UTP and FTP cable systems shall exhibit the following characteristics:
1. Independently tested and verified for CAT 6A component performance.
  2. Constructed of shielded 26 AWG stranded conductor cable for maximum flexibility and outside diameter of .240", for use in shielded and unshielded systems.
  3. Power over Ethernet (PoE and PoE+) compatible to 100W PoE
  4. See Appendix A for pre-approved established system colors.
- C. Standard-diameter copper patch cords for CAT6A UTP user locations shall exhibit the following characteristics:
1. 26-gauge, unshielded, twisted pair, stranded conductor construction with a standard 8-position modular plug on both ends.
  2. Maximum Outer Diameter of 0.24"
  3. Power over Ethernet (PoE and PoE+) compatible to 100W
  4. See Appendix A for pre-approved established system colors.
- D. High-flex copper patch cords for CAT6A UTP cable systems used inside Telecom Enclosures, Rooms and racks shall exhibit the following characteristics:
1. 28-gauge, unshielded, twisted pair, stranded conductor construction with a standard 8-position modular plug on both ends.
  2. Ultra-narrow diameter, highly flexible cord for less congestion in higher density applications
  3. Maximum Outer Diameter of 0.15", minimum bend radius 0.60"
  4. Power over Ethernet (PoE and PoE+) compatible to 60W in unbundled configurations.
  5. Support 1 Gigabit applications over 90-meter permanent links with up to 6 meters of cordage
  6. To be used at patch panel end of any CAT6 UTP permanent link.
  7. Provide and install only factory-assembled patch cords of the same or better Category rating of the permanent link cabling system, in quantities as described in Part 3 of this Specification.
  8. See Appendix A for pre-approved established system colors.

## 2.03 FIBER OPTIC PATCH CORDS

- A. Fiber optic LC-LC patch cords, or jumpers, will make LC connections from the rack termination points to the equipment. The jumpers will meet the following requirements:
1. Factory-manufactured using Laser-Optimized Fiber. Field terminations on fiber jumpers are not acceptable.
  2. Shall utilize A-B polarity.
  3. Shall be available in standard lengths of 1, 2, 3, 5 and 10 meters and custom-orderable up to any length of feet or meters
  4. Provide factory assembled patch cords meeting or exceeding all criteria specified in the horizontal cabling standard
  5. Verify lengths, quantities, and configuration with actual project requirements prior to ordering and delivery.



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PART 3 – EXECUTION

3.01 ACCEPTABLE INSTALLERS

- A. The cable plant system shall only be installed by Contractors who are qualified to install, service and maintain the cable plant system.
- B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years experience before the Bid Opening Date.

3.02 EXAMINATION

- A. The Contractor shall be required to visit the installation site(s) prior to bidding the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to the District.
- B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

- A. The Contractor shall order all required parts and equipment upon receipt of approved product submittals.

3.04 INSTALLATION

- A. Contractor to provide and install fiber and copper patch cords in quantities as described below. Neatly install patch cords in lengths as appropriate to keep reduce unnecessary length in wire managers. No more than 12" of slack for the copper patch cords will be allowed.
- B. Install patch cords at the equipment cabinet between patch panel and equipment / switches for each patch panel and workstation location. Patch cords shall direct-connect between patch panel and networking switch or other electronics equipment. Dress and bundle patch cords as appropriate for final installation. Provide any unused equipment patch cables to Owner in original packaging upon completion of project.
- C. Provide workstation patch cords to Owner in original packaging.
- D. All fiber patch cords and required workstation/equipment patch cords not installed shall be provided in hand to Owners Representative prior to project closeout.
- E. Install all patch cords in accordance with the Owners I.T. Department or the person in charge of the telecommunications infrastructure.

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- F. Bend radius of cables shall be maintained as recommended by the manufacturer and per BICSI standards.
- G. Dress and bundle all patch cords in a neat and workmanlike manner. Do not create patch cord bundles larger than 24 cables. Use Velcro every 12" or less and as needed at turn and entry points to secure and organize cords.
- H. Provide strain relief as needed using Velcro straps. Utilize cable managers for routing cords among devices.
- I. Use the following guidelines for project bid. Verify all lengths with project requirements / excess slack requirements prior to ordering / purchase:
  - 1. Provide one (1) 10-foot patch cord of the same category rating, at the workstation for each cable terminated at the terminal outlet location
  - 2. Provide one (1) 2-meter patch cord of the same grade of fiber, for each LC connector pair installed at the IDF, MDF, and all other terminal enclosure locations.

### 3.05 WORKMANSHIP

Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.

Perform Work with persons experienced and qualified to produce workmanship specified.

Maintain quality control over suppliers and Subcontractors.

Quality of workmanship is considered important. The District's Project Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.

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**APPENDIX-A**  
**(Unless Otherwise Specified on Construction Document Plan Sheets)**

**CAT 6 / 6A PATCH CORDS / FIBER PATCH CORDS**

DESCRIPTION	MANUFACTURER	PART NUMBER
Cat 6 Patch cables, eXtreme High Flex HD6 (O.D. 0.15") (Insert length in feet <u>6l [6"]</u> , <u>01'</u> , <u>02'</u> , <u>03'</u> , <u>05'</u> <u>07'</u> , <u>10'</u> instead of XX in part number) Insert color instead of "*" in part number. <ul style="list-style-type: none"> <li>• Data (includes voice)/UPS – Blue (L)</li> <li>• IP Clock – Gray (S)</li> <li>• Admin – Red (R)</li> <li>• CCTV – Green (G)</li> <li>• Access Control – Green (G)</li> <li>• HVAC – Yellow (Y)</li> <li>• Lighting Control – Yellow (Y)</li> <li>• Audio-Visual - Orange</li> <li>• Switch uplink – Black (E)</li> </ul>	Leviton, or equal	6H460-XX*
Cat6 Patch Cables, slim  Intrusion Alarm – Pink	Leviton	Cat6 Unshielded (UTP) Slim Ethernet Network Patch Cable-Pink, length as required
Cat6A Patch Cables, slim  Wireless AP - Purple	Leviton	Cat6A Unshielded (UTP) Slim Ethernet Network Patch Cable-Purple, length as required
1M or 2M LC to LC OS2 / OM4 cross-over patch cords	Leviton	Length as needed

**END OF APPENDIX A**

**END OF 27 16 00**

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SECTION 27 51 23 - INTERCOMMUNICATION PROGRAM SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. This section specifies intercommunications equipment, accessories, materials, installation, configuration, and testing requirements for a complete and operable system. This system shall provide the ability to communicate bi-directionally with an individual room, announce to defined speaker zones and bell tones on a programmed schedule.

1.02 SCOPE

- A. The Contractor shall provide and install all components and accessories as outlined in the design documents for a complete and operable system.
- B. For existing construction, the Contractor shall provide and install all components and accessories as outlined in the design documents to modify the existing system while maintaining code compliance and to seamlessly integrate the new components into the existing intercommunications system.
- C. Prior to commencement of work, the Contractor shall be responsible for identifying any existing system errors or faults and bring these issues to the attention of the Project Manager.
- D. The Contractor shall provide and pay for all labor, materials, equipment, tools, utilities, construction equipment and machinery, transportation and other facilities and services necessary for the proper execution, operation and completion of the Work.
- E. The Contractor shall furnish and install all new conduit/raceway and wire as indicated on the project drawings and/or as required to provide a turn-key system.
- F. The Contractor shall install wire and cable that is appropriate for the installed environment (i.e. non-plenum, plenum, underground & etc.)
- G. The Contractor shall be responsible for programming the Intercommunications System.
- H. The Contractor shall coordinate with site staff for bell schedule programming requirements.
- I. The Contractor shall review the proposed final system programming, functionality and expectations with the project Owner, Construction Manager, Architect, and Designer prior to final programming.

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- J. After completion of the installation and pretest of the system a satisfactory final test of the entire system shall be made in the presence of the Owner, Construction Manager, Inspector of Record (IOR), and Designer.
- K. The Contractor shall adjust any speaker levels to the appropriate level as determined in system testing.

1.03 CODES AND STANDARDS

- A. See Division 27 for requirements.

1.04 INDUSTRY GUIDELINES AND STANDARDS

- A. ANSI/TIA-568-1.D: Commercial Building Telecommunications Cabling Standard.
- B. ANSI/TIA -568-C.2: Balanced Twisted-Pair Telecommunications Cabling and Components Standard.
- C. ANSI/TIA -606-C: Administration Standard for Telecommunications Infrastructure.
- D. ANSI/TIA -607-C: Generic Telecommunications Bonding and Grounding (Earthing) Requirements for Customer Premises

1.05 QUALIFICATIONS

- A. The Contractor shall hold a California C7 or C10 license.
- B. The Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.
- C. The Contractor shall have been actively engaged in the installation of projects similar in scope and size for a minimum period of 5 years.
- D. The Contractor shall be a factory direct dealer for, or establish an equivalent relationship with, the major equipment specified herein, suitable to carry out warranty administration and post warranty repair and provide documentation of same.
- E. The Contractor shall notify the Owner, prior to submission of bid, about any part of the design, which fails to comply with abovementioned requirements.
- F. If after contract is awarded, minor changes and additions are required by the mentioned authorities, even though such work is not shown on drawings or covered in the specifications, they shall be included at Contractor's expense.

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- G. The Contractor shall be fully conversant and capable in the cabling of low voltage, technology applications such as, but not limited to audio-video, data, voice and imaging network systems.
- H. The Contractor shall at a minimum possess the following qualifications:
  - I. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.
  - J. Must possess current liability insurance certificates.
  - K. The Contractor shall show proof of current certification of the approved manufacturer's products.
  - L. Personnel trained and certified in the design of the approved manufacturer's products.
  - M. Personnel trained and certified to install the approved manufacturer's products.
  - N. Personnel trained in the installation of pathways and support for backbone and horizontal cabling.
  - O. Personnel knowledgeable in local, state, province and national codes, and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.

1.06 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

- A. See Division 27 for requirements.

1.07 SUBMITTALS

- A. See Division 27 for requirements.

1.08 WARRANTY

- A. See Division 27 for requirements.

PART 2 – PRODUCTS

2.01 GENERAL

- A. The approved manufacturers for the project are:

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- a. Control unit and related accessories: As noted on construction drawings.
- b. Speakers: Unless noted otherwise on construction drawings.
  - i. Wire, cable, and accessories:

- B. All products shall be new and unused and shall be of manufacturer's current and standard production.
- C. Drawings and Specifications indicate major system components, and may not show all expansion modules, connectors, or accessories that may be required to support the operation specified. The Contractor shall provide all components needed for complete and operable system.

## 2.02 PRODUCT AVAILABILITY

- A. Contractor, prior to submitting a bid, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
- B. Certain products specified may only be available through factory authorized dealers and distributors. The Contractor shall verify his ability to procure the products specified prior to submitting a bid.

## 2.03 CABLING

- A. Single speaker cables shall be 4-Conductor, 22AWG, solid, with one pair shielded.
- B. Multi-pair speaker cables shall be 24-pair 22AWG solid with an overall shield.
- C. Cross-connect wire shall be Telecom Industry standard 22AWG solid twisted pair blue/white in color.

## PART 3 – EXECUTION

### 3.01 EQUIPMENT AND CABINET INSTALLATION

- A. Install equipment and cabinets per design documents.
- B. Install equipment/cabinets per manufacturer's installation requirements
- C. Communication system equipment shall conform to a 6-foot separation requirement from the main power panel, transformers, switchgear and/or starter motors adjacent to the main Termination Cabinet (TC1), intermediate TCs and termination locations.
- D. Install 3/4"-inch fire rated A-C plywood, cut to fit, in back of rack or cabinet.

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- E. MDF and IDF rooms speaker termination blocks can be installed directly on the plywood walls.
- F. Care shall be taken to layout termination blocks in an organized and professional looking manner.
- G. Install termination blocks in accordance with manufacturer's design and installation guidelines.
- H. Install cable distribution spool post ("mushroom") in abundant quantity so cross-connect wire is supported and routed carefully.

3.02 CABLE INSTALLATION PARAMETERS

- A. See section 27 0 00 for requirements.

3.3 CABLE ROUTING

- A. Single and multi-pair speaker cable shall be routed in compliance with section 27 00 00.

3.04 CABLE TERMINATION

- A. Each speaker cable shall be terminated at one speaker using the red (+), black (-) pair with wire nut to the appropriate speaker transformer wires for the wattage indicated in the design documents. Green and white pair are designated for spare.
- B. Cut off jacket, shielding and drain wire.
- C. Wrap end of speaker cables with white PVC electrical tape to prevent shielding from grounding/shorting.
- D. Wrap machine produced label with speaker ID at 4" from jacket end.
- E. All labels to be machine generated black letters on white adhesive label stock that is appropriate for the environment (interior/exterior). Handwritten labels are not acceptable.
- F. Provide 12" service loop at speaker.
- G. At the main terminal cabinet terminate each individual speaker cable on termination blocks in the following top to bottom order: Red, black, white, green and drain.
- H. Feeder cables shall be terminated on termination blocks each end.
- I. Terminate drains at upstream termination block only.



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- J. The Contractor shall connect the intercommunications system to the site telephone system.
- K. Feeder cables shall be terminated using ANSI/TIA color-coding.

3.05 PROGRAMMING

- A. The Contractor shall coordinate with site staff for Bell schedule programming requirements.
- B. The Contractor shall review the proposed final system programming, functionality and expectations with the Owner, Construction Manager, Architect, Designer prior to final programming.
- C. The Administrative telephone phone set port shall be 0100
- D. The telephone paging port shall be 0101
- E. Room speakers, the first digit corresponds to letter equivalent (A=1, B=2 continuing). The following 3-digits shall correspond to the final posted room numbers. Example: building A, room 202 would be: 1202.
- F. Exterior speakers shall start at 0501 and be sequential.

3.06 TESTING AND FINAL ADJUSTMENTS

- A. Contractor shall test each speaker, cable, termination block combination with an impedance meter and record impedance and wattage readings to verify wiring and setting of wattage before connecting to the system headend. This record shall be made available for review at final acceptance.
- B. After completion of the installation and pretest of the system a satisfactory final test of the entire system shall be made in the presence of the Owner, Construction Manager, Architect, and Designer.
- C. The Contractor shall adjust individual speaker tap to the appropriate dB level as identified in system acceptance testing.

3.07 TRAINING

- A. From the Administrative Paging phone and user telephone handset.
- B. Call a single room speaker
- C. Make an "All Interior" announcement

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- D. Make an "All Exterior" announcement
- E. Make an "All Call" announcement
- F. Make an "Emergency All Call" announcement
- G. From the "administrative user" computer:
- H. Set up short-cut in web browser software to controller address
- I. Create and modify paging zones.
- J. Create and modify bell schedules.
- K. Create and modify Holiday schedules.

END OF SECTION

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SECTION 27 53 13 - CLOCK SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies equipment, accessories, materials, installation, configuration, and testing requirements for a complete and operable clock system.

1.02 SCOPE

- A. The project has standardized on Sapling for the Clock system.
- B. The Contractor shall provide and install all components and accessories as outlined in the design documents for a complete and operable system.
- C. Existing construction, the Contractor shall provide and install all components and accessories as outlined in the design documents to modify the existing system while maintaining code compliance and seamlessly integrate the new components into the existing Clock system. Prior to beginning any work, the Contractor shall be responsible for identifying any existing system errors or faults and bring these issues to the attention of the Construction Manager.
- D. Labor and Materials: The Contractor shall provide and pay for all labor, materials, equipment, tools, utilities, construction equipment and machinery, transportation and other facilities and services necessary for the proper execution, operation, and completion of the Work
- E. Contractor shall furnish and install all new conduit, raceway and wire as indicated on the project drawings and/or as required to provide a complete and operable system.
- F. The Contractor shall be responsible for all and any programming requirements of the Clock system.
- G. Upon completion of the installation of the system, a confirming walk test shall be performed verifying that each clock installed is operating and is displaying the correct time (has corrected as required). The project inspector, and other project representative shall be present.
- H. The contractor is responsible for removing decommissioned and/or removed equipment, pathways and repairing any disturbed surfaces to match original surface condition.

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1.03 CODES AND STANDARDS

- A. See Division 27 for requirements.

1.04 INDUSTRY GUIDELINES AND STANDARDS

- A. ANSI/TIA-568-1.D: Commercial Building Telecommunications Cabling Standard.
- B. ANSI/TIA -606-C: Administration Standard for Telecommunications Infrastructure.
- C. ANSI/TIA -607-C: Generic Telecommunications Bonding and Grounding (Earthing) Requirements for Customer Premises

1.05 QUALIFICATIONS

- A. The Contractor shall hold a California C7 or C10 license.
- B. The Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.
- C. The Contractor shall have been actively engaged in the installation of projects similar in scope and size for a minimum period of 5 years.
- D. The Contractor shall be a factory direct dealer for, or establish an equivalent relationship with, the major equipment specified herein, suitable to carry out warranty administration and post warranty repair and provide documentation of same.
- E. The Contractor shall notify the Owner, prior to submission of bid, about any part of the design, which fails to comply with abovementioned requirements.
- F. If after contract is awarded, minor changes and additions are required by the mentioned authorities, even though such work is not shown on drawings or covered in the specifications, they shall be included at Contractor's expense.
- G. The Contractor shall at a minimum possess the following qualifications:
  - 1. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.
  - 2. Must possess current liability insurance certificates.
  - 3. The Contractor shall show proof of current certification of the approved manufacturer's products.
  - 4. Personnel trained and certified in the design of the approved manufacturer's products.
  - 5. Personnel trained and certified to install the approved manufacturer's products.
  - 6. Personnel trained in the installation of pathways and support for backbone and horizontal cabling.

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7. Personnel knowledgeable in local, state, province and national codes, and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.

1.06 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

- A. See Division 27 for requirements.

1.07 SUBMITTALS

- A. See Division 27 for requirements.

1.08 WARRANTY

- A. See Division 27 for requirements.

PART 2 – PRODUCTS

2.01 GENERAL

- A. The Contractor shall furnish and install all equipment, material, devices, cables, control devices, labor requirement and necessary tooling to provide proper operation of the Clock system.

2.02 CLOCKS

- A. Reference construction drawings for manufacturer and model.

2.03 CABLING

- A. IP Clock cables shall be 4-pair Cat6 minimum.
- B. Analog Clock cables shall be jacketed 3-conductor, 14AWG, stranded.
- C. Contractor shall be responsible for installing the proper cable type (underground, riser, or plenum) required by the installation environment.

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2.04 SERVICE INVENTORY

- A. Projects with over 15 installed clocks provide 3 extra standard clocks.

PART 3 – EXECUTION

3.01 CABLE INSTALLATION PARAMETERS

- A. See section 27 00 00 for requirements.
- B. For dedicated MDF/IDF rooms clock termination strips can be installed on the plywood walls without the need for a metal cabinet.
- C. Care shall be taken to layout termination field in an organized and professional looking manner.
- D. Cable:
  - 1. Clock cable to be terminated as follows: white = common, black = run power, red = correction.
  - 2. For transition interior to OSP cable terminate as follows: white -> blue, black -> black, red -> red with OSP brown as spare.
- E. Cables shall be labeled with destination description 4" back from jacket end. (i.e. "To TC1.1 Rm.12A").
- F. System Master Clock
  - 1. The Contractor shall configure the master clock system for time synchronization to the PST time server.
  - 2. The Contractor shall configure the master clock system for hourly clock correction at 59th minute of each hour.
  - 3. The Contractor shall configure the master clock system for full clock correction at 11:59 AM and 11:59 PM.
  - 4. The Contractor shall verify that all clocks correct at correction times.

END OF SECTION

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SECTION 28 23 00 - VIDEO SURVEILLANCE

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies equipment, licenses, accessories, materials, installation, configuration, and testing requirements for a complete and operable video surveillance system.

1.02 SCOPE

- A. Furnish and install a surveillance camera system in accordance with the design drawings and specifications.
- B. Install conduit and raceways for video surveillance system.
- C. Install and configure network video recorder (NVR).
- D. Install and configure video management software.
- E. Install and configure surveillance cameras at exterior and interior locations.
- F. Camera power shall be provided from network PoE switch unless noted otherwise on design drawings.
- G. Cable lengths greater than 315', but less than 1000' long-range data extenders are permitted.
- H. Configure administrative video management software workstations for video monitoring and playback.
- I. Training for site personnel on how to operate the system primary and advanced functions as required.
- J. Calibration of the video surveillance system, as required. This includes, but not be limited to the following: camera mounting and/or view adjustments, frame rates, video masking, and additional product feature settings as required.

1.03 CODES AND STANDARDS

- A. See Division 27 for requirements.

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1.04 INDUSTRY GUIDELINES AND STANDARDS

- A. ANSI/TIA-568-1.D: Commercial Building Telecommunications Cabling Standard.
- B. ANSI/TIA -568-C.2: Balanced Twisted-Pair Telecommunications Cabling and Components Standard.
- C. ANSI/TIA -606-C: Administration Standard for Telecommunications Infrastructure.
- D. ANSI/TIA -607-C: Generic Telecommunications Bonding and Grounding (Earthing) Requirements for Customer Premises

1.05 QUALIFICATIONS

- A. The Contractor shall hold a California C7 or C10 license.
- B. The Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.
- C. The Contractor shall have been actively engaged in the installation of projects similar in scope and size for a minimum period of 5 years.
- D. The Contractor shall be a factory direct dealer for, or establish an equivalent relationship with, the major equipment specified herein, suitable to carry out warranty administration and post warranty repair and provide documentation of same.
- E. The Contractor shall notify the Owner, prior to submission of bid, about any part of the design, which fails to comply with abovementioned requirements.
- F. If after contract is awarded, minor changes and additions are required by the mentioned authorities, even though such work is not shown on drawings or covered in the specifications, they shall be included at Contractor's expense.
- G. The Contractor shall be fully conversant and capable in the cabling of low voltage, technology applications such as, but not limited to audio-video, data, voice and imaging network systems.
- H. The Contractor shall at a minimum possess the following qualifications:
  - I. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.
  - J. Must possess current liability insurance certificates.
  - K. The Contractor shall show proof of current certification of the approved manufacturer's products.
  - L. Personnel trained and certified in the design of the approved manufacturer's products.
  - M. Personnel trained and certified to install the approved manufacturer's products.



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- N. Personnel trained in the installation of pathways and support for backbone and horizontal cabling.
- O. Personnel knowledgeable in local, state, province and national codes, and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.

1.06 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

- A. See Division 27 for requirements.

1.07 SUBMITTALS

- A. See Division 27 for requirements.

1.08 WARRANTY

- A. See Division 27 for requirements.

PART 2 – PRODUCTS

2.01 GENERAL

- A. All products shall be new and unused and shall be of manufacturer's current and standard production.
- C. Where two or more equipment items of the same kind are provided, all shall be identical and provided by the same manufacturer.
- D. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory operation.
- E. Product Availability
  - 1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
  - 2. Certain products specified may only be available through factory authorized dealers and distributors. Contractor shall verify his ability to procure the products specified prior to submitting a proposal.

2.02 MATERIALS

- A. See 27 15 00 Communications Horizontal Cabling for requirements

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- B. Cameras, network video recorders (NVR), housings and mounts, network switches, LED display/monitor, including all materials and equipment necessary to provide a complete and operable system shall be as shown on design drawings.
- C. Surveillance Camera equipment shall be as specified on the design drawings.
- F. All exterior weatherproof cameras shall be installed with smoke dome covers.
- D. Cameras shall have one (1) each 64Gb microSDXC card properly formatted and installed.

### PART 3 – EXECUTION

#### 3.01 EXAMINATION

- A. The Contractor shall be required to visit the installation site(s) prior to bidding the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to the District.
- B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date

#### 3.02 PREPARATION

- A. The Contractor shall order all required parts and equipment upon receipt of approved product submittals.
- B. The Contractor shall bench test all equipment prior to delivery to the job site.
- C. The Contractor shall verify the availability of power where required.
- D. The Contractor shall verify network PoE switch port availability and provide a new PoE switch when required.
- E. The Contractor shall verify network patch panel port availability and provide a new patch panel when required.

#### 3.03 CABLE ROUTING

- A. Refer to Section 27 15 00 Communications Horizontal Cabling for cable routing requirements.

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3.04 EQUIPMENT MOUNTING PARAMETERS

- A. All camera, monitors, recording equipment, racks and cabinets shall be anchored in accordance with manufacture specifications and drawn details, to walls and floors and grounded to building ground grid (not to water pipes etc.). Individual or new ground points are acceptable.

3.05 SYSTEM COMMISSIONING AND CALIBRATION

- A. Contractor shall provide necessary time for commissioning and calibrating the entire video surveillance system.
- B. Camera views and adjustments:
  - a. During training the district will shall gather information regarding final camera views and the areas the end user is trying to monitor.
  - b. The contractor shall adjust cameras after reviewing the collected information with a site designated person. The contractor shall maintain contact with this site designated person via 2-way radio or telephone during final camera adjustments.
- C. The contractor, as part of contract documents, shall be responsible to return to the project site up to 60 days after activation to adjust and fine-tune cameras base on site and district staff direction. This 2nd adjustment shall be coordinated by the district authorized project manager or district staff.
- D. Head end adjustments, as required:
  - a. Head end adjustments, including but not limited to frame rates, shall be made by the Contractor.
  - b. After camera views have been finalized the Contractor shall set up masking of non-essential video for each camera.

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**APPENDIX-A**  
**(Unless Otherwise Specified on Construction Document Plan Sheets)**

**VIDEO SURVEILLANCE:**

DESCRIPTION	MANUFACTURER	PART NUMBER
Network Video Recorder 48TB	exacqVision	IP0848T2Z2E
Camera license for each, enterprise version	exacqVision	EVENIP01
Camera license, upgrade Pro to Enterprise	exacqVision	EVIP-EVENIP
'Upgrade, 16GB RAM, XEPN E31276	exacqVision	EXQ500040383
'26" RKMT Sliding Rail Kit F/Z Series	exacqVision	EXQ500020070
Network Camera, exterior	AXIS	P3245-LVE
Network Camera, dome, interior	AXIS	P3245-V
Pole Mount	AXIS	T91B47
Adapters for protected cable routing in 3/4" conduit (M25 pipe).	AXIS	TP3601
White metal stand with hole for easy cable management. For indoor wall- or hard ceiling mount	AXIS	T91B21
Aluminum corner mount for indoor and outdoor use	AXIS	T94P01B
IP66/IP67 rated outdoor back box with conduit entrance	AXIS	T94S01P
Adapters for protected cable routing in 1/2" conduit (M20 pipe).	AXIS	TP3602
Pendant Wall Mount	AXIS	TP3101
J-Box & Pole Adapter	AXIS	TP3701
Outdoor recessed mount for roof overhang/soffit installations	AXIS	T94M02L
Outdoor pendant kit for mounting the camera on 1.5" NPS threaded brackets.	AXIS	T94T01D
Pole mount for fixed dome cameras	AXIS	T91B67
Smoked dome with anti-scratch hard coating, indoor	AXIS	TP3802
Smoked dome with anti-scratch hard coating, exterior	AXIS	TP3802-E
High endurance microSDXC™ card	AXIS	64GB
Audio and I/O Interface	AXIS	T6112

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**END OF APPENDIX A**

**END OF 28 20 00**

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SECTION 28 46 00  
FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Transmitters for communication with supervising station.
- C. Circuits from protected premises to supervising station, including conduit.
- D. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.
- E. Maintenance of fire alarm system under contract for specified warranty period.
- F. The fire alarm system shall consist of all necessary hardware equipment and software programming to perform the following functions:
  - 1. Fire alarm detection operations
- G. Thoroughly inspect the existing system and site conditions before bid. Advise the District's Representative of all conditions requiring immediate attention or might cause difficulties that are not addressed, or inferred to, in the contract drawings and specifications prior to new construction and the commencement of the guarantee period.
- H. Review the Drawings and Specifications for work and material provided by others that will affect work specified under this Section. Carefully coordinate with other trades, equipment suppliers, contractors, etc. as required to provide a high-quality reliable installation with a minimum of construction delays. All work required to be re-accomplished due to lack of coordination shall be done at the Contractor's expense.

1.02 RELATED REQUIREMENTS

- A. Section 23 33 00 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

1.03 REFERENCE STANDARDS

- A. ADA Standards – American with Disabilities Act (ADA) Standards for Accessible Design; 2022.

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- B. IEEE C62.41 - IEEE Recommended Practice on Surge Voltages in Low-Voltage Power Circuits; 1991 (R1995).
- C. CEC 2022 – California Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 72 - National Fire Alarm and Signaling Code; 2022.
- E. NFPA 101 - Life Safety Code; 2022.

1.04 AMERICANS WITH DISABILITIES ACT (ADA)

- A. All visual Notification appliances and manual pull stations shall comply with the requirements of the Americans with Disabilities Act or 2022 CBC, whichever is more stringent.

1.05 SUBMITTALS

- A. Proposal Documents: Submit the following with cost/time proposal:
  - 1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
  - 2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
  - 3. Certification by that the system design will comply with Contract Documents.
  - 4. Proposed maintenance contract.
- B. Drawings must be prepared using AutoCAD Release 2017.
  - 1. District will provide floor plan drawings for Contractor's use; verify all dimensions on District-provided drawings.
- C. Evidence of designer qualifications.
- D. Evidence of installer qualifications.
- E. Evidence of instructor qualifications; training lesson plan outline.
- F. Evidence of maintenance contractor qualifications, if different from installer.
- G. Inspection and Test Reports:

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1. Submit inspection and test plan prior to closeout demonstration.
  2. Submit documentation of satisfactory inspections and tests.
  3. Submit NFPA 72 "Inspection and Test Form," filled out.
- H. Operating and Maintenance Data: See Section 01 78 00 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Complete set of specified design documents, as approved by authority having jurisdiction.
  2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
  3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
  4. List of recommended spare parts, tools, and instruments for testing.
  5. Replacement parts list with current prices, and source of supply.
  6. Detailed troubleshooting guide and large-scale input/output matrix.
  7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to District.
  8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.
- I. Project Record Documents: See Section 01 78 00 for additional requirements; have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
  2. "As installed" wiring and schematic diagrams, with final terminal identifications.
  3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- J. Closeout Documents:



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1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
  2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
  3. Certificate of Occupancy.
  4. Maintenance contract.
  5. Report on training results.
- K. Maintenance Materials, Tools, and Software: Furnish the following for District's use in maintenance of project.
1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
  2. In addition to the items in quantities indicated in PART 2, furnish the following:
    - a. All tools, software, and documentation necessary to modify the fire alarm system using District's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
    - b. One copy, on CD-ROM, of all software not resident in read-only-memory.

#### 1.06 QUALITY ASSURANCE

- A. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to District upon completion.
- B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.

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1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
  2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
  3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
  4. Contract maintenance office located within 100 miles of project site.
  5. Certified in California as fire alarm installer.
- C. Maintenance Contractor Qualifications: Same entity as installer.
- D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.
- E. WARRANTY
1. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.
  2. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS (MATCH CAMPUS EXISTING SYSTEM)

- A. Fire Alarm Control Units - Basis of Design: Honeywell Security & Fire Solutions/Notifier ; NFS2-3030D : [www.notifier.com](http://www.notifier.com). No known equal.
- B. Initiating Devices and Notification Appliances:
1. Honeywell Security & Fire Solutions/Notifier for Initiating Devices; System Sensor for Notification Devices: [www.notifier.com/#sle](http://www.notifier.com/#sle).
  2. Same manufacturer as control units.

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3. Providing initiating devices and notification appliances made by the manufacturer, where possible.

## 2.02 FIRE ALARM SYSTEM

- A. Fire Alarm System: Provide modifications and extensions to the existing automatic fire detection and alarm system:
  1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
  2. Protected Premises: Entire building shown on drawings.
  3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
    - a. ADA Standards.
    - b. The requirements of DSA.
    - c. The requirements of the local authority having jurisdiction, which is Department of State Architects.
    - d. Applicable local codes.
    - e. Contract Documents (drawings and specifications).
    - f. NFPA 101.
    - g. NFPA 72; where the word "shall" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
  4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
  5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
  6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
  7. Program notification zones as directed by District.

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8. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
  9. Fire Command Center: Location indicated on drawings.
  10. Fire Alarm Control Unit: Existing, located at fire command center.
  11. Combined Systems: Do not combine fire alarm system with other non-fire systems.
- B. Supervising Stations and Fire Department Connections:
1. Public Fire Department Notification: By on-premises supervising station.
  2. Remote Supervising Station: UL-listed central station under contract to facility.
  3. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.
- C. Circuits:
1. Initiating Device Circuits (IDC): Class B, Style A.
  2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
  3. Notification Appliance Circuits (NAC): Class B, Style W.
- D. Spare Capacity:
1. Initiating Device Circuits: Minimum 25 percent spare capacity.
  2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
  3. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.
- E. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
  2. Secondary: Storage batteries.
  3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.

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4. Each Computer System: Provide uninterruptible power supply (UPS).

## 2.03 EXISTING COMPONENTS

- A. Existing Fire Alarm System: Remove existing components indicated and incorporate remaining components into new system, under warranty as if they were new; do not take existing portions of system out of service until new portions are fully operational, tested, and connected to existing system.
- B. Clearly label components that are "Not In Service."
- C. Remove unused existing components and materials from site and dispose of properly.

## 2.04 FIRE SAFETY SYSTEMS INTERFACES

- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
  - 1. Sprinkler water control valves.
- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
  - 1. Sprinkler water flow and supply valves.
- C. HVAC:
  - 1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

## 2.05 COMPONENTS

- A. General:
  - 1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
  - 2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
- B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

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- C. Master Control Unit: As specified for Basis of Design above, or equivalent.
- D. Initiating Devices:
  - 1. Addressable Systems
  - 2. Smoke Detectors: Notifier FSP-951.
  - 3. Heat Detectors: Notifier FST-951; FST-851H
- E. Notification Appliances:
  - 1. Weatherproof Speaker: System Sensor SPSWK.
  - 2. Strobes: System Sensor. SWL
  - 3. Strobes/Speaker: System Sensor SPSCWL.
  - 4. Notification Appliance Circuit provides synchronization of strobes at a rate of 1Hz and operates horns with a Temporal Code Pattern operation. The circuit shall provide the capability to silence the audible signals, while the strobes continue to flash, over a single pair of wires. The capability to synchronize multiple notification appliance circuits shall be provided.
- F. The internal power supply & battery charger shall be capable of charging up 12.7 Ah batteries internally mounted or 18Ah batteries mounted in an external cabinet.
- G. Emergency Power Supply:
  - 1. General: Components include battery, charger, and an automatic transfer switch.
  - 2. Battery: Sealed lead-acid or nickel cadmium type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm indicating devices in alarm or supervisory mode for a period of 5 minutes.
- H. Accessories: The contractor shall furnish the necessary accessories
- I. Circuit Conductors: Copper; provide 200 feet extra; color code and label.
- J. Locks and Keys: Deliver keys to District.

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1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type.
- K. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
  2. Provide one for each control unit where operations are to be performed.
  3. Obtain approval of District prior to mounting; mount in location acceptable to District.
  4. Provide extra copy with operation and maintenance data submittal.
- L. Storage Cabinet for Spare Parts and Tools: Steel with baked enamel finish, size appropriate to quantity of parts and tools.
1. Padlock eye and hasp for lock furnished by District.
  2. Locate as directed by District.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Install in accordance with applicable codes, NFPA 72, CEC 2022, and the contract documents.
- B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
  1. Factory trained and certified personnel.
  2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
  3. Personnel licensed or certified by state or local authority.
- C. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- D. Install all wiring in conduit, 3/4" minimum. No exception.

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- E. Existing Fire Alarm Equipment shall be maintained, and new control equipment and devices shall be 100% compatible with the existing system.
- F. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.
- G. Install instruction cards and labels.

### 3.02 CLEANING AND ADJUSTING

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.
- B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

### 3.03 INSPECTION AND TESTING FOR COMPLETION

- A. Notify District 7 days prior to beginning completion inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- H. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
  - 1. Record all system operations and malfunctions.



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2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
3. District will provide attendant operator personnel during diagnostic period; schedule training to allow District personnel to perform normal duties.
4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

### 3.04 DISTRICT PERSONNEL INSTRUCTION

- A. Provide the following instruction to designated District personnel:
  1. Hands-On Instruction: On-site, using operational system.
  2. Classroom Instruction: District furnished classroom, on-site or at other local facility.
  3. Factory Instruction: At control unit manufacturer's training facility.
- B. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
  1. Initial Training: 1 session pre-closeout.
- C. Detailed Operation: Two-hour sessions for engineering staff; assume NICET level I qualifications or equivalent; combination of classroom and hands-on:
  1. Initial Training: 1 session pre-closeout.
- D. Maintenance Technicians: Detailed training for electrical technicians, on programming, maintaining, repairing, and modifying; factory training:
  1. Initial Training: One 3-day session, pre-closeout.
- E. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.
- F. Provide means of evaluation of trainees suitable to type of training given; report results to District.

### 3.05 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to District.
  1. Be prepared to conduct any of the required tests.

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2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
3. Have authorized technical representative of control unit manufacturer present during demonstration.
4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
5. Repeat demonstration until successful.

### 3.06 MAINTENANCE

- A. Provide to District, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.
- B. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
  1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
  2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
  3. Record keeping required by NFPA 72 and authorities having jurisdiction.
- C. Provide trouble call-back service upon notification by District:
  1. Provide on-site response within 24 hours of notification.
  2. Include allowance for call-back service during normal working hours at no extra cost to District.
  3. District will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- D. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

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- E. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to District's representative upon completion of site visit.
- F. Comply with District's requirements for access to facility and security.

END OF SECTION 28 46 00

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SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnish labor, material and equipment required for the removal of surface debris, removal of trees, shrubs and other plant life, where indicated on the Drawings; remove temporary structures, miscellaneous debris in and around structures to be demolished; remove appurtenances and abandoned utilities; remove brush, trash, salvage and debris resulting from clearing; remove paved asphalt concrete areas. Include stripping and stockpiling of topsoil, and dust control.

1.2 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Perform Work, including disposal of debris, in accordance with rules and regulations of State and local agencies having jurisdiction. Comply with Section 01 41 00.

1.3 SUBMITTALS

- A. Conform to the requirements of Section 01 33 00 for submittal procedures.
- B. Product Data: Provide data for Products specified.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Project Record Documents: Record actual locations of pipe mains, valves, connections, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.4 SURROUNDING SITE CONDITION SURVEY

- A. Prior to commencing the Work, Contractor, and District's Representative shall tour the Project site together to examine and record damage to existing adjacent buildings, streets, sidewalks, and all other improvements. This record shall serve as a basis for determination of subsequent damage due to Contractor's operations and shall be signed

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by all parties making the tour. Any cracks, sags, or damage to the adjacent buildings and improvements not noted in the original survey, but subsequently discovered, shall be reported to the District's Representative.

1.5 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

- A. The Drawings show existing above and below grade structures, drainage lines, storm drains, sewers, water, gas, electrical, hot water, steam, condensate and other utilities that are known to the District in their approximate location. The Contractor shall exercise care in avoiding damage to these facilities. The Contractor will be held responsible for the repair if damaged. The District or District's Representative does not guarantee that all utilities or obstructions are shown or that the locations indicated are accurate.
- B. Locate and surface mark (various colors specified by USA) all known existing underground structures and utilities before proceeding with construction operations that may damage them. Stake and flag utility valve boxes and other surface structures. Prior to commencing excavation and trenching, coordinate with Underground Service Alert (USA North/1-800-227-2600 or 811) for field verification and marking of utilities within limits of Project site. Provide USA notification permit number to District's Representative prior to starting site Work. Existing underground structures and utilities shall be kept in service unless approval to interrupt or shutdown service is obtained from District's Representative. If damaged, the utility shall be repaired with no adjustment of Contract Sum or Contract Time.
- C. Contractor shall uncover, prior to any earthwork for new construction, all existing piping where crossings, interferences, close proximity (5 feet or less) or connections are shown on the Drawings, from 1 foot below proposed construction limit to the existing ground surface. Any variation in the actual elevations and the indicated elevations shall be brought to the District's Representative's attention. If the Contractor does not expose all existing utilities, Contractor shall not be entitled to additional compensation for Work necessary to avoid interferences.
- D. If interferences occur at locations other than the general locations shown on the Drawings, and such utilities are damaged before their locations have been established, or create an interference, the Contractor shall notify the District's Representative and a method for repairing the damage or correcting the interference shall be supplied by the District's Representative. Payment for additional Work due to interferences not shown on the Drawings shall be in accordance with the General Conditions.
- E. Care shall be exercised to prevent damage to adjacent facilities including walks, streets, curbs, and gutters from settlement, lateral movement, undermining, and washout and other hazards; where equipment will pass over these obstructions suitable planking shall

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be placed. Damaged facilities, due to the Contractor operations, shall be removed and replaced at the Contractor's expense.

- F. If any other structures or utilities are encountered, request District's Representative to provide direction on how to proceed with the Work.
- G. If any structure or utility is damaged, take immediate action to ensure the safety of persons and property. Correct damage immediately. Contractor shall bear all costs of correction, replacement, repair, restoration, including related damages additional testing, inspection, and compensation for District's Representatives services and expenses. Compensation to the District shall be made by deductive Change Order.
- H. No Work is to be performed on energized electrical equipment unless scheduled with the District's Representative. The District reserves the right to specify specific conditions for all Work involving energized high-voltage electrical equipment.

## PART 2 – PRODUCTS

### 2.1 MATERIALS

- A. Herbicide: Surflan, Chipco, Ronstar G, or equal.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Existing Conditions: Verify existing conditions at the site and include all work evident by site inspection whether or not shown on the Drawings.

### 3.2 PREPARATION AND COORDINATION

- A. Notify District's Representative before starting Work and comply with District requirements.
- B. Do not close or obstruct roadways, sidewalks or hydrants without District's Representative's approval.
- C. Tree Protection: Tree and plant protection shall be sufficient to protect the trees and plant material.

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3.3 SITE CLEARING

- A. Conduct clearing with minimum interference to public and private access. Maintain egress and access from adjacent structures at all times.
- B. Clear the site within the limits shown and remove all pavement, trees, shrubs, remaining brush, stumps and waste material that would interfere with construction operation, except as specifically indicated otherwise on the Drawings, or identified by the District's Representative.
- C. Apply an approved herbicide to remaining roots over 1 1/2 inches in diameter.
- D. In areas not to be further excavated, fill depressions resulting from site clearing. Place and compact satisfactory soil materials in accordance with the Geotechnical Report.
- E. Clear undergrowth and deadwood without disturbing subsoil.
- F. Pollution and Dust:
  - 1. Conduct operations so as to prevent windblown dust and dirt from interfering with adjacent property's normal operations.
  - 2. Wet down dirt areas by spraying as required to prevent dust from becoming airborne.
- G. Assume liability for all claims related to windblown dust and dirt.
- H. No burning on District property.

3.4 CONSTRUCTION WASTE MANAGEMENT

- A. Comply with the applicable provisions of Section 01 50 13, including, but not limited to:
  - 1. Separate packaging materials by type and place in locations designated by the Contractor.
  - 2. Place unused scrap material in locations designated by the Contractor.

END OF SECTION

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SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rough Grading of site, Excavating, backfilling, compaction, and grading, as required to obtain contours and elevations indicated on the Drawings.
2. Subgrade preparation for buildings, exterior concrete slabs, and pavement areas.
3. Handling of soils identified to contain naturally occurring asbestos (NOA).

B. Related Sections:

1. Section 02 41 00 Site Demolition.
2. Section 31 23 33 Trenching and Backfilling.

1.2 REFERENCES

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 1997.
- B. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)); 2000a.
- C. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2000.
- D. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN m/m<sup>3</sup>)); 2000.
- E. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 1994.
- F. ASTM D 2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregates; 1995.
- G. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 1996.
- H. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 1996.
- I. LEED – Leadership in Energy and Environmental Design

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1.3 DEFINITIONS

- A. Excavation: Earth excavation includes excavation of pavement and other obstructions visible on the ground surface; underground structures, utilities, and other items to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.
- B. Subgrade: Previously undisturbed material prepared and compacted to required density and elevation to support a structure, or pavement system.
- C. Subbase: Compacted layer of approved material used between the subgrade and the pavement.
- D. Earth Excavation: Materials not otherwise defined as rock excavation including removal and disposal of pavements, visible on grade obstructions, underground structures, utilities, and other items indicated to be removed.
- E. Unauthorized Excavation: Includes removal and disposal of material beyond subgrade elevations, and dimensions indicated without prior approval of the Owner's Representative.
- F. Standard Specifications: Refers to the Standard Specifications of the State of California, Business and Transportation Agency, Department of Transportation (Caltrans), latest edition. In case of conflict between the Standard Specifications and these Specifications, the strictest Specifications shall govern.
- G. Provisions for measurement and payment specified within the Standard Specifications shall be disregarded and the provisions of this Agreement shall govern.
- H. Relative Compaction: Ratio, expressed as a percentage of field dry density as compacted to a maximum dry density of representative sample of the same material determined by ASTM D1557.

1.4 SUBMITTALS

- A. Conform to the requirements of Section 01 33 00 Shop Drawings, Product Data and Samples for submittal procedures.
- B. Product Data: Provide data on Products specified.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

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- E. Project Record Documents: Record actual locations of pipe mains, valves, connections, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- F. Deliver samples of import backfill materials to the Owner's Representative in quantities sufficient for testing. Deliver at least 15 days prior to use.
- G. Submit a Confined Space Emergency Plan in accordance with Section 01 41 00 Regulatory Requirements prior to any personnel entering trenches or excavations greater than 5 feet in depth.

1.5 QUALITY ASSURANCE

- A. Testing and Inspection Service: The Owner will engage soil testing and inspection service, for quality assurance testing during earthwork operations.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Stockpile satisfactory excavated materials in approved location, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
  - 1. Do not store soil within drip line of trees indicated to remain.

1.7 PROJECT CONDITIONS

- A. Subsurface Conditions: Contractor responsibility to determine the exact nature and extent of subgrade conditions.
  - 1. Subgrade and geotechnical information provided by the Owner shall not relieve the Contractor of responsibility for being familiar with the character and extent of subsurface conditions that may be encountered during performance of the Work.
- B. Do not use explosives.
- C. The Contractor shall assess and evaluate all site conditions and layout the work before any earthwork shall begin.

1.8 MAINTENANCE

- A. Repair settlement at excavated areas for a period of one year following final acceptance at no additional cost to Owner. Remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment; restore appearance, quality, and condition of surface and finish to match adjacent work, and eliminate evidence of restoration.

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1.9 WARRANTY

- A. The Contractor shall warrant the Work against settlement for a period of one year after the date of final acceptance, and shall repair damage caused by settlement within that time. For the purpose of this Specification, settlement will be deemed to have occurred if on paved surfaces, depressions greater than 3/8 inch occur relative to paved surfaces outside the excavation area.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fill Materials: Use only suitable fill except where sand is required. Do not use water saturated soil material or contaminated material.
1. On-site soils are generally suitable for use in engineered fill material, provided that they are at a workable moisture content and free of significant concentrations of organic materials, rubble or debris. The on-site clay soils located at an approximate depth of ten feet below existing site grades are not considered suitable for use in fill construction beneath at-grade structures, exterior slab-on-grade concrete or pavements.
  2. If imported material is required for fill and backfill, the imported material must be granular soil, free of organic matter, which does not exhibit excessive shrinkage or swelling behavior when subjected to changes in water content. Imported fill shall contain no environmental contaminants or construction debris. All imported fill materials to be used for engineered fill shall be samples, tested and approved by project geotechnical engineer prior to being used at the site. The material shall conform to the following:
    - a. Have 100 percent pass through a 3 inch sieve, 70 to 100 percent pass through a 3/4 inch sieve and 15 to 70 percent pass through a No. 200 sieve.
    - b. Be thoroughly compacted without excessive voids.
    - c. Have a maximum Plasticity Index of 12.
    - d. Have an Expansion Index less than 20.
- B. Crushed Rock Capillary Break: Compacted, free-draining crushed rock at least 4 inches thick, graded so that 100 percent passes the 1-inch sieve and less than 5 percent passes the No. 4 sieve.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Excavate by hand within drip-line of trees to remain. Do not damage trees or roots, prevent dehydration of exposed roots.

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- B. Surfaces to receive fill and soils to be compacted shall be free of standing water, and shall not be saturated with water.
- C. In asphalt concrete paved areas, neatly saw cut pavement 12 inches beyond the limits of excavations. If edge of pavement is located within 30 inches of limit of excavation, remove pavement to existing edge.
- D. Remove existing utility lines that traverse the site as indicated on Drawings.

### 3.2 SITE CLEARING

- A. Complete clearing and stripping as indicated on Drawings. Existing surface vegetation, root zones, organic materials, over-sized materials (greater than 3 inches in maximum dimension) and all debris shall be removed from development areas and disposed of outside the construction limits.
- B. It is possible abandoned utility lines, septic tanks, cesspools, wells and/or foundations may exist on site. If encountered within the area of construction, these items shall be removed and disposed of off-site. Abandon existing wells in accordance with applicable regulatory requirements. Existing utility pipelines that extend beyond the limits of the proposed construction and that are to be abandoned in-place shall be plugged with cement grout to prevent migration of soil and/or water. All excavations resulting from removal activities shall be cleaned of loose or disturbed material, including all previously-placed backfill, and dish-shaped to permit access for compaction equipment.

### 3.3 EXCAVATION AND OVEREXCAVATION

- A. Overexcavate the existing soils beneath proposed building pads to a depth of 12" into the subgrade and recompact as engineered fill. The overexcavation limits shall extend a minimum of 5-feet laterally in all directions from the building footprint. When excavation has reached required subgrade elevation, notify the Owner's Representative who will inspect conditions. When unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and place excavated material as directed by the Owner's Representative. After overexcavation and prior to placement of engineered fill, processing of the exposed subgrades shall be performed by scarifying the subgrade to a depth of at least 8-inches, uniformly moisture conditioning or drying-back the soil to 2-percent above the optimum moisture content, and compacting to a minimum of 90-percent relative compaction.
- B. Excavation for Pavements: Cut surface under pavements to comply with pavement section shown on Contract Documents.
- C. Coordinate excavation, preparation and backfill with Work of related Sections for Project Site utilities, drainage and irrigation systems.

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- D. Perform footing excavations after fill placement is complete.

3.4 BACKFILL AND COMPACTION

- A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification as indicated below.
- B. Moisture condition to a minimum of 1 percent above the optimum moisture content and replace the excavated material or any approved supplementary import material in lifts not to exceed 8 inches in loose thickness and compact each lift to a minimum 90 percent relative compaction. Depending on the type of compaction equipment selected by the Contractor, thinner lifts may be necessary to achieve the required degree of compaction. Additional fill lifts shall not be placed if the previous lift did not meet the minimum required relative compaction or if soils conditions are not firm and stable. Disking and/or blending may be required to uniformly moisture-condition soils used for engineered fill. Acceptance of compacted material is based on the material being properly mixed, moisture conditioned, compacted and stable under construction equipment. If any of these criteria are not met, the material may not be accepted.
- C. Percentage of Maximum Density Requirements: Compact soil to no less than the following percentages of maximum density in accordance with ASTM D 1557.
1. Building Slabs: Compact top 12 inches of subgrade and each layer of backfill or fill material at 90 percent relative compaction.
  2. Lawn or Unpaved Areas: Compact top 12 inches of subgrade and each layer of backfill or fill material at 90 percent relative compaction.
  3. Vehicular pavements: The upper 12 inches of pavement subgrade soils shall be compacted to at least 95 percent relative compaction.
  4. Exterior Concrete Slabs: Scarify to a minimum depth of 12" and compact to at least 90 percent relative compaction.
- D. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.
1. Should grading be performed during or following extended periods of rainfall, the moisture content of the near-surface soils may be significantly above the optimum moisture content. Remove and replace or scarify and air dry soil material that is too wet to permit compaction to specified density.
  2. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

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3.5 FOUNDATIONS

- A. Foundations shall be underlain by a minimum of 12 inches of newly constructed engineered fill placed and compacted as required above.
- B. Prior to placing steel or concrete, footing excavations shall be cleaned of all debris, loose or soft soil and water. All footing excavations shall be observed by project geotechnical engineer just prior to placing steel or concrete to verify compliance.

3.6 EXTERIOR CONCRETE SLABS

- A. Once slab subgrade soil has been moisture conditioned and compacted, the soil shall not be allowed to dry prior to placement of aggregate base and concrete. If allowed to dry, the moisture content of the soil shall be restored by sprinkling or wetting prior to placement.
- B. Place a minimum 6" base course of Caltrans Class 2 aggregate base material under all exterior concrete, compacted to at least 95 percent relative compaction at a moisture content slightly above optimum.

3.7 ASPHALT PAVEMENTS

- A. Prepare subgrades as specified above.
- B. The moisture content of the subgrade soils must be a minimum of 1 percent above optimum moisture content at the time of aggregate base placement. Recommended soil moisture contents shall be established by scarifying, moisture conditioning and compacting the subgrade immediately prior to placement of aggregate base.
- C. Subgrade soils shall be in a stable, non-pumping condition at the time aggregate base materials are placed and compacted.
- D. Compact aggregate base to at least 95 percent relative compaction.

3.8 GRADING

- A. Provide smooth finished surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated on Drawings, or between such points and existing grades.
- B. Grade areas outside of building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, within the following tolerances above or below required finish grade.
  - 1. Lawn and Unpaved Areas to Receive Topsoil: 0.10 foot

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- 2. Pavements and Walks: Line, grade and cross-section, 0.10 foot
- 3. Structures: 0.10 foot.
- C. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.
- D. Grade fill under building slabs smooth and even, free of voids, to required elevation. Provide final grades with a tolerance of plus or minus 1/4 inch in 10 feet.

3.9 FIELD QUALITY CONTROL

- A. See Section 01 45 00 Tests and Inspections, for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D6938.
- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 ("modified Proctor"), or AASHTO T 180.
- D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no additional cost to the Owner.

3.10 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Comply with the applicable provisions of Section 01 77 00 Final Cleaning.
- B. Remove excess excavated material, trash, debris and waste materials and dispose of it off the Owner's property.
- C. Except for stripped topsoil or other material indicated to remain the Owner's property, cleared materials shall become the Contractor's property and shall be removed from the Project site.

3.11 PROTECTION

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.
- C. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

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- D. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

3.12 CONSTRUCTION WASTE MANAGEMENT

- A. Comply with the applicable provisions of Section 01 77 00 Final Cleaning and Waste including, but not limited to:
  - 1. Separate packaging materials by type and place in locations designated by the Contractor.
  - 2. Place unused scrap material in locations designated by the Contractor.

END OF SECTION



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SECTION 31 22 19 - FINISH GRADING

PART 1 - GENERAL

1.1. SCOPE OF WORK

- A. Provide all labor, materials, services and equipment indicated on Drawings and/or herein specified to complete all Landscape Grading Work.
- B. Finish grading shall consist of scarifying and establishing finish grade to conform to the contours, grades, line and shapes as indicated on the Drawings, and insuring that all landscape areas are uniformly graded to an outlet.

1.2. DEFINITIONS

- A. Subgrade: Surfaces upon which additional specified materials are to be placed, prepared or constructed.
- B. Rough grade: The establishment of grades to one-tenth (1/10) foot plus or minus tolerance of grades required to accomplish the Work described in other documents and drawings.
- C. Finish grade: The establishment of grades to a plus or minus tolerance of final grades as indicated on Drawings. Tolerances are specified in applicable documents of the specifications (i.e. Planting, Decorative Concrete, Decomposed Granite, etc.)
- D. Grading intent: Spot elevations (grades) and contours are indicated based on the best available data. Drawings are referenced to provide additional site grading data. The intent is to maintain constant slopes between spot elevations. If a spot elevation is determined to be in error, or the difference in elevation between points change, contact the Owner's Representative immediately for field adjustments of spot elevations.

1.3. EXISTING UTILITIES

- A. Contractor is responsible to contact Underground Service Alert (USA North) at 811 and mark the location of all existing utilities before commencing Work.
- B. Refer to the Drawings for information on proposed site utilities and their locations.
- C. Retain and protect in operating condition all active utilities traversing the site designated to remain.

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- D. Where existing utilities not indicated on the Drawings are encountered, support, shore up, protect same and immediately contact the Owner's Representative for continuance and/or relocation of such services.

#### 1.4. PROTECTION OF EXISTING CONDITIONS AND ADJACENT PROPERTIES

- A. Use all means necessary to protect existing conditions designated to remain, newly constructed conditions and adjacent properties. Avoid any encroachment on adjacent properties.
- B. Prevent damage to existing benchmarks, pavement and utility lines. In the event of damage or loss, immediately make all repairs and replacements required to the satisfaction of the Owner's Representative and at no additional cost to the Owner.

#### 1.5. EXISTING TREES

- A. The Contractor shall protect the tops, trunks and roots of all existing trees on/or near the project site that are designated to remain.
- B. Do not permit the parking of vehicles, or storage of materials or equipment under the dripline of existing trees.

#### 1.6. QUALITY ASSURANCE

- A. Finish grades shall conform to contours, grades, lines and shapes, as indicated on Drawings, with uniform slopes between finish grades or between finish grades and existing grades.
- B. Establish finish landscape grades in a continuous, uniform line, resulting in a uniform surface with positive drainage and without ridges or water pockets.
- C. Finish landscape grade tolerance shall be .04 feet plus or minus of final grades indicated on Drawings.

#### 1.7. SUBMITTALS

- A. If specified under this contract, provide one (1) cubic foot sample of topsoil material for the Owner's Representative's approval prior to delivery to the site, but in any case, prior to placement.

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PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

1.1. GENERAL

- A. Rough grades shall be within plus or minus .10 foot of final finish grades as indicated on plans. If any discrepancies exist, notify the Owner's Representative immediately for direction.
- B. Contractor shall be responsible for bringing rough grades into conformity with finish grades as indicated on the plans. Comply with tolerances specified in this document and as specified in applicable documents of the specifications (i.e. concrete, asphalt, planting, etc.).
- C. Conduct work in an orderly manner. Dirt shall not be permitted to accumulate on streets or sidewalks or washed into storm drains.
- D. Use all means required to prevent the erosion of freshly graded areas during construction and until such time as proposed hard surfaces and landscaping have been constructed.

1.2. LAYOUT

- A. Layout of all work under this Section shall be made by a licensed surveyor.
- B. Maintain all bench marks, control monuments and stakes. Protect from damage and dislocation.
- C. If any discrepancies are found by the surveyor between the Drawings and actual site conditions, the Owner's Representative reserves the right to make minor adjustment in Work Specified as necessary to accomplish the intent of the Contract Documents without increased cost to the Owner.

1.3. SUBGRADE PREPARATION

- A. Cut out areas, to subgrade elevation, which are to receive paving and sidewalks.
- B. Scarify subgrade to a depth of twelve (12) inches and bring to uniform moisture content.
- C. Bring subgrade to required levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

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- D. Slope grade away from building minimum two-and-one-half (2-1/2) inches in ten (10) feet (2%) unless indicated otherwise on Drawings.
- E. Compact subgrade to the following:
  - 1. 6 inch depth at 95% relative compaction in accordance with ASTM D1557-78 for pavement areas.
  - 2. 12 inch depth at 90% relative compaction in accordance with ASTM D1557-78 for landscape areas.

#### 1.4. FINISH LANDSCAPE GRADING

- A. Scarify or rototill to a 6" depth all planting areas prior to finish grade operations and work until uniform and free from large clods larger than one (1) inch in greatest dimension.
- B. Finish grade shall conform, after compaction, to shapes, spot elevations and contours as indicated on Drawings, with uniform levels or slopes between finish elevations or between finish elevations and existing elevations.
- C. Soil amendment and preparation shall comply with Section 32 90 00 Planting.
- D. Spread excess soil material excavated from plant pits to establish subgrades in surrounding planting areas.
- E. Top six (6) inches of all areas to be planted shall be free of stones, stumps or other deleterious matter one (1) inch in greatest dimension.
- F. Compact soil in planting areas to 85% relative compaction in accordance with ASTM D1557-78.
- G. Fine grade all planting areas to a smooth, loose and uniform surface. Eliminate uneven areas, ridges and depressions.
- H. Shrub/ground cover planting areas shall be graded three and one-half (3-1/2) inches below adjacent paved areas, sidewalks, valve boxes, mow bands, drains, etc. in order to receive three (3) inch depth of mulch, establishing final grade one-half (1/2) inches below these surfaces.
- I. Turf areas shall be graded 1/2 inch in hydroseed, and 1/2 inch in sod, below adjacent paved area, sidewalks, valve boxes, mow bands, drains, top of seat walls etc. in order to receive turf, establishing final grade flush with these surfaces.

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1.5. OBSERVATION SCHEDULE

- A. Normal progress observations shall be requested by the Contractor from the Owner's Representative as per observations listed in Sections: 32 84 00 Planting Irrigation, and 32 90 00 Planting.

1.6. CLEAN UP

- A. Remove all trash, excess soil, or rubbish from the property. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a neat and orderly condition throughout the site.
- B. The Contractor shall leave the site area broom-clean and shall wash down all paved areas within the Contract area, leaving the premises in a clean condition acceptable to the Owner's Representative.

END OF SECTION

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SECTION 31 23 33 - TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes trenching, backfilling and compacting for utilities.
- B. Related sections
  - 1. Section 01 41 00 Regulatory Requirements
  - 2. Section 01 45 00 Quality Control
  - 3. Section 31 20 00 Earth Moving

1.2 REFERENCES

- A. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>); 2000.
- B. Manual of Warning Signs, Lights and Devices for Use in Performance of Work Upon Highways, issued by the California State Department of Transportation.
- C. Office of Safety and Health Act (OSHA) Construction Safety Orders
- D. California Code of Regulations Title 8: Construction Safety Orders.

1.3 DEFINITIONS

- A. Finish Grade Elevations: Indicated on Drawings.
- B. State Standard Specifications: State of California, Business and Transportation Agency, Department of Transportation (Caltrans), Standard Specifications, latest edition, excluding Sections pertaining to measurement and payment items.
- C. Relative Compaction: Ratio, expressed as a percentage of field dry density as compacted to a maximum dry density of representative sample of the same material determined by American Society for Testing and Materials (ASTM) Test Method D1557 (c).

1.4 SUBMITTALS

- A. Conform to the requirements of Section 01 33 00 Shop Drawings, Product Data and Samples for submittal procedures.
- B. Product Data: Provide data for Products specified.

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- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Project Record Documents: Record actual locations of pipe mains, valves, connections, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- F. Submit name of imported materials source.
- G. Deliver samples of backfill and fill materials to the Owner's Representative in quantities sufficient for testing. Deliver at least 15 days prior to use.

## 1.5 WARRANTY

- A. The Contractor shall warrant against settlement for a period of one year after the date of final acceptance, and shall repair damage caused by settlement within that time. For the purpose of this Specification, settlement will be deemed to have occurred if on paved surfaces, the depression falls 3/8-inches below the average of the sides of the uncut portion.

## PART 2 - PRODUCTS

### 2.1 BEDDING AND BACKFILL MATERIALS

- A. Bedding: bank sand; washed, free of silt, clay, loam, friable or soluble materials and organic matter; graded as follows: Sand bedding shall have a minimum sand equivalent of 45 and shall be uniformly graded from No. 4 to 200 mesh screen.
- B. Backfill: Native backfill shall be selected material excavated from the trench. In all cases it shall be capable of compaction to at least the relative compaction required. In-place moisture content shall not be more than 5 percent over optimum when the material is silty or clayey and will not provide a stable subsurface.

### 2.2 SOURCE QUALITY CONTROL

- A. See Section 01 45 00 Quality Control for general requirements for testing and analysis of soil material.
- B. Provide materials of each type from same source throughout the Work.

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PART 3 - EXECUTION

3.1 PREPARATION

A. Preparation of Work

1. Underpin adjacent structures, which may be damaged by excavation Work, including utilities.
2. Maintain trench crossings for vehicular and pedestrian traffic at street crossing, driveways and fire hydrants.

3.2 EXAMINATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. See Section 31 20 00 Earth Moving for additional requirements.

3.3 PIPE BEDDING

- A. Bedding Excavation: Excavate trenches below grade of pipe bottom to the depth indicated on drawings.
- B. Stabilization of Trench Bottom: When trench is unstable due to wet or spongy foundation, stabilize trench bottom with gravel or crushed rock. The Owner's Representative will determine suitability of trench bottom and amount of gravel or crushed rock needed to stabilize soft foundation. Remove and replace soft material with gravel or crushed rock when directed by the Owner's Representative.
- C. Placement of Bedding Material: Place sufficient bedding material in trench bottom up to grade of bottom of pipe. Relative compaction of tamped material shall be not less than 90 percent relative compaction. Place and compact additional bedding material to provide uniform bearing under the full length of the pipe to a minimum width of 60 percent of its external diameter.

3.4 TRENCHING

A. Work Included

1. Perform operations necessary to excavate earth, regardless of character and subsurface conditions, from the trench or adjacent thereto, and to place trench stabilization, pipe bedding, pipe cover, trench water removal, trench backfill and base, as shown on the Drawings, as well as providing traffic control and regulation through construction areas.

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2. The Contractor shall do excavation of whatever substance is encountered to the lines and grades shown on the Drawings. Materials suitable for use as backfill shall be piled in an orderly manner a sufficient distance from the edge of the trench to avoid overloading and to prevent sliding into the trench.
  3. The Contractor shall do such grading or Work as is necessary to prevent surface water from entering the excavation.
  4. Demolish and remove existing pavement, curb and gutter, and other Project Site facilities as shown on the Drawings allow Project operations. Existing asphalt concrete pavement to be removed shall be saw cut in longitudinal neat straight lines while maintaining the cuts vertical for the full depth of the asphalt concrete pavement. Portions of existing concrete curbs, gutters and sidewalks to be removed to permit new construction shall be cut using a concrete saw to provide neat straight lines with vertical cuts.
  5. Maximum allowable open trench is 600 L.F. at any one time. Trenches outside the enclosure of the temporary construction fence are to be covered or otherwise protected at the end of each work day.
  6. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
  7. Footings located adjacent to utility trenches should have their surfaces below an imaginary 1.5:1 (horizontal to vertical) plane projected upward from the edge of the bottom of the trench.
  8. Cut trenches wide enough to allow inspection of installed utilities.
  9. Hand trim excavations. Remove loose matter.
  10. Remove large stones and other hard matter which could damage piping or impede consistent backfilling or compaction.
  11. Remove lumped subsoil, boulders and rock up to 1/3 cu. yd. in size.
  12. Remove excavated material that is unsuitable for re-use from Project Site.
  13. Stockpile excavated material to be re-used in area designated on Project Site in accordance with Section 31 20 00 Earth Moving.
  14. Remove excess excavated material from Project Site in accordance with provisions in Section 31 20 00 Earth Moving.
- B. Width of Trench: Except where otherwise specifically permitted by the Owner's Representative, sides of trenches shall be vertical, shored, as required, and shall be of uniform width from top to bottom. Trenches shall be of a width as shown on the Drawings.

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- C. Trench Backfill: Native backfill shall be compacted by machine in uniform layers not exceeding 0.67 foot. Backfill shall be compacted to a relative compaction of not less than 95 percent to within 1 foot of subgrade. The upper 1 foot of subgrade shall be compacted to 95 percent; 85 percent compaction will be acceptable in undeveloped areas.

### 3.5 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.
- D. Buried pipe shall have at least 36 inches of cover and 12 inches of clearance from other utilities.

### 3.6 BACKFILLING

- A. Backfill to contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
- C. Employ a placement method that does not disturb or damage other Work.
- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.
- G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.
- H. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise on the Drawings. Make gradual grade changes. Blend slope into level areas.
- I. Reshape and re-compact fills subjected to vehicular traffic.

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3.7 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 0.10 foot from required elevations.
- B. Top Surface of Backfilling Under Paved Areas: Plus or minus 0.10 foot from required elevations.

3.8 FIELD QUALITY CONTROL

- A. See Section 01 45 00 Quality Control for general requirements for field inspection and testing.
- B. The Owner will make soils tests when advised by the Contractor that in the Contractor's opinion sufficient densities have been achieved. If the first tests in any areas fails, the Contractor shall pay for further testing in that area until specified densities are obtained. The Owner's Representative shall determine the number and location of tests required. Contractor shall provide a backhoe and operator upon request at no additional cost to the Owner.
- C. Lights, flags, and other warning and safety devices for street and highway work shall conform to the requirements set forth in the current Manual of Warning Signs, Lights and Devices for Use in Performance of Work Upon Highways, issued by the California State Department of Transportation.
- D. Preparation, excavation and trenching shall comply with California Code of Regulations Title 8: Construction Safety Orders.

3.9 CLEANING

- A. Leave unused materials in a neat, compact stockpile during progress of work.
- B. Remove unused stockpiled materials. Leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

3.10 DISPOSAL OF EXCESS EXCAVATED MATERIAL

- A. The Contractor shall remove and dispose of all excess excavated material to a suitable site. The proper and legal disposal shall be the responsibility of the Contractor.

END OF SECTION

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SECTION 31 25 13 - EROSION CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work included: The work included in this Section includes all labor, materials, and equipment necessary to place temporary and permanent erosion and sediment control measures as detailed on the Drawings and specified herein.

1.2 RELATED SECTIONS

- A. Section 31 20 00 Earth Moving

1.3 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Section 01 42 16 for definitions, acronyms, and abbreviations.
- B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Project Manual.
- C. Referenced Standards:
  - 1. Caltrans Standard Specifications.

1.4 QUALITY ASSURANCE AND CONTROL

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Protect adjacent properties and water resources from erosion and sediment damage throughout life of contract.

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1.6 SUBMITTALS

A. Product Data: Submit:

1. Materials list of items proposed to be provided under this Section.
2. Specifications and other data needed to prove compliance with the specified requirements.
3. Monthly Inspection Report and Certification Form for Erosion and Sediment Controls. Please note that inspections must be done monthly at least two (2) weeks apart and after a Two-Year rainfall (4 to 6 inches of rain). Keep reports on file at the job trailer. Do not mail to state or city offices. A copy of the report form is attached in the SWPP Plan.

PART 2 - PRODUCTS

2.1 FOR EROSION AND SEDIMENT CONTROL

- A. The primary erosion and sediment control measures implemented during the Mass Grading/Site Preparation phase of the project shall be inspected, maintained, and repaired in accordance with the Storm Water Pollution Prevention Plan for this project. Secondary measures such as Inlet Protection, dust control, erosion control blanket, temporary and permanent seeding shall be installed/applied as necessary. See Civil Plans for placement of BMP's and the Erosion Control Details for further information.
- B. Inlet Protection as shown on the above mentioned detail sheet.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Review Site Improvement Plans and the Storm Water Pollution Prevention Plan along with the approved "Notice of Intent" issued by the California Regional Water quality Control Board (RWQCB).
- B. Deficiencies or changes on Site Improvement Plans or Storm Water Pollution Prevention Plan as it is applied to current conditions shall be brought to the attention of the Project Civil Engineer for remedial action.

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3.2 EROSION CONTROL AND STORM WATER POLLUTION PREVENTION PLAN  
IMPLEMENTATION

- A. Place erosion control and storm water pollution prevention measures in accordance with the approved Contract Documents as construction proceeds and the appropriate phase is in progress for each measure.
- B. Permanent erosion control measures shall be incorporated into the Project at the earliest practical time to minimize the need for temporary controls.

3.3 PERMANENT AND TEMPORARY SEEDING MEASURES

- A. Permanently seed and mulch cut slopes as excavation proceeds to extent considered desirable and practical.
- B. Slopes that erode easily or that will not be graded for a period of fourteen (14) days or more shall be temporarily seeded as work progresses with temporary seeding.

3.4 REMOVAL OF EROSION AND SEDIMENT CONTROL MEASURES

- A. When site is ninety-five percent (95%) re-vegetated and stabilized with grasses, remove temporary sediment risers. Remove accumulated sediment and regrade area to original contours. Seed and protect with permanent grass seed mixture.
- B. Remove drainage structure inlet protection.
- C. Remove silt fence and temporary check dams. Seed and protect any disturbed areas with permanent grass seed mixture.

END OF SECTION

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SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Asphaltic concrete paving, wearing, binder and base course.
2. Surface sealer.
3. Aggregate subbase course.

1.2 REFERENCES

A. Asphalt Institute:

1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types
2. AI MS-19 - Basic Asphalt Emulsion Manual.

B. ASTM International:

1. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
2. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.

C. Caltrans Standard Specifications:

1. Standard Specifications of the State of California, Business and Transportation Agency, Department of Transportation, CALTRANS, latest edition.

1.3 PERFORMANCE REQUIREMENTS

- A. Paving: Designed in accordance with Caltrans Standard Specifications, Section 39.

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1.4 SUBMITTALS

- A. Product Data: Submit product information and mix design.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with Caltrans Standard Specifications, Section 39.
- B. Mixing Plant: Conform to Caltrans Standard Specifications, Section 39.
- C. Obtain materials from same source throughout.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Asphalt Cement: In accordance with Caltrans Standard Specifications, Section 39.
- B. Aggregate for Base Course Mix: In accordance with Caltrans Standard Specifications, Section 39.
- C. Aggregate for Wearing Course Mix: In accordance with Caltrans Standard Specifications, Section 39.
- D. Tack Coat: In accordance with Caltrans Standard Specifications.
- E. Slurry Seal: In accordance with Caltrans Standard Specifications, Section 37-3.
- F. Aggregate for Slurry Seal: In accordance with Caltrans Standard Specifications, Section 37-3.

2.2 ASPHALT PAVING MIX

- A. Use dry material to avoid foaming. Mix uniformly.

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- B. Base Course: In accordance with Caltrans Standard Specifications, Section 39.
- C. Wearing Course: In accordance with Caltrans Standard Specifications, Section 39.

2.3 SOURCE QUALITY CONTROL AND TESTS

- A. Comply with requirements of Section 01 45 00 Quality Control.
- B. Submit proposed mix design of each class of mix for review prior to beginning of Work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify compacted subgrade subbase is dry and ready to support paving and imposed loads.
- C. Verify gradients and elevations of base are correct.
- D. Verify gutter drainage grilles and frames, manhole frames, and are installed in correct position and elevation.

3.2 SUBBASE

- A. Prepare subbase in accordance with Caltrans Standard Specifications, Section 39.

3.3 PREPARATION – SURFACE

- A. Clean surface free of dirt, water, and debris.
- B. Fill cracks greater than 1/8 inch.
- C. Correct areas of subgrade failure.

3.4 PREPARATION - PRIMER

- A. Apply primer in accordance with Caltrans Standard Specifications, Section 39.

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3.5 PREPARATION - TACK COAT

- A. Apply tack coat in accordance with Caltrans Standard Specifications.

3.6 PLACING ASPHALT PAVEMENT - SINGLE COURSE

- A. Install Work in accordance with Caltrans Standard Specifications, Section 39.
- B. Place asphalt within twenty-four hours of applying primer or tack coat.
- C. Place asphalt wearing course as shown.
- D. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- E. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.7 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Place wearing course within twenty-four hours of placing and compacting binder course. When binder course is placed more than twenty-four hours before placing wearing course, clean surface and apply tack coat before placing wearing course.
- B. Compact each course by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- C. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.8 TOLERANCES

- A. Section 01 45 00 Quality Control.
- B. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- C. Scheduled Compacted Thickness: Within 1/4 inch.
- D. Variation from Indicated Elevation: Within 1/2 inch.

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3.9 FIELD QUALITY CONTROL

- A. Comply with requirements of Section 01 45 00 Quality Control.

3.10 PROTECTION OF FINISHED WORK

- A. Immediately after placement, protect pavement from mechanical injury for 48 hours or until surface temperature is less than 140 degrees F.
- B. Comply with requirements of Section 01 77 00 Execution and Closeout Procedures.

END OF SECTION

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SECTION 31 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes site concrete, including but not limited to pavements, walls, footings and sub slabs.
- B. Provide all labor, materials, equipment, and services to complete the work as indicated on the drawings, and in accordance with these specifications. Work includes but is not limited to the following:
  - 1. Concrete formwork
  - 2. Concrete reinforcement
  - 3. Cast-in-place concrete items:
    - a. Concrete paving, sidewalks, ramps, pads, curbs, mow bands, etc.
    - b. Miscellaneous concrete.
    - c. All imbeds including anchor bolts, tiedowns, hold downs with bolts, straps, and sleeves.

1.2 REFERENCES

- A. Caltrans Standard Specifications - Standard Specifications of the State of California, Business and Transportation Agency, Department of Transportation (Caltrans), latest edition.
- B. ASTM - American Society for Testing and Materials
- C. ACI - American Concrete Institute, Manual of Concrete Practice.
- D. CBC – California Building Code

1.3 DEFINITIONS

- A. Percent Compaction: ASTM D1557, percentage as shown on the Drawings of the maximum in-place dry density of the same material.

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1.4 SUBMITTALS

- A. Conform to the requirements of Division 1, Section 01 33 00 Shop Drawings, Product Data, and Samples.
- B. Shop Drawings Reinforcement: Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars and arrangement of concrete reinforcement. Include special reinforcement required at openings through concrete structures.
- C. Concrete Design Mixes:
  - 1. The preparation of design mixes will be the responsibility of the Contractor. Mix designs may be prepared by the supplier and shall be certified by a Civil Engineer registered in California. Mix designs will be designed by the supplier and approved by the Owner's Representative.
  - 2. Written reports will be submitted to the Owner's Representative of each proposed mix for review. Do not begin concrete production until mixes have been reviewed by the Owner's Representative.
  - 3. Adjustment of Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results and other circumstances warrant; at no additional cost to the Owner and as accepted by the Owner's Representative. Provide submittals as in A above. Submit adjustment designs a minimum of 48 hours ahead of schedule for concrete production.
- D. Product Data: Manufacturers' current catalog cuts and specifications for the following:
  - 1. Expansion joint filler, sealant, backer rod and bond breaker, including manufacturer's standard color chart for sealant
  - 2. Air-entrainment.
  - 3. Curing Compound.
  - 4. Fly Ash or Slag
  - 5. MDO plywood made for forming
- E. Samples:
  - 1. MDO plywood made for forming, one 6"x 6" piece

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F. Certificates:

1. Reinforcing Steel: Certificate of compliance
2. Concrete Mix Design: Ticket for each batch delivered showing the following:
  - a. Mix identification.
  - b. Weight of cement, aggregate, water, and admixtures, aggregate sizes/proportion, and air entrainment.

1.5 QUALITY ASSURANCE

- A. Comply with American Society for Testing Materials (ASTM) A-615 "Standard Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement," and "Manual of Standard Practice for Detailing Reinforced Concrete Structures," publication American Concrete Institute (ACI) 315-65 of the American Concrete Institute.
- B. Comply with all pertinent recommendations contained in ACI, "Recommended Practice of Concrete Formwork, ACI-347", and Section 2606, 1997 California Building Code (CBC).
- C. Construct forms to sizes, shapes, lines and dimensions indicated on Drawings, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in Work. Use selected materials to obtain required finish. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.
- D. Provide complete forms of such strength and construction as to prevent any spread, shifting, or settling when concrete is deposited, and tight enough to avoid any leakage or washing out of cement mortar.
- E. Provide at least one person who shall be present at all times during execution of this portion of the Work and who shall be thoroughly trained and experienced in placing the types of concrete specified and who shall direct all Work performed under this Section. For finishing of exposed surfaces of the concrete, use only thoroughly trained and experienced journeymen concrete finishers.
- F. Conform to Section 90 of the Caltrans Standard Specifications.
- G. The Contractor shall contact the Owner's Representative of any discrepancies between field conditions and plans prior to proceeding with Work. The written dimension on

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Drawings shall supersede the graphic presentation. Dimensions are from back of curb, center line, base lines or as noted on the plans. All field adjustments must be approved by the Owner's Representative prior to installation.

- H. All walks and curbs shall be established in the field for review and approval prior to concrete pours. The Contractor shall layout the area or form work for review by the Owner's Representative. If approval is not obtained, the Contractor is responsible for removal of any unauthorized field adjustments.
- I. Transitions of curves to other curves, and curves to straight line tangents, shall be smooth and continuous.
- J. Place expansion joint and score joints as shown on plan. Adjustments in the field shall be made only with the approval of the Owner's Representative.
- K. Where new concrete paving is placed adjacent to curbs or existing concrete paving, a construction joint (cold joint) shall be provided between the new concrete paving and curbs or existing concrete paving.
- L. Sleeving shall be coordinated with concrete work. Refer to irrigation plan for sleeving location.
- M. The Contractor shall be responsible for repairing, at no additional cost to the Owner, any disturbed existing landscape designated to remain which resulted from construction of this project.
- N. Some materials may require a several week order lead time. Contractor is responsible for determining any and all ordering lead times, and providing required materials at the project site in a timely manner. No unapproved substitutions will be allowed. Contact the Owner's Representative immediately if a specified material is not available.
- O. Lines and Levels: To be established by a licensed Surveyor or registered Civil Engineer.
- P. Mix Standards: Conform to the ACI Manual and the Portland Cement Association's "Design and Control of Concrete Mixes".
- Q. Design of Concrete Mix: Employ approved commercial testing laboratory to design concrete mixes as follows:



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Item	Minimum Cement Content *	28-Day Minimum Strength	Slump ± 1"	Maximum Aggregat e Size	Maximum Water to Cement Ratio (By Weight)
Site Foundations (light poles, equipment pads, mow strips)	470 lb/cu. yd	2,500 PSI	6 in.	1 in	0.60
Sidewalks, Curbs, Gutters	517 lb/cu. yd.	3,000 PSI	4 in.	3/4 in	0.55
Structure Foundations	517 lb/cu. yd.	3,000 PSI	4 in.	3/4 in	0.60
Paving, Slab on Grade	564 lb/cu. yd.	3,500 PSI	4 in.	3/4 in	0.45
Walls	564 lb/cu. yd.	3,500 PSI	4 in.	3/4 in	0.45

\*Up to 15% of cement may be substituted with Fly Ash per ASTM A618.

R. Fly Ash:

1. Source Control: The following sources of ash are not to be used:
  - a. Ash from a peaking plant instead of a base loaded plant.
  - b. Ash from plants burning different coals or blends of coal.
  - c. Ash from plants burning other fuels (wood chips, tires, trash) blended with coal.
  - d. Ash from plants using oil as a supplementary fuel.
  - e. Ash from plants using precipitator additives, such as ammonia.
  - f. Ash from start-up or shut-down phases of operation.
  - g. Ash from plants not operating at a "steady state."
  - h. Ash that is handled and stored using a wet system.
2. Fly ash used in concrete should be as consistent and uniform as possible. Fly ash to be used in concrete should be monitored by a quality assurance/quality control (QA/QC) program that complies with the recommended procedures in ASTM C311.(6) These procedures establish standards for methods of sampling and frequency of performing tests for fineness, loss on ignition (LOI), specific

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gravity, and pozzolanic activity such that the consistency of a fly ash source can be certified.

1.6 QUALIFICATION OF INSTALLER

- A. Installer shall be thoroughly trained and experienced in the skills required, and shall be completely familiar with the products and their installation as specified on the Drawings and in this Section. Installer shall be present at all times during progress of Work of this Section and shall direct all Work performed.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivered Mixes: Coordinate delivery so that mixes may be immediately poured upon arrival at site.
- B. Components and Accessories:
  - 1. Fittings and Reinforcements: Protect from rust, soil and oil contamination at all times. Store on pallets above ground.
  - 2. Templates: Protect from damage. Test accuracy prior to each use.

1.8 SEQUENCING AND SCHEDULING

- A. Coordination: Coordinate all items of other trades to be furnished and set in place. Coordinate proper installation of all accessories embedded in the concrete and for the provision of holes, openings, etc., necessary to the execution of the work of the trades in ample time that progress of the work is not delayed.

1.9 JOB CONDITIONS

- A. Cold-Weather Placement: comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
- B. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

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1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators.
- C. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled 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 reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
  3. Fog spray form, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

1.10 COORDINATION

- A. Secure all pipe sleeves, anchors and bolts, including those for angle frames, inserts, ties and other materials in connection with concrete construction, in position before concrete is placed.
- B. Obtain information and instructions from other Trades and suppliers in ample time to schedule and coordinate the installation of items furnished by them to be embedded in concrete so provisions for their work can be made without delaying the project.

1.11 FORM CONSTRUCTION TOLERANCES

- A. Set form to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of Work so that forms can remain in place for twenty-four hours after concrete placement.
- B. Check completed formwork for grade and alignment to following tolerances:
- C. Top of forms not more than one-eighth inch in ten feet vertical elevation.

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- D. Vertical face on longitudinal axis not more than one-fourth inch in ten feet horizontal width.
- E. Circular or curved formwork shall be continuous, complete radii as indicated on Drawings. No straight segments in circular/curved formwork shall be accepted.

1.12 TESTS AND OBSERVATIONS

- A. The following tests shall be made by Owner's testing laboratory or by a certified Special Inspector as determined by the Owner. Special inspections for Concrete Construction shall be in accordance with Section 1704.4 and Table 1704.4 of the 2022 CBC and as noted below:
  - 1. Periodic Inspection of reinforcing steel and placement.
  - 2. Cement: Mill analysis and test reports by supplier certifying cement conforms to Specifications is acceptable in lieu of tests at the discretion of the Owner's Representative.
  - 3. Provide free access to Work and cooperate with testing laboratory.
  - 4. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.
  - 5. Concrete Inspections:
    - a. Continuous Placement Inspection: Inspect for proper installation procedures.
    - b. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.
  - 6. Strength Test Samples:
    - a. Sampling Procedures: ASTM C172.
    - b. Cylinder Molding and Curing Procedures: ASTM C31, cylinder specimens.
  - 7. Concrete cylinders: Make and cure in accordance with ASTM C31.
    - a. Record shall be made of the time cylinders were made and of locations of concrete from which the cylinders were taken.
    - b. Three identical cylinders shall be taken from each pour of 25 cubic yards or part thereof, being placed each day.

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- c. When volume of concrete for any class of concrete would provide less than 5 sets of cylinders, take samples from five randomly selected batches, or from every batch when less than 5 batches are used.
  - d. Make one additional cylinder during cold weather concreting, and field cure.
- 8. Field Testing:
  - a. Slump Test Method: ASTM C143.
  - b. Air Content Test Method: ASTM C173.
  - c. Temperature Test Method: ASTM C1064.
  - d. Measure slump and temperature for each compressive strength concrete sample.
  - e. Measure air content in air entrained concrete for each compressive strength concrete sample.
- 9. Cylinder Compressive Strength Testing:
  - a. Test Method: ASTM C39.
  - b. Test Acceptance: In accordance with ACI 318.
  - c. Test one cylinder at 7 days.
  - d. Test two cylinders at 28 days.
- 10. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.
- 11. Should tests show that concrete is below specified strength; the Contractor shall remove all such concrete. Full cost of removal of inferior concrete, its replacement with concrete of proper specified strength and testing shall be borne by the Contractor.

1.13 CODES AND STANDARDS

- A. ACI 301 "Structural Concrete for Building"
- B. ACE 305 "Recommended Practice for Hot Weather Concreting"
- C. ACI 306 "Recommended Practice for Cold Weather Concreting".
- D. ACI 308 "Curing Concrete"
- E. ACI 309 "Recommended Practice for Consolidation of Concrete"

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- F. ACI 318 "Building Code Requirements for Reinforced Concrete".
- G. ACI 347 "Recommended Practice for Concrete Formwork".
- H. ACI 605 "Recommended Practice for Hot Weather Concreting".
- I. ACI 614 "Recommended Practice for Measuring, Mixing, and Placing Concrete".
- J. ASTM C31 "Practices for Making and Curing Concrete Test Specimens in the Field".
- K. ASTM C33-86 "Specifications for Concrete Aggregate".
- L. ASTM C94-89 "Specifications for Ready Mixed Concrete".
- M. ASTM C143 "Test Method for Slump Portland Cement Concrete".
- N. ASTM C150 "Portland Cement".
- O. ASTM C309 "Specifications for Liquid Membrane-forming Compounds for Curing Concrete".
- P. Western Concrete Reinforce Steel Institute (WCRSI) "Manual of Standard Practice".
- Q. Where provisions of pertinent codes and standards conflict with this Specification, the more stringent provisions shall govern.
- R. California Building Code (CBC), latest edition.
- S. Section 90 of the Caltrans Standard Specifications.

## PART 2 - PRODUCTS

### 2.1 CONCRETE REINFORCEMENT

- A. Reinforcing Bars: Deformed Billet Steel Bars, ASTM A-615, Grade 40 or 60, containing a minimum of 70% total recycled content, clean and free from rust, scale, or coating that will reduce bond.
- B. Smooth Dowels for Joints: ASTM A615, Grade 40 smooth, billet-steel bars, shop painted with iron-oxide zinc-chromate primer.
- C. Welded Wire Mesh: ASTM A-185 plain type and uncoated finish.

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2.2 CONCRETE

A. Concrete Mix:

1. Ready-mixed concrete in accordance with ASTM C-94 and with aggregates comply with ASTM C-33 and Portland Cement ASTM C-150, Type II.
2. All mixes shall conform to applicable building code requirements listed herein or on the Drawings. All mix designs shall be submitted to the Owner's Representative for approval before being used. Mix design shall show proportions of cement, fine and coarse aggregate, and water and gradation of combined aggregates. Calcium chloride shall not be added at any mix.
3. Concrete shall be Class B per Caltrans Standards.
4. Cement: All cement shall be Portland cement Type II, and shall be the product of one manufacturer. The temperature of cement delivered to the plant shall not exceed 150 degrees Fahrenheit.
5. Aggregates
  - a. Coarse aggregate shall have a minimum cleanliness value of 75.
  - b. Fine aggregate shall have a minimum of sand equivalent of 75.
  - c. Any suitable individual grading of coarse aggregates may be used.
6. Water: All water shall be clean and free from deleterious matter.
7. Admixture: No admixture of any type shall be used without prior approval of the Owner's Representative.
8. Concrete shall be as specified: Class B
  - a. 28-Day Minimum Strength: Refer to Table in Paragraph 1.5(R) above
  - b. Concrete slump: Refer to Table in Paragraph 1.5(R) above
  - c. Air Content: No air entrainment

B. Fly Ash: Pozzolanic admixtures, conforming to ASTM C618, Class C, with weight loss of ignition limited to not exceed 3 percent shall be used in mix designs to replace Portland Cement up to 15% by weight, unless noted otherwise on drawings.

1. Reference: ACI 211.4R-93.

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- C. Water: Clean, potable (domestic) free from injurious amounts of salts, oils, acids, alkalis, organic materials or other deleterious matter. Available from source determined by the Owner's Representative.
- D. Air Entrainment: ASTM C260.
- E. Admixtures: Admixtures containing chlorides are not permitted. All admixtures shall be mixed in accordance with manufacture's written recommendations.

## 2.3 ACCESSORIES

- A. Tie Wires: Black annealed, ASTM A-82, minimum 16 gauge.
- B. Chains, Bolsters, Bar supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete.
- C. Stirrup Steel: ASTM A-82.
- D. Snap Ties: Snap-off metal of fixed length capable of leaving no metal within one and one-half (1 1/2) inches of surface nor causing fractures, spall or other defects larger than one (1) inch in diameter.
- E. Expansion Joint Materials:
  - 1. Premolded Joint Filler: ASTM D1751, non-extruding and bituminous type resilient filler, compatible with sealant, and having a "guide strip" removable depth gauge.
  - 2. Joint Sealant: ASTM C290, non-snag sealant "Dynatred" by Pecora Corporation, [214] 278-8158 or "Sonolastic Sealant Two-Part" by Sonneborn, [415] 889-9899, or equal.
    - a. Color shall be selected by the Owner's Representative from the manufacturer's full color selection.
  - 3. Bond Breaker: Pressure-sensitive tape as recommended by sealant manufacturer to suit application.
- F. Forms:
  - 1. Steel or wood of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal.
  - 2. Use forms that are straight and free of distortions and defects.
  - 3. Use flexible spring forms or laminated boards to form radius bends as required.

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- G. Form Release Agent: Colorless non-staining, free from oils. Chemical agent shall not impair bonding of paint or other proposed coatings.
- H. Form-Facing Materials:
  - 1. All Surfaces: of sufficient strength to hold concrete properly in place and prevent leakage of water from forms.
  - 2. Exposed Surfaces: Matte finish, coated, medium density overlay plywood made for forming. No wood-textured finish will be permitted on exposed concrete unless specified as such.
- I. Wood Headers:
  - 1. Wood: Construction Heart grade rough Redwood header and stake or pressure-treated rough Douglas Fir stake.
  - 2. Nails: Hot-dipped galvanized.
- J. Curing Compound: ASTM C309, Type I-D, Class A.
- K. Integral Color: as required for decorative finishes to match existing paving.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verification of Conditions: Verify that subgrade preparation for concrete paving has been completed prior to commencement of work.
- B. Surface Drainage:
  - 1. Report in writing conflicts discovered on the site or prior work, which would prevent positive drainage. Correct prior to performing concrete work.
  - 2. Do not permit finished paving surfaces to vary more than 1/4 in. measured with a 10 ft. metal straightedge, except at grade changes. No "birdbaths" or other surface irregularities will be permitted. Properly correct irregularities.

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3.2 PREPARATION

- A. Templates: Use templates for all anchor plates, bolts, inserts and other items embedded in concrete. Accurately secure so that they will not be displaced during placing of concrete.
- B. Piping and Conduit: Do not embed piping, other than electrical conduit, in structural concrete. Locate conduit to maintain strength of structures at maximum. Verify size, length and location of electrical conduit.
- C. Aggregate Base Course: Compact base course to thicknesses and relative compaction shown on Drawings.

3.3 CONCRETE REINFORCEMENT PLACEMENT

- A. Fabricate reinforcement in accordance with ACI-315, providing a minimum concrete cover of three inches or as specified in UBC, latest edition.
- B. Place all reinforcement in the exact position shown on the Drawings and secure in position during the placing and compacting of concrete. Wire bars together with No.16 gauge wire with ties at all intersections except where spacing is less than twelve inches in each direction, in which case tie alternate intersections.
- C. Place all sleeves, inserts, anchors and embedded items required for adjoining work or for its support prior to concreting. Fill voids in embedded items temporarily with readily removable material to prevent entry of concrete.
- D. Give all contractors and subcontractors whose work is related to concrete or supported by it, ample notice and opportunity to introduce and/or furnish embedded items before concrete placement.
- E. Verify that concrete reinforcement may be installed in strict accordance with all pertinent codes and regulations, the Shop Drawings and the original design.
- F. Verify score joints in sidewalk slabs are constructed at 5-foot maximum intervals.
- G. Bending:
  - 1. Fabricate all reinforcement in strict accordance with the reviewed Shop Drawings.

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2. Do not use bars with kinks or bends not indicated on the Drawings or on the reviewed Shop Drawings.
  3. Do not bend or straighten steel in a manner that will injure the material.
  4. Bend all bars cold.
  5. Make all bends for other bars, including hooks, around a pin having diameter not less than six times the minimum thickness of the bar for number 8 and smaller and eight times the thickness for number 9 and larger.
- H. Before the start of concrete placement, accurately place all concrete reinforcement, positively securing and supporting by concrete blocks, metal chairs or spacer, or by metal hangers.
- I. Clearance:
1. Preserve clear space between bars of not less than one time the normal diameter of round bars.
  2. In no case let the clear distance be less than 1 inch or less than 1-1/3 times the maximum size of aggregate.
  3. Provide the following minimum concrete covering of reinforcement:
  4. Concrete below ground deposited against forms: 3 inches.
  5. Concrete deposited against earth: 3 inches.
  6. Concrete elsewhere: as indicated on Drawings.
- J. Splicing:
1. Horizontal bars:
  2. Place bars in horizontal members with minimum laps at splices sufficient to develop the strength of the bars. Splice 40 bar diameters minimum.
  3. Bars may be wired together at laps.
  4. Wherever possible, stagger the splices of adjacent bars.
  5. Wire fabric: Make all splices in wire fabric at least 1-1/2 meshes wide.

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- 6. Other splices: Make only those other splices that are indicated on the approved Shop Drawings or specifically approved by the Owner's Representative.
- K. Dowels/Anchor Bolts: Place all required steel dowels/anchor bolts and securely anchor them into position before the concrete is placed. Bending the dowels after placement of concrete will not be permitted.
- L. Obstruction: In the event conduits, piping, inserts, sleeves, or any other items interfere with placing reinforcement as indicated on the Drawings, or as otherwise required, immediately consult the Owner's Representative and obtain review of new procedure before placing concrete.

### 3.4 CONCRETE FORMWORK CONSTRUCTION

- A. Construct support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete.
- B. Contractor assumes full responsibility in the removal of forms. The length of time forms must remain in place depends on the rate of time required for concrete to obtain a proper strength. Remove forms after the concrete is sufficiently hard to prevent damage to concrete.
- C. Circular or curved formwork shall be continuous, complete radii as indicated on Drawings. No straight segments in circular/curved formwork shall be accepted.
- D. Reuse of Forms:
  - 1. Do not reuse forms if there is any evidence of surface wear or defect which would impair quality of surface.
  - 2. Thoroughly clean and properly coat forms before reuse.

### 3.5 INSTALLATION

- A. Notification: Notify the Owner's Representative at least 48 hours before placing concrete.
- B. Placing Concrete:
  - 1. Unless otherwise indicated or required by the Drawings, concrete paving shall be placed on compacted subgrade to thicknesses indicated on the Drawings to 95 percent compaction.

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2. Place concrete in accordance with ACI-304 and Section 2605 of the California Building Code. Immediately after depositing, compact concrete thoroughly by mechanical vibration. No vibrating of form is allowed. Mixing shall be continuous, with no interruptions from the time the truck is filled until the time it is emptied. Concrete shall be placed within one and a half hours from the time water is first added.
3. Insure anchors, seats, plates, and other items to be cast into concrete are placed, held securely and will not cause hardship in placing concrete.
4. Insure reinforcement, inserts, embedded parts, etc. are not disturbed during concrete placement.
5. Pour concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur, unless otherwise indicated on the Drawings.
6. Lines and Grades: Elevations requiring accurate placement shall be set by a competent instrument man, using a professional type instrument.
7. For all concrete placed on soil, the subgrade shall be wet and compacted prior to placing.
8. Before placing concrete mixing, conveying and finishing equipment, forms and reinforcing shall be well-cleaned. Wet form before placing concrete, unless oiled forms are used.

3.6 CURING AND PROTECTION

- A. Beginning immediately after placement, protect concrete from premature drying, from excessively hot or cold temperatures, and from mechanical injury. Maintain concrete with minimal moisture loss at relatively constant temperature for a period necessary for hydration of cement and hardening of concrete. In hot, dry and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation – control material. Apply according to manufacturer's instruction.
- B. As soon as building flat work has hardened sufficiently to prevent injury to finish, apply an approved concrete curing agent in accordance with the manufacturer's recommendation.
- C. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Keep continuously moist for not less than seven (7) days.

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- D. Excessive cracking as determined by the Owner's Representative which is aesthetically unacceptable or which will result in premature disintegration of paving shall result in replacement of concrete.
- E. Removal of Forms: Remove no sooner than at seven days after each pour.
- F. Conform to all applicable requirements for curing and protection of concrete, Sections 90-7 and 90-8 of the Caltrans Standard Specifications.
- G. Spraying: Spray concrete during the curing period as frequently as drying conditions may require.
- H. Curing: Cure concrete in accordance with the ACI Manual of Concrete Practice. During curing period, maintain concrete above 70 degrees F. for at least 3 days or above 50 degrees F. for at least 5 days.
- I. Damage and Defacement: Protect all concrete work against damage and defacement during subsequent construction operations until final acceptance.

3.7 CLEANING AND PATCHING

- A. Removal: Remove all projecting fins, bolts, wire, nails, etc., not necessary for the work, or cut them back 1 in. from the surface and patch in an inconspicuous manner.
- B. Snap Ties: Immediately after removal of forms, cut off snap ties extending from the face of concrete to at least 1 in. deep in the concrete. Fill or plug as detailed in Drawings.
- C. Voids: Fill holes with a 1:3 cement/sand mortar with the same color as the adjoining concrete. Mix and place the mortar as dry as possible and finish flush with the adjacent surface.
- D. Corrective Patching: Correct all defects in concrete work. Chip all voids to a depth of at least 1 in. with the edges perpendicular to the surface and parallel to form markings. Fill all voids, surface irregularities, or honeycombing by patching or rubbing. Ensure that all concrete surfaces so repaired duplicate the appearance of the unpatched work.
- E. Finishing: Work finish surface texture as specified below.

3.8 FINISHES

- A. Light Broom Finish:

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1. Floating: Float surface once it has sufficiently stiffened. Check planeness of surface with a 10 ft. straightedge in all directions. Cut down high spots and fill lows. Immediately refloat to a uniform non-directional sandy texture.
2. Obtain by drawing a stiff bristled broom across a floated finish.
3. Direction of brooming to be perpendicular to direction of paving.

B. Decorative Finish

1. Match existing. Match shall be as determined by the Owner's Representative.

3.9 JOINTS

A. Construction Joints:

1. Locate and install joints as indicated on the Drawings so they do not impair strength or appearance of slab.
2. All joints and other edges shall be formed in the fresh concrete using an edging tool to provide a smooth uniform impression.

B. Score Joints:

1. Locate and install joints as indicated on the Drawings so they do not impair strength or appearance of slab.
2. Score joints shall be formed in the fresh concrete using a jointer to cut the groove so that a smooth uniform impression is obtained. All joints shall be struck before and after sandblast.
3. Locate and form joints with 1/4 inch radius edges and 1 inch to 1-1/4 inch deep score at the location as shown on the Drawings.
4. All joints and other edges shall be formed in the fresh concrete using an edging tool to provide a smooth uniform impression.

C. Expansion Joints:

1. Locate and install joints as indicated on the Drawings so they do not impair strength or appearance of slab.

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2. Expansion joints shall be provided at the location and 40-foot maximum intervals as shown on the plans, and at all locations where concrete paving abuts buildings, curbs or other proposed or existing structures. Install as per detail on the Drawings.
3. All joints and other edges shall be formed in the fresh concrete using an edging tool to provide a smooth uniform impression.
4. Install backer-rod and joint sealant as indicated on the Drawings.
5. Sealing of Expansion Joints: After the curing period, strip out all depth gauge strips and carefully clean expansion joints. Fill with joint compound as shown on Drawings. Avoid spilling compound on paved surfaces or overflowing from joint.
6. Protect expansion joints from damage until placement of filler or caulk.

3.10 FIELD QUALITY CONTROL

- A. Samples: Contractor shall coordinate with the Owner to select a qualified testing laboratory to take samples for testing during the course of the work as described in Article 1.13 Tests and Observations.
- B. Field inspection and testing will be performed by a qualified testing laboratory in accordance with ACI 318 and as described in Article 1.13 Tests and Observations.
- C. Cost of Testing: Contractor shall be responsible for costs associated with testing.
- D. Rejected Materials: Remove off the site all concrete below specified strength.
- E. Cost of Removal and Retesting: Contractor shall be responsible for costs associated with removal and costs associated with retesting.
- F. Integral color: Color shall be evenly saturated in concrete mix to provide consistent, even, and distinct color in finished installation, including after medium sandblast finish is applied.
- G. Defective Work: Remove in its entirety and replace all defective concrete work which after corrective patching, rubbing, etc., fails to duplicate the appearance of unpatched work and/or conform to the standards set forth in these Specifications.
- H. Observe formwork continuously while concrete is being placed to see that there are no deviations from desired elevation, alignment, plumbness or camber.



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- I. If during construction any weakness develops and falsework shows undue settlement or discoloration, stop work, remove affected construction if permanently damaged, and strengthen falsework.

END OF SECTION

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SECTION 32 13 13.1 - CONCRETE WORK (LANDSCAPE)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. All grading, earthwork, excavations, backfills, compaction, and other grading operations shall be accomplished in accordance with the soils report (which shall be part of the Contract Documents). Contractor shall be responsible for securing a copy of the soils report. The project soils engineer shall be present during all grading operations. The soils engineer shall direct samples to be submitted and tests to be taken. Contractor shall cooperate with the requirements of the soils engineer.
- C. Specification Division 31, Earthwork, Soils and Earthwork, Rough Grading, and Excavation and Fill.

1.2 DESCRIPTION OF WORK:

- A. The extent of concrete work is shown on the landscape architectural drawings and details and shall include, but is not limited to, pedestrian concrete walkways, steps, ramps, curbs, mowbands, footings and walls.

1.3 QUALITY ASSURANCE:

- A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:
  - 1. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".
  - 2. ACI 318 Building Code Requirements for Structural Concrete.
  - 3. ASTM C150, for Type I, Type II or Type III Portland cement concrete.
  - 4. Chapter 19A, 2022 C.B.C.
- B. Certification: Weighmaster Certificate
- C. Duties of the Inspector: The inspector shall notify the Architect, Structural Engineer and the Division of State Architect at least 48 hours in advance of the first pour of concrete and sufficiently in advance of subsequent pours. Comply with Section 4-333.1 and Chapter 7, Part I, Title 24, California Code of Regulations (CCR).
- D. Installer Qualifications:
  - 1. Experience: The concrete installing firm shall have contracted for and successfully completed construction of a minimum of five (5) California public school district construction projects, approved by the Division of the State Architect (DSA), within the past five (5) years of similar size, complexity, budget and scope.
  - 2. Licensure: The concrete installation firm shall hold a current, active C8 "Concrete Contractor" license classification by the California State License Board that has been consistently active for at least five (5) years and that has not been suspended or revoked.

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3. Supervision: The concrete installing firm shall have a qualified and experienced concrete technician on site during concrete installation.

1.4 SUBMITTALS:

- A. Shop Drawings Reinforcement: Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required and openings through concrete structures.
- B. Design Mixes Submittal: Submit written reports of design mixes to the Architect of each proposed mix for each class of concrete within thirty-five (35) days after the issuance of the "Notice to Proceed", but no later than ten (10) days prior to the first scheduled concrete pour. Do not begin concrete production until all design mixes have been reviewed by the Architect and independent testing facility.
  1. Separate submittal data shall be submitted for each mixture for the following:
    - a. Concrete Paving – Pedestrian, steps, curbs, walls, footings and concrete base at resilient surfacing
    - b. Concrete Paving – Vehicular.
- C. Job-site Samples: Contractor shall pour concrete samples as indicated below for each concrete color and finish specified on Drawings for written approval from Owner's Representative prior to installation as follows:
  1. Two (2) foot by two (2) foot concrete flatwork.
  2. Two linear feet by width and height detailed for each concrete wall specified to include decorative tile.
- D. Submittal Checklist:
  1. Installer qualifications.
  2. Reinforcement shop drawings.
  3. Design mixes.
  4. Aggregate Base rock.
  5. Expansion joint material.
  6. Joint filler.
  7. Sealant.
  8. Concrete colors; natural, lamp black, and/or colored.
  9. Waterproofing for walls.

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PART 2 - PRODUCTS

2.1 FORM MATERIALS:

- A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.
- B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments.
- D. Expansion Joint for flatwork that does not have a stamp pattern: Asphalt impregnated felt fiber expansion material, one half inch (1/2") thick by full depth of concrete, in compliance with ASTM D1751.
- E. Expansion Joint for flatwork with a stamp pattern: Use Form-A-Key (or equal) key-loc system joint and stake manufactured of 24 gauge galvanized steel with dowel knock outs six (6) inches on center spacing shaped in the form of a constant tongue and groove key between adjacent concrete slab sections secured in place by 13 gauge HRPO steel stakes installed at 24" intervals conforming to ASTM A653 joint and ASTM A569 stakes.
- F. Expansion Joint for poured-in-place walls: Asphalt impregnated felt fiber expansion material, one half inch (1/2") thick by full depth of concrete, in compliance with ASTM D1751.

2.2 REINFORCING MATERIALS:

- A. Reinforcing Bars (Rebar): ASTM A 615, Grade 60, deformed, except #3 and smaller may be Grade 40. Test in accordance with Section 1903A and 1910A.2, 2022 C.B.C.
- B. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place.

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2.3 CONCRETE MATERIALS:

- A. Portland Cement: ASTM C 150, Type V, conforming to ACI 318-14 and test in accordance with Section 1903A, 2022 C.B.C.
- B. Fly Ash or other pozzolan can be used as a partial substitute for ASTM 150 Portland cement as follows:
  - 1. Fly Ash conforming to ASTM C618, Class F, the maximum Loss on Ignition (LOI) shall be less than 3%. Class C is not permitted.
  - 2. Slag, Ground Granulated Blast Furnace Slag Cement (GGBFS) shall conform to ASTM C989 or AASHTO M 302 Grade 100 or 120.
  - 3. Silica Fume: ASTM C1240, Standard Specification for Silica Fume used in cementitious mixtures.
  - 4. High-Reactivity Metakaolin (HRM): ASTM C618, aluminosilicate pozzolan.
- C. Normal Weight Aggregates: Shall be #57 aggregate, uniformly graded and in compliance with ASTM C 33. Test in accordance with ACI 318 Section 3.2.1 and ACI 318 Section 3.3.2.
  - 1. Maximum aggregate size: 100% passing 1" sieve for footings, walls, steps, curbs and exterior walkways.
  - 2. Class: Negligible weathering region, but not less than 1N.
  - 3. Aggregate shall be certified by testing to be "innocuous" with respect to alkali silica reactivity, or shall be certified by the supplier based on service records in accordance with ASTM C33 Appendix X1.
- D. Water: Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials or other substances that may be deleterious to concrete or reinforcement and shall be tested and verified through ASTM C1602.
- E. Admixtures: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
  - 1. Air-Entraining Admixture: ASTM C 260.
  - 2. Water-Reducing Admixture: ANSI/ASTM C 494, Type A, and contain not more than 1% chloride ions.
  - 3. High-Range, Water-Reducing Admixture: ASTM C 494, Type F
  - 4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E
  - 5. Water-Reducing and Retarding Admixture: ASTM C 494, Type D
- F. Crushed Aggregate Base Rock: Shall be coarse aggregate for regular weight concrete. Aggregate shall be hard, durable, uncoated, graded, cleaned and screened crushed rock or gravel conforming to current requirements of ASTM C33. Crusher-run stone or bank-run gravel will not be permitted.
- G. Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound complying with ASTM C-309, Type I, Class A unless other type acceptable to Architect. Comply with Volatile Organic Compounds (VOC) content limits, as required by Air Pollution Control Regulations on Architectural Coatings (less than 350 g/l).

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H. Curing Methods:

1. Moist Curing: continuous misting, sprinkling or ponding.
2. Moisture-retaining cover curing: After wetting the concrete surface, cover with wet-curing blanket. Lay blanket in accordance with manufacturer's instructions, over-lapping edges and extending edges twelve (12) inches beyond area of concrete to be cured. Remove air pockets. Repair any holes or tears that occur using sheeting material and waterproof tape.
3. Compound curing: Apply specified curing compound as soon as final finishing operations are complete. Use as recommended by the manufacturer's written instructions.

I. Color Materials:

1. Liquid lamp black shall be default color for concrete flatwork not specified on drawings as "Natural" or "Colored". Add one pint of liquid lamp black per cubic yard of concrete flatwork.
2. Concrete specified as "Natural" shall have no color added. Unless specified otherwise on Drawings, concrete curbs, steps, and walls to be "Natural."

J. Concrete Colors and Patterns:

1. Type I – Lamp Black with asphalt impregnated felt fiber expansion material.

2.4 PROPORTIONING AND DESIGN OF MIXES:

- A. Prepare design mixes for each type and strength of concrete. Use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.
- B. Comply with Section ACI 318-19 section 26.4.3.
- C. Submit written reports to Architect of each proposed mix for each class of concrete at least 10 days prior to the first scheduled concrete pour. Do not begin concrete production until mixes have been reviewed by Architect.
- D. Design mixes to provide normal weight concrete with the following properties:
  1. Concrete Paving – Pedestrian, steps, curbs, walls, footings and concrete base at resilient surfacing:
    - a. 3,000 psi 28-day compressive strength
    - b. 0.60, maximum, water to cement (W/C) ratio
    - c. Minimum cementitious content shall be 470 pounds, minimum, per cubic yard.
    - d. Aggregate to be 1" maximum.
    - e. 28-day shrinkage, SEAONC Method: 0.050 maximum.

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2. Concrete Paving – Vehicular
  - a. 4,000 psi 28-day compressive strength
  - b. 0.50, maximum, water to cement (W/C) ratio
  - c. Minimum cementitious content shall be 470 pounds, minimum, per cubic yard.
  - d. Aggregate to be 1" maximum.
  - e. 28-day shrinkage, SEAONC Method: 0.050 maximum.

- E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.
- F. Admixtures: Use only as indicated by approved design mix.
- G. Color Additive for concrete not specified as "colored": add one pint of liquid lamp black per cubic yard of all exterior Concrete Paving – Pedestrian and Concrete Paving - Vehicular. Steps, Curbs, Walls and Footings shall not include lamp black in the design mix.
- H. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
  1. All concrete: Shall be four (4) inches, plus or minus one (1) inch.

2.5 CONCRETE MIXES:

- A. Ready-Mix Concrete: Comply with ASTM C94. Measure, batch and mix concrete materials and concrete according to ASTM C-94. Furnish batch certificates, indicating project identification, name and number, date, mixture type, mixing time, quantity and amount of water added for each batch discharged and used in the Work to the Architect.

2.6 SACK FINISH MORTAR

- A. Mortar shall be composed of Portland cement, sand, and water proportioned and mixed as specified in CalTrans Section 51 1.135.
- B. Mortar shall be furnished and placed in recesses and holes, on surfaces, under structural members, and at other locations specified in these specifications, the special provisions or shown on the plans.
- C. The proportion of cement to sand, measured by volume, shall be one to two (1:2) unless otherwise specified.
- D. Materials shall conform to the provisions in CalTrans Section 90, "Portland Cement Concrete."
- E. The maximum size of sand shall not be larger than 0.5 of the size of the recess, hole or space where the mortar is to be placed.
- F. The mortar shall contain only enough water to permit placing and packing.
- G. Concrete areas to be in contact with the mortar shall be cleaned of all loose or foreign material that would in any way prevent bond between the mortar and the concrete surfaces and shall be flushed with water and allowed to dry to a surface dry condition immediately prior to placing the mortar.

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- H. The mortar shall completely fill and shall be tightly packed into recesses and holes, on surfaces, under structural members, and at other locations specified. After placing, all surfaces of mortar shall be cured by the water method as provided in CalTrans Section 90 7, "Curing Concrete," for a period of not less than 3 days.
- I. Keyways, spaces between structural members, holes, spaces under structural members and other locations where mortar could escape shall be mortar tight before placing mortar.
- J. No load shall be allowed on mortar that has been in place less than 72 hours, unless otherwise permitted by the Engineer.
- K. All improperly cured or otherwise defective mortar shall be removed and replaced by the Contractor at the Contractor's expense.

2.7 WATERPROOF MEMBRANE:

- A. Rolled, self-adhering waterproof membrane, composed of nominally 56 millimeter thick layer of polymeric waterproofing membrane on a heavy duty, four-millimeter thick, cross-laminated polyethylene carrier film laminated together, MEL-ROL, product of W. R. Meadows/Sea Tight, or equal conforming to A.R.E.M.A. Specifications Chapter 29, Waterproofing.

PART 3 - EXECUTION

3.1 AGGREGATE BASE PLACEMENT

- A. Place aggregate in maximum 6-inch layers and compact to specified density.
- B. Level and contour surfaces to elevations and gradients indicated.
- C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.
- F. Tolerances:
  - 1. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge.
  - 2. Scheduled Compacted Thickness: Within 1/4 inch.
  - 3. Variation From Design Elevation: Within 1/2 inch.
- G. Field Quality Control:
  - 1. Flatness: Compaction testing will be performed in accordance with ASTM D1557.
  - 2. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.



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3.2 FORMS

A. FORMS – FOR FLATWORK

1. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.
2. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.
3. Fabricate forms for easy removal without hammering or prying against concrete surfaces or damage to cast-in-place concrete or adjacent materials. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.
4. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items build into forms. Comply with ACI 347 and ACI 318-19 Section 26.11.
5. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.
6. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

3.3 PLACING REINFORCEMENT:

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
- C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- D. Place reinforcement to obtain at least minimum coverage for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

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- E. Where concrete is installed at door thresholds and/or transitions to building interior spaces, 24" length, #3 smooth rebar dowels shall be installed 12" into the new concrete paving and 12" into the adjacent building structure, spaced at 18" on center with a minimum of two in each location. Epoxy to secure end of dowel set into building and lubricate end cast into new concrete paving.
- F. Where concrete is installed at door thresholds of modular buildings with steel framing, #5 rebar shall be welded securely to building floor plate, extending 12" into new concrete paving, spaced 18" on center with a minimum of two at each door threshold. Lubricate end cast into new concrete paving.
- G. Where concrete is installed adjacent to concrete walkways that are part of the building structural pad, 24" length, #3 smooth rebar dowels shall be installed 12" into the new concrete paving and 12" into the adjacent building structure pad, spaced at 18" on center spacing. Epoxy to secure end of dowel set into building structural pad and lubricate end cast into new concrete paving.

3.4 EXPANSION AND CONTROL JOINTS:

- A. Locate and install joints so as not to impair strength and appearance of the structure, and as acceptable to Architect.
- B. Continue reinforcement across expansion and control joints or install smooth rebar dowels.
- C. Control/score joints (for walkways, steps, ramps and curbs): Unless shown otherwise on plan, install 1/2" radius score joints evenly spaced at a maximum of eight feet in two perpendicular directions, continuous and one third the depth of the slab.
- D. Control/score joints (for walls, steps and vertical surfaces): Unless shown otherwise on plan, install 1/2" radius score joints evenly spaced at a maximum of eight feet in on center. Align vertical wall score joints with horizontal paving joints whenever possible. Install 1/2" radius or chamfered edge at each side of joint as called for in drawings, continuous and 1 1/2" in depth.
- E. Expansion Joints for new walkways and ramps that are not colored and/or do not have a stamp pattern: Asphalt impregnated felt fiber expansion material, one half inch (1/2") thick by full depth of concrete, in compliance with ASTM D1751.
- F. Expansion Joints (for walls, steps and vertical surfaces): Unless shown otherwise on plan, install expansion joints where walls meet existing or proposed structures and evenly spaced at a maximum of 24 feet in two perpendicular directions. Align vertical wall expansion joints with horizontal paving joints whenever possible. Install 1/2" asphalt saturated felt expansion joint material 1/2" below the finish surface where 1/2" radius concrete edges are indicated and flush with base of chamfer where chamfer edges are indicated and continuously throughout the concrete section. Install 1/2" radius or chamfered edge at each side of joint as called for in drawings.

3.5 INSTALLATION OF EMBEDDED ITEMS:

- A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.

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- B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.6 PREPARATION OF FORM SURFACES:

- A. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

3.7 CONCRETE PLACEMENT:

- A. Pre-placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in, in accordance with ACI 318-19. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.
- B. Coordinate the installation of joint materials with placement of forms and reinforcing steel.
- C. General: Comply with ACI 304, and as herein specified.
- D. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- E. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
- F. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
- G. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" in to preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- H. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction (expansion) joints, until the placing of a panel or section is completed.
- I. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
- J. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- K. Maintain reinforcing in proper position during concrete placement operations.

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- L. Cold Weather Placing: Do not place concrete when air temperature is below 40 degrees F., or expected to fall below within 24 hours. Comply with ACI 306.
- M. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305.
- N. Concrete flatwork over-pour: Over-pour is excess concrete spilling beyond the limits of the concrete forms. Contractor shall remove over-pour to allow for installation of tree root barriers, irrigation and similar landscape improvements.

3.8 FINISH OF FORMED SURFACES:

- A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture impaired by form facing material used, with tie holes and defective areas repaired and patched and fine and other projections exceeding 1/4" in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp proofing, painting or other similar system. For "as-cast" concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams, repair and patch defective areas with fins or other projections completely removed and smoothed
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 CONCRETE EXTERIOR FLATWORK FINISHES:

- A. Float Finish: Apply float finish to concrete slab surfaces to receive trowel finish and other finishes as hereinafter specified.
- B. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 1/8" in 10' when tested with a 10' straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- C. Round top edges of all exposed slabs, nosing, etc. with 3/8" radius edging tool, unless chamfered or otherwise noted.
- D. Non-Slip Broom Finish (NSBrm-Fn): Unless specified otherwise, apply non-slip broom finish to exterior concrete walks, platforms, steps and ramps, and elsewhere as indicated. Slopes less than 6% shall have a medium broom finish. Slopes 6% and greater shall be heavy broom slip resistant.
- E. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

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3.10 CONCRETE CURING AND PROTECTION:

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 305R-20, Guide to Hot Weather Concreting.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days and above 50 deg. F.
- C. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
- D. Curing Method: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and/or by combinations thereof, at contractor's option except as noted during hot weather.
- E. Cold Weather Requirements: Protect concrete from freezing conditions during the first seven (7) days after placement.
- F. Hot Weather Requirements: When hot weather conditions will cause an evaporation rate exceeding 0.2 pounds of water per square foot per hour, as determined by Figure 2.1.5 of ACI 305, cure for initial 24 hours minimum by moisture retaining cover methods.

3.11 REMOVAL OF FORMS:

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
- B. Form removal shall comply with ACI 347 and ACI 318-14 Section 26.11.

3.12 RE-USE OF FORMS:

- A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.
- B. 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, except as acceptable to Architect.

3.13 MISCELLANEOUS CONCRETE ITEMS:

- A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

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- C. Equipment and Enclosure Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

3.14 CONCRETE SURFACE REPAIRS

- A. Concrete pavement surface repairs shall be stable, firm and slip resistant per CBC 11B-302.1.
- B. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Owner's Representative.
- C. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush-coat the area to be patched with specified bonding agent. Place patching mortar, colored to match surrounding surfaces after bonding compound has dried. Surfaces exposed-to-view shall be sacked with colored mortar as directed by Owner's Representative.
- D. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Owner's Representative. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning.
- E. Flush out form tie holes, fill with dry pack mortar.
- F. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
- G. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.
- H. Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions. Color of repair shall match surrounding surface color.
- I. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.
- J. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Owner's Representative.
- K. Repair methods not specified above may be used, subject to acceptance of Owner's Representative.

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3.15 WATERPROOFING SITE RETAINING WALLS:

- A. Contractor shall apply waterproof membrane to site retaining walls. Membrane shall continuously cover the surface in contact with soil, vertically from the footing to 2" above the finished grade level of the soil retained.
- B. Prepare surface as recommended by manufacturer by filling cracks, priming, filling joint and voids, penetrations and corners.
- C. Apply waterproof membrane as recommended by manufacturer.

3.16 SACK FINISH WALLS, STEP SEATING AND CURBS

- A. Sack finish shall consist of filling holes or depressions in the surface of the concrete, repairing all rock pockets, removing fins, and removing stains and discolorations visible from traveled ways. Sack finish, unless otherwise specified, shall be considered as a final finish where designated on the plans and details.
- B. Except as provided herein, form bolts and any metal placed for the convenience of the Contractor shall be removed to a depth of at least one inch below the surface of the concrete. All rock pockets and other unsound concrete shall be removed. The resulting holes or depressions shall be cleaned and filled with mortar. Form bolts projecting into the cells of box girders need not be removed unless deck forms are removed from the cells, in which case the bolts shall be removed flush with the surface of the concrete.
- C. Mortar used to fill bolt holes shall conform to the provisions in this Section for "Mortar." Other depressions and pockets shall be filled with packed mortar as directed by the Architect and the mortar shall be cured in conformance with the provisions in this Section
- D. For exposed surfaces, integral concrete color (LM Scofield Chromix) cement shall be added to the mortar in an amount sufficient to result in a patch which, when dry, matches the surrounding concrete.
- E. If rock pockets, in the opinion of the Architect, are of such an extent or character as to affect the strength of the structure materially or to endanger the life of the steel reinforcement, the Architect may declare the concrete defective and require the removal and replacement of the portions of the structure affected.

3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION:

- A. The Owner will employ a testing laboratory to perform other tests and to submit test reports.
- B. Reinforcing steel shall be supplied with heat number and mill analysis per ACI 318-19.
- C. Shrinkage Limitation: All concrete shall meet drying shrinkage limitations as follows:
- D. 0.032 percent at age 21 days, with tolerance of +25% for specimens taken during the course of the work.
- E. The use of aggregates with a proven history of compliance with the above limitations will be accepted as fulfilling this requirement. In the absence of satisfactory evidence, the laboratory shall prepare specimens (4" x 4" prisms 10" gage length, ASTM C-157-64T) and test for compliance prior to approval.

END OF SECTION 32 13 13.1

(Revised 9/19/2024)

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SECTION 32 14 00 - UNIT PAVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. All grading, earthwork, excavations, backfills, compaction, and other grading operations shall be accomplished in accordance with the soils report (which shall be part of the Contract Documents). Contractor shall be responsible for securing a copy of the soils report. The project soils engineer shall be present during all grading operations. The soils engineer shall direct samples to be submitted and tests to be taken. Contractor shall cooperate with the requirements of the soils engineer.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Concrete pavers set in aggregate and sand setting bed – Interlocking Pavers.
- B. Related Sections include the following:
  - 1. Specification Division 31, Earthwork, Soils and Earthwork, Rough Grading, and Excavation and Fill.
  - 2. Specification Section 32 13 13.1 Concrete Work (Landscape).

1.3 SUBMITTALS

- A. Product Data for the following:
  - 1. Concrete pavers.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of unit paver indicated.
  - 1. Include similar Samples of material for joints and accessories involving color selection.
- C. Samples for Verification: Full-size units of each type and color of unit paver indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
  - 1. Include Samples of exposed edge restraints.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.



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1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed permeable paver installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Installer must hold a current certificate from the Interlocking Concrete Paving Institute Concrete Paver Installer Certification program.
- C. Source Limitations: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.
- D. Mockups: Before installing unit pavers, build mockups (approximately 7' by 7') for each form and pattern of unit pavers required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work, including same base construction, special features for expansion joints, and contiguous work as indicated:
  - 1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
  - 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
  - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
  - 4. Obtain Architect's approval of mockups before starting unit paver installation.
  - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - 6. Demolish and remove mockups when directed.
  - 7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver unit pavers to site in palletized and plastic wrapped packaging capable of transfer by a forklift.
- B. Unload pavers in such a manner that no damage occurs to the product.
- C. Protect unit pavers and aggregate during storage and construction against soiling or contamination from earth and other materials.
  - 1. Cover pavers with plastic or use other packaging materials that will prevent rust marks from steel strapping.
- D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- E. Store liquids in tightly closed containers protected from freezing.
- F. Store asphalt cement and other bituminous materials in tightly closed containers.

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1.6 PROJECT CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.
- B. Do not install sand or pavers during heavy rainfall or on a saturated base.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Unit Pavers:
    - a. Calstone Quarry Stone, refer to drawings for dimensions and shapes.

2.2 UNIT PAVERS

- A. Refer to Drawings for unit paver style and color.
- B. Concrete Pavers: Solid, interlocking paving units, ASTM C 936, made from normal-weight aggregates in sizes and shapes indicated, tested in accordance with ASTM C 140.
- C. Concrete Pavers located on Accessible Path of Travel: shall have a smooth, firm, stable and slip resistant surface. Refer to architectural site plan for Accessible Path of Travel (Barrier Free) locations.

2.3 ACCESSORIES

- A. Edge restraint: Where pavers do not abut a rigid, concrete, vertical edge, contractor shall install Permaloc StructurEdge Heavy Duty (3/16" x 1-5/8") aluminum brick and paver restraint. Contact Permaloc at (800) 356-9660 or [www.permaloc.com](http://www.permaloc.com).
- B. Geotextile fabric: shall be Mirafi 500x for interlocking concrete paver stabilization comprised of UV stabilized polypropylene silt film with puncture and tear resistant properties and high tensile strength and uniform openings for filtration.

2.4 AGGREGATE SETTING-BED MATERIALS

- A. Sand for Leveling Course: Sound, sharp, washed, concrete sand complying with gradation requirements of ASTM C 33 for fine aggregate and sieve according to ASTM C 136. Do not use mason sand or sand conforming to ASTM C 144 for the leveling bed.
- B. Sand for Joints: Sakrete Polymeric Joint Sand mixture of sand and special additives specifically for paving stone joints. Engineered to resist wind, rain, freezing conditions and substrate movement without washing away.

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- C. Crushed Aggregate Baserock: Shall be class II aggregate, for regular weight concrete. Aggregate shall be hard, durable, uncoated, graded, cleaned and screened crushed rock or gravel conforming to current requirements of ASTM C33. Crusher-run stone or bank-run gravel will not be permitted. The aggregate size shall be 3/4" minus.
- D. Water: Potable.

2.5 PAVER SEALER

- A. Sealer for pavers and concrete banding adjacent to pavers shall be White Mountain "Wet Look SC™", extremely low VOC, clear protection for concrete and masonry, below maximum limit SCAQMD regulations, or equal. Contact Triangle Coatings, Inc. (925) 583-0800.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas indicated to receive paving for compliance with requirements for installation tolerances, compaction and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Compaction of soil subgrade shall be at least 98% standard Proctor density per ASTM D 698 for pedestrian areas and driveways. Compaction to at least 98% modified Proctor density per ASTM D 1557 in areas subject to heavy vehicular traffic. Stabilization of the subgrade and/or base material may be necessary with weak or saturated subgrade soil.
- C. Where pavers are to be installed over waterproofing, examine waterproofing installation, with waterproofing Installer present, for protection from paving operations. Examine areas where waterproofing system is turned up or flashed against vertical surfaces and horizontal waterproofing. Proceed with installation only after protection is in place.

3.2 PREPARATION

- A. Proof-roll prepared subgrade surface to check for unstable areas and areas requiring additional compaction. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive subbase for unit pavers.
- B. Install aggregate base as detailed in 3" to 4" lifts. Compaction of aggregate base shall be at least 98% standard Proctor density per ASTM D 698 for pedestrian areas and driveways. Compaction to at least 98% modified Proctor density per ASTM D 1557 in areas subject to heavy vehicular traffic.
- C. Only install as much base aggregate and sand settling bed as can be covered with pavers in the same day.
- D. Prior to installation of geotextile fabric and screeding the bedding sand, the recommended base surface tolerance should be  $\pm 3/8"$  over a 10 foot straight edge.
- E. Install geotextile fabric per manufacturer over entire aggregate base surface. Overlap fabric edges 12" to 18" at seams.

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- F. Install edge restraints per manufacturer recommendations and/or as detail within Drawings.

### 3.3 INSTALLATION, GENERAL

- A. Moisten base aggregate such that a handful can be formed into a ball and keep its shape. If a ball is formed and water is squeezed out, it is too wet. When adding water, use a steady stream and not a mist to limit wind drift and evaporation.
- B. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible or cause staining in finished work.
- C. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- D. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
- E. If pavers are cut, cut with a wet saw and rinse the paver immediately after cutting. The mix of water and paver dust results in a substance that will stain any surface it is dripped on.
- F. Joint Pattern: pattern and direction shall be reviewed and approved by architect prior to installation.
- G. Pavers over Waterproofing: Exercise care in placing pavers and setting materials over waterproofing so protection materials are not displaced and waterproofing is not punctured or otherwise damaged. Carefully replace protection materials that become displaced and arrange for repair of damaged waterproofing before covering with paving.
  - 1. Provide joint filler, where indicated, at waterproofing that is turned up on vertical surfaces; or, if not indicated, provide temporary filler or protection until paver installation is complete.
- H. Tolerances: Do not exceed 1/32-inch (0.8-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet (3 mm in 3 m) from level, or indicated slope, for finished surface of paving.
- I. Tolerances: Do not exceed 1/16-inch (1.6-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface of paving.
- J. Provide steps made of pavers as indicated. Install paver steps before installing adjacent pavers.

### 3.4 INSTALLATION OF AGGREGATE BASE, SAND SETTING-BED AND PAVERS

- A. Place sand leveling course and screed to a thickness of 1 to 1-1/2 inches (25 to 38 mm), taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted. Sand must be dry when placed to avoid settlement.
- B. Treat leveling base with soil sterilizer to inhibit growth of grass and weeds.

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- C. Place pavers carefully by hand in straight courses, maintaining accurate alignment and uniform top surface. Protect newly laid pavers with plywood panels on which workers can stand. Advance protective panels as work progresses, but maintain protection in areas subject to continued movement of materials and equipment to avoid creating depressions or disrupting alignment of pavers. If additional leveling of paving is required, and before treating joints, roll paving with power roller after sufficient heat has built up in the surface from several days of hot weather.
- D. Set clean pavers with joints tight, tapping pavers horizontally to ensure tight fit. Verify pattern with Architect prior to installation. Lay out pavers prior to installation to ensure pavers are spread in a manner to avoid cutting pavers to a size less than two (2) inches in any direction.
- E. Sweep pavers clean before compacting into sand leveling course.
- F. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-kN) compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:
  - 1. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.
  - 2. Before ending each day's work, fully compact installed concrete pavers to within 36 inches (900 mm) of the laying face. Cover open layers with nonstaining plastic sheets overlapped 48 inches (1200 mm) on each side of the laying face to protect it from rain.
- G. Fill joints with Sakrete Paver Set Sand per manufacturer recommendations. Pavers must be dry prior to placement. Pour Paver Set Sand over clean pavers. Sweep into joints, filling completely. Remove excess sand from surface prior to wetting. Failure to remove excess sand may result in staining. Spray using a mist.

### 3.5 REPAIR, CLEANING, AND PROTECTION

- A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.
- B. Cleaning: Wash and scrub clean.

### 3.6 PAVER SEALER

- A. Prepare paver surface to be sealed per manufacturer recommendations.
- B. Protect adjacent surfaces, structures and plant materials from over-spray.
- C. Apply per manufacturer recommendations.
- D. Perform "Water Penetration Test" on sealed surface. Apply additional sealer if water does not bead up on the surface. Apply as many coats as necessary for water to bead up on the surface.

END OF SECTION 32 14 00

(Revised 9/19/2024)

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SECTION 32 31 19 - DECORATIVE METAL FENCES AND GATES

**NOT PART OF DSA STRUCTURAL APPROVAL**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Decorative metallic-coated-steel tubular picket fences.
  - 2. Swing gates.
- B. Related Sections:
  - 1. Section 03 30 53 "Miscellaneous Cast-in-Place Concrete" for concrete post concrete fill.
  - 2. Section 08 71 00 "Door Hardware" for gate hardware not specified in this Section.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For fencing and gates.
  - 1. Include plans, elevations, sections, gate locations, post spacing, and attachment details.
  - 2. Wiring Diagrams: Include diagrams for power, signal, and control wiring.
- C. Samples: For each fence material and for each color specified.
  - 1. Provide Samples 12 inches in length for linear materials.

1.03 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For gate operators to include in maintenance manuals.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Wind Loading:
  - 1. Fence Height: As indicated on drawings.
  - 2. Wind Exposure Category: As indicated on drawings.
  - 3. Design Wind Speed: As indicated on drawings.
  - 4. Design Wind Pressure: In accordance with ASCE-7.

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2.02 DECORATIVE METALLIC-COATED-STEEL TUBULAR PICKET FENCES

- A. Decorative Metallic-Coated-Steel Tubular Picket Fences: Comply with ASTM F2408 for light-industrial (commercial) application (class) unless otherwise indicated.
  - 1. Basis-of-Design Product:
    - a. Ameristar; Montage Plus Welded and Rackable (ATF – All Terrain Flexibility) Ornamental Steel, Majestic.
- B. Posts:
  - 1. Square tubes minimum 3 by 3 inches formed from minimum 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from minimum 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
- C. Post Caps: Formed from steel sheet and hot-dip galvanized after forming.
- D. Rails: Double-wall channels.
  - 1. Size: 1-1/2 by 1-1/2 inches minimum.
  - 2. Metal and Thickness: 0.079-inch nominal-thickness minimum, metallic-coated steel sheet or 0.075-inch nominal-thickness minimum, uncoated steel sheet, hot-dip galvanized after fabrication.
- E. Pickets: Square tubes.
  - 1. Picket Spacing: 4.65 inches clear, maximum.
  - 2. Metal and Thickness: 18 gage thickness minimum, metallic-coated steel sheet.
- F. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components.
- G. Metallic-Coated Steel Sheet: Galvanized-steel sheet or aluminum-zinc, alloy-coated steel sheet.
- H. Interior surface of tubes formed from uncoated steel sheet shall be hot-dip zinc coated same as exterior or coated with zinc-rich thermosetting coating to comply with ASTM F2408.
- I. Galvanizing: For components indicated to be galvanized and for which galvanized coating is not specified in ASTM F2408, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.
- J. Finish: Organic coating complying with requirements in ASTM F2408.

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2.03 SWING GATES

- A. Gate Configuration: As indicated.
- B. Gate Frame Height: As indicated.
- C. Gate Opening Width: As indicated.
- D. Galvanized-Steel Frames and Bracing: Fabricate members from square tubes minimum 1-3/4 by 1-3/4 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
- E. Frame Corner Construction: Welded.
- F. Additional Rails: Provide as indicated, complying with requirements for fence rails.
- G. Infill: Comply with requirements for adjacent fence.
- H. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.
- I. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet wide. Provide center gate stops and cane bolts for pairs of gates.
- J. Spring Hinges: BHMA A156.17, Grade 1, suitable for exterior use.
  - 1. Function: **[320 - Gate spring pivot hinge. Adjustable tension] [321 - Gate spring pivot hinge. Fixed tension]**.
  - 2. Material: Malleable iron; galvanized.
- K. Rim Locks: BHMA A156.5, Grade 1, suitable for exterior use.
  - 1. Material: Cast, forged, or extruded brass or bronze.
  - 2. Mounting Plate: Configuration necessary for mounting locks. Fabricate from 1/8-inch- thick, steel plate; galvanized.
- L. Exit Hardware: BHMA A156.3, Grade 1, Type 1 (rim exit device), with push pad actuating bar, suitable for exterior use.
  - 1. Function: **[01 - Exit only, no trim or blank escutcheon] [04 - Entrance by trim when latch bolt is released by key or set in a retracted position by key] [08 - Entrance by lever. Key locks or unlocks lever] [09 - Entrance by lever only when released by key. Key removable only when locked] <Insert function>**.

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2. Mounting Channel: Bent-plate channel formed from 1/8-inch- thick, **[steel]** **[aluminum]** plate. Channel spans gate frame. Exit device is mounted on channel web, recessed between flanges, with flanges extending 1/8 inch beyond push pad surface.
- M. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 1/2-inch-diameter, round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in closed position.
- N. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.
- O. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.
- P. Metallic-Coated-Steel Finish: High-performance coating.
- 2.04 STEEL AND IRON
- A. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.
- B. Tubing: ASTM A500/A500M, cold-formed steel tubing.
- C. Galvanized-Steel Sheet: ASTM A653/A653M, structural quality, Grade 50, with G90 coating.
- D. Aluminum-Zinc, Alloy-Coated Steel Sheet: ASTM A792/A792M, structural quality, Grade 50, with AZ60 coating.
- E. Castings: Either gray or malleable iron unless otherwise indicated.
1. Gray Iron: ASTM A48/A48M, Class 30.
2. Malleable Iron: ASTM A47/A47M.
- 2.05 MISCELLANEOUS MATERIALS
- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M and specifically recommended by manufacturer for exterior applications.

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2.06 METALLIC-COATED-STEEL FINISHES

- A. Galvanized Finish: Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.
- B. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a zinc-phosphate conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A780/A780M.
- C. High-Performance Coating: Apply epoxy primer, polyurethane intermediate coat, and polyurethane topcoat to prepared surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
  - 1. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
- B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
  - 1. Construction layout and field engineering are specified in Section 01 73 00 "Execution."

3.03 DECORATIVE FENCE INSTALLATION

- A. Install fences according to manufacturer's written instructions.

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- B. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.
- C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
  - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
  - 2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
  - 3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.

3.04 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.05 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

END OF SECTION

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SECTION 32 84 00 - PLANTING IRRIGATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Provide complete, automatically controlled, spray sprinkler, turf rotor, bubbler and/or drip underground irrigation system as shown on Drawings.
- B. This Section includes but is not limited to: excavating, backfilling, finish grading, piping, valves, sprinklers, specialties, controls, and wiring for automatic control irrigation system.
- C. Related Sections include the following:
  - 1. Specification Section 31 23 33 Trenching and Backfilling.
  - 2. Specification Section 32 13 13.1 Concrete Work (Landscape).
  - 3. Specification Section 32 90 00 Planting.

1.3 DEFINITIONS

- A. Certified Landscape Irrigation Auditor (CLIA): a person certified to perform landscape irrigation audits by the Irrigation Association Certification Board.
- B. Lateral (Circuit) Piping: Downstream from control valves to sprinklers, rotors, emitters and specialties. Piping is under pressure during flow.
- C. Mainline Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.
- D. The following are industry abbreviations for plastic materials:
  - 1. ASME: American Society of Mechanical Engineers.
  - 2. ASTM: American Society for Testing and Materials.
  - 3. AWG-UF: American Wire Gauge - Underground Feeder
  - 4. NFPA: National Fire Protection Association.
  - 5. PSIG: Pounds per Square Inch Gauge.
  - 6. PVC: Polyvinyl Chloride Plastic.
  - 7. SDR: Standard Direct Ratio.
  - 8. V: Volt

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1.4 PERFORMANCE REQUIREMENTS

- A. Location of Sprinklers, Rotors, Emitters and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent, head to head, water coverage of turf and planting areas indicated with uniform coverage and minimum over-spray onto paving and no spray onto buildings and structures.
- B. Minimum Working Pressures: The following are minimum rated pressure requirements for piping, valves, and specialties, unless otherwise indicated:
  - 1. Irrigation Main Piping: 200 psig.
  - 2. Lateral (Circuit) Piping: 150 psig.
- C. Irrigation Schedule: In accordance with DSA Title 24, Part 11 – Outdoor Water Use Requirements, Contractor shall prepare two (2) – three (3) irrigation schedules, one for plant establishment, one for the established landscape and one for temporarily irrigated areas if applicable. Each schedule shall indicate the number of gallons used and shall target the Estimated Total Water Use (ETWU) and not exceed the Maximum Applied Water Allowance (MAWA) calculated on the Irrigation Plan “California Water Efficient Landscape Worksheet.” Irrigation Schedule shall be submitted at substantial completion. After acceptance of substantial completion, Contractor shall laminate schedule in plastic and place in controller enclosure prior to final completion and end of maintenance. In preparing the Irrigation Schedule, the Contractor shall consider the following:
  - 1. Irrigation interval (days between irrigation).
  - 2. Irrigation run times.
  - 3. Number of cycle starts to avoid runoff.
  - 4. Amount of applied water scheduled to be applied on a monthly basis.
  - 5. Application rate setting.
  - 6. Root depth setting.
  - 7. Plant type setting.
  - 8. Soil type.
  - 9. Slope factor setting.
  - 10. Shade factor setting.
  - 11. Irrigation uniformity or efficiency setting.

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1.5 SUBMITTALS

- A. Product and Project Data: With-in 14 days after award of the contract, furnish the Owner's Representative with submittal data on all items intended for installation. Substitute equipment or material installed without the approval of the Owner's Representative will be removed and replaced with specified items at this Contractor's expense. Submit manufacturer's technical data and installation instructions for irrigation components conforming to requirements of Division 1, Section 01 33 00 Submittal Procedures. Include pressure ratings, rated capacities, and settings of irrigation components. Submittal shall include the following:
1. Backflow device including cage and/or blanket.
  2. Master control valve
  3. Flow Sensor(s)
  4. Hydrometer
  5. Main, lateral (circuit) and sleeving pipe.
  6. Pipe fittings, primer and cement.
  7. Tracer wire and/or warning tape.
  8. Isolation valves.
  9. Remote control valves.
  10. Valve boxes.
  11. Sprinklers, rotors, bubblers, drip emitters.
  12. Swing joints.
  13. Tree bubbler drain tubes.
  14. Controllers. Include wiring diagrams, enclosures and mounting methods.
  15. Control wires. Include splice kits and conduit.
  16. Valve identification tags.
  17. Irrigation Wiring Diagram: Contractor shall prepare and submit an irrigation wire diagram showing location of control wire, common wire, spare control wire and spare common wire with quantities noted at each run shown on copy of irrigation plan in a legible size and format.
  18. Irrigation installation firm qualifications in accordance with "quality assurance".
  19. Name and contact information of certified irrigation auditor performing the irrigation audit for this project.
- B. Coordination Drawings: During the course of construction, maintain orderly set of irrigation drawings and details on project site during installation of irrigation system. Record daily changes showing piping and major system components. Measure and neatly record dimensions for all mainlines, control wire runs, and all other pertinent information facilitating maintenance and extension of the irrigation system to within one (1) foot horizontally and six (6) inches vertically. Indicate interface and spatial relationship between piping, system components, adjacent utilities, and proximate structures. Up to date coordination drawings shall be available for review prior to meetings with the Owner's Representative.

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C. Submittals at Substantial Completion:

1. Irrigation Record Drawings. Contractor shall record information gathered on "Coordination Drawings" onto a clean set of Irrigation Plans for documentation of as-built conditions.
2. Controller Legend: Upon approval of record drawing submittal, prepare two (2) legible, reduced to 11" by 17" in size, non-fading, waterproof copies of the Record Irrigation Drawings, laminated between two (2) .020 mm (minimum) plastic sheets, printed on front side only. Attach one (1) copy to door of controller or enclosure and deliver one (1) copy to Owner. Plan sheet shall include the following information:
  - a. Installing Contractor's company name, phone number and address.
  - b. Color coded zone identification by valve.
  - c. Zone start time.
  - d. Zone water duration.
  - e. Type of planting irrigated.
  - f. Valve size, station numbers and controller designations.
3. Contractor shall retain the services of a third party Certified Landscape Irrigation Auditor to perform a landscape irrigation water audit and prepare an irrigation audit report compliant with MWELO 492.12 including, but not limited to inspection, system tune-up, system test with distribution uniformity, correcting over-spray or run-off and configuring controllers with application rate, soil type, plant factors, slope, sun exposure and other factors necessary for accurate programming. Submit preliminary report at substantial completion, allow for adjustments during maintenance and submit report confirming irrigation installation is compliant with DSA MWELO at final completion.
4. Submit Irrigation Schedule for review and approval in accordance with DSA Title 24, Part 1 at substantial completion. Once approved, laminate in plastic and place inside controller enclosure for final completion at end of maintenance period.
5. Contractor shall provide the owner with one (1) quick coupler key with hose swivel per each five (5) quick couplers.
6. Irrigation System Leak Test Results.
7. Irrigation backflow preventer certification.
8. Central control installation certification.
9. Operation and Maintenance Data: For irrigation systems, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures," include data for the following:
  - a. Automatic-control valves.
  - b. Sprinklers, rotors and/or emitters.
  - c. Controllers.

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1.6 QUALITY ASSURANCE

- A. Governing Agency Requirements:
  - 1. For projects subject to review and approval by local governing agencies, Contractor shall comply with the State of California Model Water Efficient Landscape Ordinance at a minimum and shall conform to local codes and/or ordinances, whichever may be more stringent.
  - 2. For projects under review of DSA, Contractor shall comply with the State of California Model Water Efficient Landscape Ordinance requirements at a minimum.
- B. Installer Qualifications:
  - 1. Experience: The irrigation installation firm shall have contracted for and successfully completed construction of a minimum of five (5) California public school district construction projects, approved by the Division of the State Architect (DSA), within the past five (5) years of similar size, complexity, budget and scope.
  - 2. Licensure: The irrigation installation firm shall hold a current, active C27 "Landscaping Contractor" license classification by the California State License Board that has been consistently active for at least five (5) years and that has not been suspended or revoked.
  - 3. Supervision: The irrigation installation firm shall have a qualified and experienced irrigation technician on site during irrigation installation.
  - 4. Drip Irrigation: The irrigation installation firm shall have contracted for and successfully complete construction of a minimum of five (5) drip irrigation installations within the past five (5) years of similar size and complexity.
- C. Manufacturer Qualifications: Provide underground irrigation system as a complete unit. Each type component produced by a single acceptable manufacturer, including heads, valves, controls and accessories.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Pipe crossings beneath fire Lanes: Comply with NFPA 24-10, Depth of Cover at Fire Access Lanes.
- F. All work and materials shall be in strict accordance with the latest rules and regulations of the State Fire Marshall, Safety Orders of the Division of Industrial Safety, National Electrical Code, California Administrative Code, part 4, Title 24, "Basic Mechanical Regulations" and other applicable state or local laws or ordinances. Nothing in these drawings or specifications is to be construed as permitting work which does not conform to the codes or regulations.
- G. Contractor shall provide all licenses, fees and other charges required for completion of the work.



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1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.8 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
  - 1. Notify Owner's Representative no fewer than two days in advance of proposed interruption of water service.
  - 2. Do not proceed with interruption of water service without Owner's Representative's written permission.
- B. Interruption of Existing Irrigation Service: Do not interrupt existing to remain irrigation service. Prior to demolition work and prior to beginning irrigation work, review project site and meet with Owner Representative to review locations and connections of existing to remain irrigation system. Coordinate with General Contractor to ensure existing irrigation remains in place and operable through the duration of construction. In the event existing irrigation is shut off or damaged during construction, contractor shall provide temporary connections or modifications to continue water service to existing to remain planting material or turf to maintain in a healthy growing condition throughout construction. In the event water service is not available, contractor shall apply water through manual delivery means as necessary. Obtain approval from Owner's Representation two days in advance of any planned disruptions in water service.

1.9 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.10 MAINTENANCE

- A. Irrigation maintenance shall coincide with planting maintenance, refer to Specification 32 90 00 "Planting". In the event planting is not part of this work, maintenance shall begin at written approval from Owner's Representative of substantial completion, run ninety (90) calendar days and until receipt of Owner's Representative's written acceptance of completion of punch list items.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Use new materials of brands shown on Drawings, specified herein or approved equal.
- B. Use existing materials if shown on Drawings.
- C. Substitution of sprinklers, rotors, drip, valves and controllers will not be allowed due to variation in flows, precipitation rates, friction losses, and sizing and maintaining consistency with client equipment standards.

2.2 PIPES, TUBES, AND FITTINGS

- A. Above Grade Irrigation Mainline Piping: Steel Pipe: ASTM A 53/A 53M, Schedule 40, Type S or E, Grade A or B, galvanized with threaded ends.
  - 1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe with threaded ends.
  - 2. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.
  - 3. Gray-Iron Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
  - 4. Cast-Iron Flanges: ASME B16.1, Class 125.
  - 5. Cast-Iron Flanged Fittings: ASME B16.1, Class 125, galvanized.
- B. Mainline Piping: (unless specified otherwise on Drawings):
  - 1. Class 200 (C900), gasketed, purple reclaimed water PVC pipe, ASTM D-2241, NSF approved (size 6" and larger).
  - 2. Class 315 purple reclaimed water PVC pipe, ASTM D-2239, NSF approved (size 2-1/2" to 4").
  - 3. Schedule 40 purple reclaimed water PVC pipe, ASTM D-1785, NSF approved (size 2" and smaller).
  - 4. Fittings to be schedule 80 PVC.
- C. Lateral Line Piping (unless specified otherwise on Drawings):
  - 1. Schedule 40 purple reclaimed water PVC pipe, ASTM D 2466, NSF approved.
  - 2. Fittings to be schedule 40 PVC.
- D. Sleeves (unless specified otherwise on Drawings):
  - 1. For irrigation piping, use schedule 40 purple PVC pipe, NSF approved, size and quantity as required for irrigation piping unless otherwise specified on drawings..
  - 2. For irrigation wiring, use schedule 40 PVC pipe, UL listed, NEMA TC-6, ANSI/UL651, ASTM F512, for outdoor, direct bury applications, PVC, size and quantity as required, unless otherwise specified on Drawings.
  - 3. Fittings to be schedule 40 PVC.

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2.3 VALVES:

A. BACKFLOW PREVENTION DEVICE:

1. As indicated on the Drawings.

B. BOOSTER PUMP:

1. As indicated on the drawings.

C. ISOLATION VALVES:

1. As indicated on the drawings.

D. QUICK-COUPLING VALVES:

1. As indicated on the drawings.

E. REMOTE CONTROL VALVES:

1. As indicated on the drawings.

F. VALVE BOXES:

1. In paved areas, use Christy or Carson concrete utility box, size as required.
2. In planting areas, use Carson plastic underground enclosure with locking lid, bolt and washer, size as required, color to be green for potable water and purple for non-potable water systems.
3. Valve boxes to be rectangular for remote control valves and ball or gate valves and round for quick coupling valves.
4. Valve box lid shall be labeled "IRRIGATION".

G. PULL BOXES AND SPLICE BOXES:

1. In paved areas, use Christy concrete utility box, size as required.
2. In planting areas, use Carson plastic underground enclosure with locking lid, bolt and washer, size as required, color to be green for potable water and purple for non-potable water systems.
3. Valve boxes to be rectangular for remote control valves and ball or gate valves and round for quick coupling valves.
4. Box lid to be labeled "IRRIGATION".

H. WIRE MESH AT VALVE BOXES:

1. 1/2 inch by 1/2", 16 gauge, galvanized wire mesh hardware cloth.

I. VALVE IDENTIFICATION TAGS:

1. Shall be plastic yellow in color for potable water systems and purple in color for recycled water systems with 1 1/8" stamped black letters indicating controller/station number.

J. SAND BACKFILL:

1. Shall consist of natural sand, manufactured sand, existing of native material, or combinations thereof, and shall conform to ASTM C-40 Organic Impurities, ASTM D-2419 Sand Equivalent and a pH value between 4.5 and 9.

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- K. VALVE BOX ROCK:
  - 1. Shall be  $\frac{3}{4}$ " or smaller drain rock or pea gravel unless specified otherwise on Drawings.

- L. VALVE BOX SUPPORT BRICK:
  - 1. Shall be common red brick unless specified otherwise on Drawings.

2.4 AUTOMATIC-CONTROL SYSTEM:

- A. CONTROLLER: As indicated on Drawings.
- B. AUTOMATIC CONTROLLER GROUNDING:
  - 1. Contractor shall install grounding recommended by manufacturer for installation method detailed on this product.
- C. 24 VOLT WIRING:
  - 1. All 24 V line to be #14-1 AWG-UF. Control wire insulation to be red in color and spare wire to be yellow in color. 24 V common wire to be #12-1 AWG-UF, insulation to be white in color and spare common insulation shall be black in color.
- D. SPLICING MATERIALS:
  - 1. Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.
- E. CONNECTORS:
  - 1. Shall be Splice-Kote, Dura Seal heat shrink waterproof nylon wire connectors, or 3M "DBY" connectors.

2.5 TRACER WIRE/DETECTABLE WARNING TAPE:

- A. Install tracer wire or detectable warning tape as indicated on Drawings.
- B. Tracer Wire: #8 solid Bare Copper Wire.
- C. Detectable Warning Tape: Electronically detectable plastic tape with metallic core, Terra Tape D, manufactured by Griffolyn Co., or equal, two (2) inches in width, continuously imprinted "caution buried water line".

2.6 CONCRETE THRUST BLOCKING:

- A. Shall be clean, Portland Cement Concrete, cast in place, five sacks of cement per cubic yard mixture with a 28-day compressive strength of 2,500 PSI.

2.7 SPRINKLERS AND/OR EMITTERS:

- A. As indicated on the drawings. Drip system fittings shall be of same manufacturer and/or as recommended by manufacturer.

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2.8 SPRINKLER SPECIALTIES:

- A. As indicated on the drawings.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Division 31 "Earthwork" for excavating, trenching, and backfilling.
- B. Install piping and wiring in sleeves under sidewalks, roadways, and parking lots, and under or through footings and building walls.
1. Install piping sleeves by boring or jacking under existing paving if possible.
  2. Install quantity and size of sleeves required for the project for irrigation piping, PVC for irrigation pipes and conduit for electrical wires.
  3. Sleeves shall extend twelve (12) inches beyond edges of paving and walls with ends capped.
- C. Provide minimum cover over top of underground piping according to the following:
1. Irrigation Mainline Piping: Minimum depth of 24 inches below finished grade to top of pipe.
  2. Lateral Piping: Minimum depth of 18 inches below finished grade to top of pipe.
  3. Sleeves containing control wires, mainline and/or lateral piping beneath standard paving: Minimum depth of 24 inches from finish surface to top of sleeve.
  4. Sleeves containing control wires, mainline and/or lateral piping beneath vehicular paving including fire lanes/emergency vehicle access (EVA): Minimum depth of 36 inches from finish surface to top of sleeve.
  5. Drip Irrigation: Install drip and/or emitter lines and tubing as detailed on Drawings.
- D. Excavate trenches with vertical sides, uniform bottom, free of deleterious materials, and wide enough for pipes to lay side by side, fully supported on bottom. Minimum 3" clearance between pipes. Twelve (12") inch minimum width for mainlines and six (6") inch minimum width for lateral lines.
- E. Trenches with pressure pipe and control wiring to be backfilled with sand to 6 inches minimum above top of pipe. Continue backfilling in 6 inch layers with soil free of rocks or waste materials. Compact soil to a density equal to the surrounding undisturbed soil, but not less than 90%. Any subsequent depressions filled at the Contractor's expense. Particular attention is directed to firmly tamp and moistening around sprinkler heads and quick-couplers.
1. For Irrigation pipe three (3) inches and larger in size, install additional six (6) inch depth sand beneath piping.
- F. Trenches and backfill installed under paving, asphalt concrete or concrete shall be backfilled with sand and compacted in layers equal in density to the adjacent undisturbed soil or to 90% compaction, using manual or mechanical tamping devices. All trenches shall be left flush with the adjoining grade.

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1. The Contractor shall set in place, cap and pressure test pressurized mainline under paving prior to the paving installation.
2. For irrigation pipes three (3) inches and larger in size, install additional six (6) inch depth sand beneath piping.

### 3.2 PREPARATION

- A. Set stakes to identify locations of proposed irrigation system. Obtain Owner's Representative's approval before excavation.

### 3.3 PIPING APPLICATIONS

- A. Install components having pressure rating equal to or greater than system operating pressure.
- B. Piping in control valve boxes and above ground may be joined with flanges instead of joints indicated.
- C. Above Ground Irrigation Mainline Piping: Use any of the following piping materials for each size range:
  1. NPS 4 and Smaller: Steel pipe; malleable-, gray-, or cast-iron fittings; and threaded joints.
  2. NPS 5 and Larger: Steel pipe; malleable-, gray-, or cast-iron fittings; and threaded joints.
- D. Underground irrigation main piping shall be purple recycled water pipe, polyvinyl chloride (Type I) plastic pipe PVC 1120 and NSF approved, Schedule 40 PVC solvent-weld.
- E. Underground Irrigation Lateral (Circuit) piping shall be purple recycled water pipe, polyvinyl chloride (Type I) plastic pipe PVC 1120 and NSF approved, schedule 40 PVC solvent-weld.
- F. Mainline pipe sizes 6" and larger shall use gasketed pipe with bell fittings. Where solvent weld joints are required, contractor shall additionally install concrete thrust blocking.
- G. Underground Branches and Offsets at Sprinklers and Devices: Schedule 80, PVC pipe; threaded PVC fittings; and threaded joints.
- H. Mainline Fittings and Couplings: Schedule 80, PVC pipe, solvent weld up to 4" and gasketed with bell fittings 6" and larger pipe.
- I. Risers to Aboveground Sprinklers and Specialties: ASTM A-120 Schedule 40 galvanized steel pipe with 150 lb. banded galvanized malleable iron fittings.
- J. Double Swing Joint Assembly:
  1. Install double swing joint at all sprinkler heads and quick couplers.
  2. Elbows shall be PVC Class 1220, Schedule 40.
  3. Install as follows:
    - a. Screw 2 inch long nipple horizontally into plastic tee or ell at lateral line.
    - b. Screw on elbow and a 6 inch long nipple.
    - c. Screw on another elbow and a 2 inch long nipple and install riser vertically to head, or quick coupler valve.
    - d. Swing joint must offset to the right.

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- K. Sleeves: Schedule 40 PVC pipe and socket fittings; and solvent-cemented joints.
- L. Transition Fittings: Use transition fittings for plastic-to-metal pipe connections according to the following:
  - 1. Couplings:
    - a. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
    - b. Underground Piping NPS 2 and Larger: AWWA transition coupling.
  - 2. Fittings:
    - a. Aboveground Piping: Plastic-to-metal transition fittings.
    - b. Underground Piping: Union with plastic end of same material as plastic piping.
- M. Dielectric Fittings: Use dielectric fittings for dissimilar-metal pipe connections according to the following.
  - 1. Underground Piping:
    - a. NPS 2 and Smaller: Dielectric couplings or dielectric nipples.
    - b. NPS 2-1/2 and Larger: Prohibited except in valve box.
  - 2. Above ground Piping:
    - a. NPS 2 and Smaller: Dielectric unions.
    - b. NPS 2-1/2 to NPS 4: Dielectric flanges.
  - 3. Piping in Valve Boxes or Vaults:
    - a. NPS 2 and Smaller: Dielectric unions.
    - b. NPS 2-1/2 to NPS 4: Dielectric flanges.
  - 4. Dielectric fittings are specified in Division 22 Plumbing.

### 3.4 VALVE APPLICATIONS

- A. Backflow Prevention Devices:
  - 1. New and relocated backflow devices must be tested at time of installation. Contractor shall have test performed by a Certified Backflow Tester who has a current State of California Contractor's license C-36 or General Contracting License.
  - 2. For new backflow preventer installation, a Certified Tester shall test and provide results and certification to the Owner's Representative within five (5) days of the date of testing and to provide any testing data or certification required by the local water provider. A Department of Public Health sticker shall be placed on backflow device before the system is accepted by the Owner's Representative.
  - 3. Install per local codes and water purveyor requirements.
  - 4. A Department of Public Health sticker shall be placed on backflow device before the system is accepted by the Owner's Representative.
- B. Underground Gate/Ball Valves: Install in control-valve box as detailed on drawings.
- C. Underground, Manual Control Valves: Install in manual control-valve box as detailed on drawings.
- D. Remote Control Valves: Install in control-valve box as detailed on drawings.
- E. Drain Valves: Install in control-valve box as detailed on drawings.

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- F. Install each valve in a separate valve box (unless noted otherwise in Drawings and details) and in appropriate locations as shown on Drawings. Allow 12 inches between valve boxes and between valve boxes and walls or walks or landscape edges. Boxes shall be arranged perpendicular and parallel to each other and aligned in a row.

### 3.5 PIPING INSTALLATION

- A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings. Piping shown on drawings is diagrammatic. General arrangement of piping shall be followed as near as practical. Where piping is shown running continuously in paving and adjacent to planting area, intent is to install piping within planting areas where practical.
- B. Install pipe sleeves at all points where pipes pass through concrete, asphalt or masonry. In footings, allow 1 inch clearance around pipe, and in other locations allow ½ inch. Each end of sleeve shall extend 6 inches beyond edge of paving or structure above. Provide removable non-decaying plug at each end of sleeve to prevent intrusion of earth and debris.
- C. If drain valves are used, install piping at minimum uniform slope of 0.5 percent down toward drain valves.
- D. Install piping free of sags and vertical bends.
- E. Install groups of pipes parallel to each other, spaced to permit valve servicing.
- F. Install fittings for changes in direction and branch connections. Pipe bending shall not exceed manufacturer recommended radii.
- G. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 or larger pipe connection.
- H. Install dielectric fittings to connect piping of dissimilar metals.
- I. Install underground thermoplastic piping according to ASTM D 2774 and ASTM F 690.
- J. Lay piping on solid sub-base, fully and evenly supported by bedding, uniformly sloped without humps or depressions.
- K. Install PVC piping in dry weather when temperature is above 40 degrees F (5 degrees C). Allow joints to cure at least 24 hours at temperatures above 40 degrees F (5 degrees C) before testing unless otherwise recommended by manufacturer.
- L. Snake pipe a minimum of one (1) additional foot per one hundred (100) feet of pipe to allow for expansion and contraction.
- M. Cap or plug openings as soon as lines have been installed to prevent intrusion of debris.
- N. Install concrete thrust blocking, at a minimum, on pressurized mainline three (3) inches and larger in size at changes in direction, connections or branches from mainline and dead ends and as necessary to prevent pipe movement thrusts created by internal water pressure. Concrete shall be placed directly on the fitting perpendicular to the line of thrust and also against the undisturbed earth. The amount of concrete shall be in accordance to the pressure, angle and soil type. Refer to pipe manufacturer for calculating exact size of thrust blocking material, 2019 CPC and IAPMO installation standards.



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- O. After installation of pipe lines and sprinkler risers, and prior to installation of sprinkler heads, automatic valves and quick couplers, thoroughly flush all lines with a full head of water to remove any foreign material, scale, sediment, etc.

3.6 TRACER WIRE

- A. Install as detailed along all new irrigation mainline piping on bottom of trench, carefully run to avoid stress from backfilling and shall be continuous throughout the mainline pipe runs. Fasten tracer wire to mainline at eight (8) foot intervals with tape. Take precautions to ensure tape is not damaged or misplaced during backfill operations.
- B. Tracer wire shall follow mainline pipe and branch lines, originating in irrigation valve box at gate, ball or remote control valve located closest to irrigation point of connection and run to ball, gate and/or remote control valves at the end of mainline runs or shall loop entire system where mainlines are looped.
- C. Record locations of tracer wire origin and terminations on project record drawings.

3.7 DETECTABLE WARNING TAPE

- A. Install tape with printed side up, directly over mainline pipe and on top of sand backfill, 18 inches below grade. Take precautions to ensure tape is not damaged or misplaced during backfill operations.

3.8 JOINT CONSTRUCTION

- A. Refer to Specification Section 22 10 05 Plumbing Piping for basic pipe joint construction.
- B. Install threaded pipe joints as follows:
  - 1. Use pipe joint sealant for all plastic to plastic and plastic to steel joints, do not apply to sprinkler inlet ports.
  - 2. For PVC, hand tighten only. Do not over tighten threaded joints. Thread until fitting stops, then add a half turn.
  - 3. Use pipe joint compound and/or Teflon tape for all steel to steel joints.
- C. Install gasketed joint per manufacturer recommendations (printed on pipe material) and using the lubricant supplied with the pipe.

3.9 VALVE INSTALLATION

- A. Underground Gate/Ball Valves: Install in valve box as detailed on drawings.
- B. Underground, Manual Control Valves: Install in manual control valve box as detailed on drawings.
- C. Remote Control Valves: Install in control valve box as detailed on drawings.
- D. Drain Valves: Install in control valve box as detailed on drawings.
- E. Install each valve in a separate valve box (unless noted otherwise in Drawings and details) and in appropriate locations as shown on Drawings. Allow 12 inches between valve boxes and between valve boxes and walls or walks or landscape edges. Boxes shall be arranged perpendicular and parallel to each other and aligned in a row.

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3.10 SPRINKLER INSTALLATION

- A. Locate part-circle sprinklers to maintain a minimum distance of six (6) inches from adjacent paving and edges and twelve (12) inches clearance from walls, fences and other structures, unless otherwise indicated on Drawings.
- B. Spray sprinklers shall not be installed less than 24" from non-permeable surfaces unless the adjacent non-permeable surface is constructed to drain entirely to the landscape area.
- C. Swing Joint Assembly:
  - 1. Install triple swing joint at all sprinkler heads and quick couplers.
  - 2. Elbows shall be PVC Class 1220, Schedule 40.
  - 3. Install as follows:
    - a. Screw 2 inch long nipple horizontally into plastic tee or ell at lateral line.
    - b. Screw on elbow and a 6 inch long nipple.
    - c. Screw on another elbow and a 2 inch long nipple.
    - d. Screw on another elbow and install riser vertically to head, or quick coupler valve.
    - e. Swing joint must offset to the right.
- D. Sprinkler Installation:
  - 1. Install sprinklers heads as shown on drawings and details.
  - 2. Install plumb to finish grade.
  - 3. Tool tighten all sprinkler body covers and nozzles.

3.11 DRIP/EMITTER INSTALLATION

- A. Minimum cover sub-surface drip tubing: drip and/or emitter lines shall be installed as detailed with drip tubing installed four (4) inches grade and below the mulch top dressing layer.
- B. Minimum cover of tubing to individual shrubs: shrub bubbler tubing shall be installed to a depth of (4) inches and rising to the surface at target shrub rootball. No more than one (1) inch of tubing shall be exposed at shrub rootball.
- C. Backfill after lines have been reviewed, tested for leaks and approved by Owner's Representative.
- D. Assembling drip system shall keep pipe and tubing free from dirt and debris, pipe ends shall be cut square, deburred and cleaned.
- E. Flush piping prior to installing remote control valve assembly (control zone kit assembly).
- F. Follow manufacturer recommendations.

3.12 AUTOMATIC-CONTROL SYSTEM INSTALLATION:

- A. Exact location of controllers shall be reviewed and approved by Owner's Representative.
- B. Provide connection to nearest available 110 volt electrical service.
- C. Contractor shall install grounding system per manufacturer recommendations.

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- D. Prior to installation of hardscape, coordinate and install electrical supply and control wire conduit, size and quantity as required for each controller and spare wiring. Install pull boxes and conduit from clock location.
- E. Control wiring shall be neatly coiled beneath controller terminal strip and labeled with corresponding station number. Controller terminal strip cover plate shall fasten securely in place.
- F. Contractor is responsible to provide fully automatic system operated by specified controller(s). Contractor shall install quantity of red wiring equal to the number of stations on the specified irrigation controller(s), plus five (5) yellow spare control wires for each controller, a common white wire and a spare common black wire. Example, 24 station clock shall have 24 control wires, 5 spare control wires and 2 common wires installed with mainline and running through all associated valve boxes. Wires shall be installed per plans and details from remote control valve(s) to controller(s).
- G. Example of mainline that is not looped and terminates in 3 locations with a 24 station clock and 18 stations used:
  - 1. Wire quantities shall be:
    - a. 18 red control wires for stations 1-18
    - b. 6 red control wires for un-used stations 19-24
    - c. 1 white common wire
    - d. 1 black spare common wire
    - e. 5 yellow spare wires
  - 2. Wire runs:
    - a. 18 red control wires (stations 1-18) shall run from controller to corresponding valve.
    - b. 6 red control wires (un-used stations 19-24) shall run from controller with 2 running down each of the 3 mainline terminations and looping through each valve box.
    - c. 1 white common wire shall run from controller and connect to each valve associated with that controller.
    - d. 1 black spare common wire shall run from controller and connect to each valve associated with that controller.
    - e. 5 yellow spare control wires shall run from controller and loop through each valve box associated with that controller.
  - 3. Contractor shall label all wires with water-proof marking with corresponding station number or as spare control wire, spare common wire or spare stations 19-24.
- H. Wiring path is not shown on drawings and shall run from specified controller(s) to irrigation pull box if shown, then to the nearest irrigation mainline location, follow mainline (existing and/or new) to each remote control valve. Indicate wire location on record drawings where it does not follow mainline. Common and spare wires shall loop through entire system. Wiring may be shown on drawings only where required for future irrigation extensions.
- I. Wiring may be shown on drawings only where required for future irrigation extensions.
- J. Irrigation Central Control system is standard for this project.

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- K. Irrigation Central Control System must be compatible with owners central control software and hardware. Contractor shall ensure controller communicates properly with project central computer and receives daily downloads for weather updates.

3.13 CONNECTIONS/ELECTRICAL WIRING

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Ground equipment according to Division 16 Section.
- C. Connect wiring according to Division 16 Section.
- D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- E. 24 volt splices to be made with 3M Co. #3577 splice kit, as to manufacturer's instructions. Splices to be made only at valve box or pull box.

3.14 REMOTE CONTROL VALVE WIRING

- A. Wires shall be installed in electrical conduit between controller and pull box. Pull box to be located in ground nearest controller. Top of box to be flush with finish grade.
- B. Provide separate irrigation wire sleeves under concrete or asphalt for irrigation wires, size and quantity as required, 24" minimum cover in planting areas and 36 "minimum cover under fire lanes and pavements. All wires from the pull box shall be direct burial. The wiring shall be bundled and secured to the lower side of the irrigation pipe at 10 foot intervals with plastic electrical tape.
- C. Wires from the pull box shall be direct burial. The wiring shall be bundled and secured to the lower side of the irrigation pipe at ten (10) foot intervals with plastic electrical tape. Provide a minimum of 24 inches excess of coil of control wires in each 100 feet of run to controller. Sufficient slack shall be left in the wire to provide for expansion and contraction.
- D. Provide 24 inches excess of coil of control wires in each 100 feet of run to controller.
- E. Provide 24 inches excess of coil of control wires in each valve box and pull box.
- F. Control wires to be buried a minimum of 24 inches below finish grade.
- G. Wiring shall be tested for continuity, open circuits and unintentional grounds prior to connecting to equipment.
- H. Install irrigation wire splice boxes where wire splices are necessary.

3.15 LABELING AND IDENTIFYING

- A. Valve Identification Tags: Install valve identification tag on each remote control valve with corresponding controller station number.

3.16 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections. Report results in writing.

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- B. For landscape projects 2,500 square feet and larger, after substantial completion, Contractor shall schedule an Irrigation Audit to be performed by a third-party certified landscape irrigation auditor. Contractor shall make necessary adjustments, if any, during maintenance period and provide written certification of installation from certified landscape irrigation auditor as part of final completion and end of maintenance.
- C. Perform the following field tests and inspections in the presence of the Inspector and/or Owner's Representative with 72 hours advance notice. Contractor shall record date, time, names of those present and results and submit to Owner's Representative prior to requesting substantial completion review:
  - 1. Leak test of pressurized mainline: After installation of mainline and prior to installing remote control valves, quick coupling valves or other valve assemblies and prior to backfilling trenches, test the mainline for leaks as follows:
    - a. Testing shall occur with trenches open. Center load piping with small amounts of backfill between fittings to prevent pipe displacement, arching or slipping. Fittings to be visible for testing.
    - b. Exercise care in filling the system with water to prevent excessive surge pressure and water hammer
    - c. Test pressurized mainline piping under hydrostatic pressure of 150 psi for eight continuous hours with no drop in pressure. Coordinate with Owner's Representative for initial observation of beginning test and observation after test.
    - d. Test pressurized mainline piping under hydrostatic pressure of 125 psi for six (6) continuous hours, minimum, with no more than five (5) psi drop in pressure. Coordinate with Owner's Representative for initial observation of beginning test and observation after test.
    - e. Correct deficiencies revealed by test and repeat pressure test to the satisfaction of the Owner's Representative.
  - 2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
  - 3. Coverage Test: When the irrigation system has been completed, the Contractor, in the presence of the Architect and Owner's Representative, shall perform a Coverage Test to determine if the coverage of water is complete and adequate, the sprinkler heads and/or emitters function according to manufacturers' data and according to the intent of the construction documents. Replace irrigation components not performing satisfactorily and/or respace sprinklers and/or nozzles and/or emitters as necessary to provide complete irrigation coverage of plant material.
    - a. For new turf areas, Contractor shall demonstrate irrigation coverage over amended planting area and prior to installation of sod and/or seeded turf.

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4. Substantial Completion Review: At substantial completion of this Section, work shall be reviewed for conformance with the Drawings and Contractor shall make recommended repairs and/or corrections in a timely manner and prior to final completion.
  - a. At substantial completion, Contractor shall submit documentation per 1.5 "Submittals at substantial completion" to Architect for review and acceptance.
  - b. At substantial completion, Contractor shall deliver spare parts to Owner's Representative per 1.5 "Submittals at substantial completion".
  - c. At substantial completion, contractor shall submit Certified Landscape Irrigation Auditor preliminary report on irrigation system.
5. Final Completion Review: After substantial completion repairs and/or corrections have been completed and at the end of the maintenance period, work shall be reviewed for final completion and approved by Owner's Representative in writing.
  - a. At final completion, Contractor shall submit Certified Landscape Irrigation Auditor final report confirming irrigation installation is compliant with DSA MWEL requirements.

3.17 CLOSING IN UN-INSPECTED WORK

- A. The Contractor will pay all costs necessitated by required opening, restoration and correction of all work closed in or concealed before inspection, testing as required, and approval by authorized inspections.

3.18 STARTUP SERVICE

- A. Verify that controllers are installed and connected according to the Contract Documents.
- B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 16 Sections.
- C. Complete startup checks according to manufacturer's written instructions.

3.19 MAINTENANCE SCHEDULE

- A. Fine tune and adjust irrigation system weekly coinciding with the landscape and/or turf planting maintenance period.
- B. Adjust settings of controllers within WELO water budget and with seasonal changes.
- C. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.
- D. Adjust sprinklers so they will be flush with, or not more than 1/2 inch above, finish grade.
- E. Fill irrigation trenches due to settling.

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3.20 CLEANING

- A. Completely flush dirt and debris from piping before installing sprinklers and other devices.
- B. After completion, cleanup and remove all resultant debris from site.

3.21 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controller and automatic control valves. Refer to Division 1 Section "Demonstration and Training."

3.22 GUARANTEE (PROJECT CLOSE-OUT ITEM)

- A. Furnish a written Guarantee to the Owner, dated from the date of Final Acceptance, against defective workmanship, materials or components and guaranteeing repair or replacement for a period of 1 year; further guarantee restoration of all damage caused by leaks in the Irrigation System for a like period.
- B. Guarantee that the entire installation was made in accordance with the drawings, specifications and manufacturer's recommendations, using designated materials and installation procedures.
- C. Submit duplicate copies of the Guarantee for approval by the Owner's Representative. Approval is mandatory before final payment and acceptance.
- D. The guarantee for the irrigation system shall be made in accordance with the form attached at the end of this Section. The guarantee form shall be retyped onto the Contractors letterhead and contain the information shown.

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**GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM**

We hereby guarantee that the sprinkler system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse or neglect excepted.

We agree to repair or replace any defects in materials and workmanship which may develop during the period for one (1) year from the date of acceptance and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within a reasonable time, as determined by the Owner, after receipt of written notice.

The Owner reserves the right to make temporary repairs as necessary to keep the irrigation system and equipment in operating conditions. This shall not relieve the Contractor of his responsibilities under this Guarantee.

In the event of failure to make such repairs or replacements within a reasonable time after receipt of written notice from the Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

Project:\_\_\_\_\_

Location:\_\_\_\_\_  
\_\_\_\_\_

Name of Contractor:\_\_\_\_\_

Signed: (Authorized Signature)\_\_\_\_\_

Print Name of Authorized Signature\_\_\_\_\_

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

Phone:\_\_\_\_\_ Date of Acceptance:\_\_\_\_\_

END OF SECTION 32 18 16.13

(Revised 9/19/2024)



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SECTION 32 90 00 - PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Trees.
  - 2. Shrubs.
  - 3. Ground cover.
  - 4. Vines.
  - 5. Edgings.
  - 6. Planters.
- B. Related Sections include the following:
  - 1. Specification Section 01 56 39 "Tree and Plant Protection".
  - 2. Specification Section 31 20 00 "Earth Moving" for excavation, filling and rough grading and for subsurface aggregate drainage and drainage backfill materials.
  - 3. Specification Section 32 84 00 "Planting Irrigation".

1.3 DEFINITIONS

- A. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Import Topsoil: Shall be obtained from a local source and coming from a site with similar soil characteristics as the project site. Topsoil shall be fertile, friable, natural loam surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter and free of roots, stumps, stones and rocks and other extraneous or toxic matter harmful to plant growth.
- D. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- E. On-site Topsoil: Naturally occurring, on-site, surface soil, usually occurring in the top four (4) to twelve (12) inches of original, undisturbed surface soil containing organic material, micro-organisms, necessary nutrients and minerals to sustain plant growth and be approved to sustain plant life by an approved soil and plant lab.
- F. Planting Soil: On-site topsoil, import topsoil or manufactured topsoil.
- G. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

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- H. Plant material: Exterior plants contained within the planting plan legend in categories of Trees, Shrubs, Vines, Perennials, Annuals and/or Ground Covers.
- I. Substantial completion for landscape and irrigation: Work shall be considered substantially complete when irrigation, planting, turf planting and seeding are installed correctly per plans and specifications with only minor adjustments required and approval has been submitted in writing by Owner's Representative.
- J. Final completion for landscape and irrigation: Work shall be considered complete when irrigation, planting, turf planting and seeding are installed correctly per plans and specifications and the maintenance period has been completed per plans and specifications and approval has been submitted in writing by Owner's Representative.

#### 1.4 SUBMITTALS

- A. Product, Material Data and/or Samples: For each type of product specified. Submit manufacturer's technical data and installation instructions for landscape products conforming to requirements of Section 01 33 00 Submittal Procedures to include, but not be limited to:
  - 1. Samples for the following:
    - a. Organic mulch top dressing (1/2 c.f. each)
    - b. Edging materials and accessories, of manufacturer's standard size, to verify color selected.
  - 2. Manufacturer's certified analysis for standard products.
  - 3. Material Test Reports: For on-site topsoil, import topsoil and/or manufactured soil proposed for use on this project.
  - 4. Planting soil amendments as recommended by the soil testing laboratory (Lucchesi Plant & Soil Consulting, Waypoint Analytical California, Inc, or approved equal).
  - 5. Qualification Data: For landscape Installer in compliance with "Quality Assurance".
  - 6. Plant Materials List: Submit confirmation from supplier 30 days prior to planting that all plant material has been ordered.
  - 7. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer shall be delivered to Owner's Representative upon delivery.
  - 8. Qualification Data: For landscape Installer prior to performing work.
  - 9. Planting Schedule: Indicating anticipated planting dates for each type of planting.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Experience: The landscape installation firm shall have contracted for and successfully completed construction of a minimum of five (5) California public school district construction projects, approved by the Division of the State Architect (DSA), within the past five (5) years of similar size, complexity, budget and scope.
  - 2. Licensure: The landscape installation firm shall hold a current, active C27 "Landscaping Contractor" license classification by the California State License Board that has been consistently active for at least five (5) years and that has not been suspended or revoked.

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3. Supervision: The landscape installation firm shall have a qualified and experienced landscape technician on site during landscape installation.
- B. Soil-Testing Laboratory Qualifications: Testing lab shall be one of the following:
1. Lucchesi Plant & Soil Consulting, located in Los Gatos, CA (408) 337-2575
  2. Waypoint Analytical California, Inc. located in Anaheim, CA (714) 282-8777
  3. Or approved equal independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Soil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity (CEC) or total exchangeable cations (TEC); sodium absorption ratio; deleterious material; pH; soluble salts, boron, mineral and plant-nutrient content of planting soil.
1. Report suitability of planting soil for plant growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory planting soil.
- D. Protect existing to remain and newly installed lawn and/or landscape areas from damage or trespass by maintaining construction fencing during construction and maintenance.
- E. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."
- F. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4-inch caliper size, and 12 inches above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.
- G. Observation: Owner's Representative may observe trees and shrubs either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality. Owner's Representative retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
1. Notify Owner's Representative of sources of planting materials 30 days in advance of delivery to site.
- H. Pre-installation Conference: Conduct conference at Project site with General Contractor and/or Owner's Representative to comply with requirements in Division 1 Section "Project Management and Coordination."
- I. Protect all planting areas from trespass or damage by installing temporary barriers or protective fencing during construction. Barrier and/or fencing material and installation method shall be approved by Owner's Representative prior to installation.

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1.6 DELIVERY, STORAGE, AND HANDLING

- A. Notify Owner's Representative fourteen (14) days prior to anticipated plant material delivery to schedule review of plant material prior to installation.
- B. Do not prune trees and shrubs before delivery, except as approved by Owner's Representative. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.
- C. Handle planting stock by root ball.
- D. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist.
  - 1. Do not remove container-grown stock from containers before time of planting.
  - 2. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.7 PROJECT/SITE CONDITIONS

- A. Prior to placing topsoil, Contractor shall collect and submit soil samples representative of on-site topsoil and/or import topsoil proposed for use in all planting and lawn areas to a Soil-Testing Laboratory for analysis and soil amending recommendations. Submit test results analysis and recommendations to Owner's Representative for review and approval prior to beginning work.
- B. Weather Limitations: Proceed with planting only when weather conditions permit.
- C. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns, unless otherwise acceptable to Owner's Representative.
  - 1. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.
- D. Contractor shall protect new plantings and/or delay planting in event of forecasted freezing temperatures.
- E. Irrigation system shall be installed and operable before beginning planting operation.

1.8 WARRANTY

- A. Special Warranty: Warrant the following exterior plants, for the warranty period indicated, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner or users, or incidents that are beyond Contractor's control.
  - 1. Warranty Period for Trees, Shrubs, Vines, Lawns and Ground Covers: One year from date of Final Completion.
  - 2. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
  - 3. Replace exterior plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
  - 4. A limit of one replacement of each exterior plant will be required, except for losses or replacements due to failure to comply with requirements.

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1.9 MAINTENANCE

- A. Plant Material and Planting Areas: Maintain for the following maintenance period by pruning, cultivating, watering, weeding, fertilizing, restoring planting basins, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Refer to "Maintenance Schedule."
  - 1. Maintenance Period: Ninety (90) days from date of Owners Representative's written approval of Substantial Completion of the planting and irrigation.
  - 2. In the event that plant material fails during the maintenance period due to Contractor negligence, the maintenance period shall extend until 90% of the plant material is established as determined by the Owner's Representative.

PART 2 - PRODUCTS

2.1 TREE, SHRUB AND VINE MATERIAL

- A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
- B. Grade: Provide trees and shrubs of sizes and grades complying with ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Owner's Representative, with a proportionate increase in size of roots or balls.
- C. Label at least one tree and one shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.
- D. If formal arrangements or consecutive order of trees or shrubs is shown, select stock for uniform height and spread, and number label to assure symmetry in planting.
- E. Provide plant material as specified on the Drawings including size, genus, species and variety.

2.2 SINGLE-TRUNK AND MULTI-TRUNK TREES

- A. Trees: Single-trunk or multi-trunk trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.
  - 1. Branching Height: typical of tree species and container size, single trunk unless specified as multi-trunk on Planting Plan Legend. Select branching height in accordance with planting location. Low branching trees shall not be planted in conflict with pathways, driveways and/or structures.
  - 2. Single-stem trees shall have straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.
  - 3. Multi-stem trees shall branch naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1.

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2.3 GROUND COVER PLANTS

- A. Ground Cover: Provide ground cover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.

2.4 PLANTS

- A. Annuals: Provide healthy, disease-free plants of species and variety shown or listed. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud and bloom.
- B. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed, remove dead flowers.

2.5 TOPSOIL

- A. Prior to placing bid, Contractor to coordinate with General Contractor, Demolition and/or Grading Contractors and verify quantity and source of planting soil for all planting areas. Identify Contractor responsible for stockpiling on-site topsoil and/or acquiring import planting soil and installing a minimum of twelve (12) inches of planting soil in all landscape planting areas and any raised planters and rough grading in accordance with these specifications, details, notes, grading and drainage plans.
- B. Coordinate with General Contractor, Demolition and/or Grading Contractors for removal and replacement of lime treated soils and replacement with planting soil prior to planting to depth required to remove lime treatment. In event trees are planted in lime treated soils, trees shall have a minimum six (6) inch layer of planting soil below their rootball to provide a suitable substrate to root into for establishment.
- C. On-site topsoil: Re-use existing topsoil or existing surface soil, top twelve (12) inches excavated and stockpiled on-site. Verify suitability of existing and/or stockpiled surface soil to produce planting soil by submitting a sample to a soil testing laboratory. Acceptable on-site topsoil shall be ASTM D 5268, pH range of 5.7 to 7.5 (5.8 to 7.8 for predominantly California native plant species), representative of productive soils in the vicinity, a range of 4 to 20 percent organic material content; free of stones one (1) inch or larger in any dimension, roots, plants, sod, clay lumps and other extraneous materials harmful to plant growth. Sodium absorption rate (SAR) shall not exceed 5.0, conductivity of the saturation extract solution shall not exceed 3.0, and boron concentration in the saturation shall not exceed 1.0 ppm. Fine gravel (2-5 mm) and coarse gravel (5-12 mm) content shall not exceed 30%.

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- D. Import Topsoil: Supplement with imported or manufactured topsoil from off-site, local sources, when quantities of on-site topsoil are insufficient. Do not obtain topsoil from bogs or marshes. If soil is obtained from agricultural land, Contractor shall submit proof soil is nematode free. Import topsoil shall meet the following requirements:

1. USDA Classification of fraction passing 2.0 mm sieve: sandy loam, sandy clay loam or loam.

Class	Particle Size Range	Maximum %	Minimum %
Coarse Sand	0.5 – 2mm	15	0
Silt	.002 - .05 mm	30	10
Clay	< .002 mm	25	10
Other Classes	Particle Size Range	Maximum %	Minimum %
Gravel	2 – 13 mm	15	0
Rock	½ - 1 inch	5% by volume with none > 1 inch	
Organic		15	4

2. Chemistry – Suitability Considerations

Salinity: Saturation Extract Conductivity (ECe)	Less than 3.0 dS/m @ 25 degrees C.
Sodium: Sodium Adsorption Ratio (SAR)	Less than 6.00 ppm
Boron: Saturation Extract Concentration	Less than 1.00 ppm
Reaction: pH of Saturated Paste:	5.5 – 7.5 <u>without</u> high lime content.

3. Soil to contain sufficient quantities of available nitrogen, phosphorus, potassium, calcium and magnesium to support normal plant growth. In the event of nutrient inadequacies, provisions shall be made to add required materials prior to planting.
4. Soil testing: Contractor shall submit to the Owner's representative for approval, certification from an agricultural soils testing laboratory that the import topsoil provided conforms to the specifications prior to delivery of import or placement on on-site topsoil. Soil testing shall have been performed on import topsoil source within the previous year.

## 2.6 FERTILIZER AND SOIL AMENDMENTS

- A. Contractor shall collect and submit sample of proposed planting soil, representative of the top eight (8) inches of planting soil, to a locally known soil testing laboratory, for analysis and amendment recommendations. Sample shall be representative of typical on-site topsoil proposed for use in planting areas.
- B. If import topsoil is proposed, import topsoil sample shall be submitted to a locally known soil testing laboratory, for analysis, amendment recommendations and installation recommendations.

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- C. Contractor shall provide to the soil testing laboratory the following information when submitting soil for analysis:
1. Project type (public school, commercial building, etc.).
  2. Anticipated maintenance (regular, low, none, etc.).
  3. Irrigation water source (potable or recycled).
  4. Proposed plant material type such as California native plants, turf, shrub and ground covers.
  5. Copy of this specification.
- D. Fertilizers: All fertilizers shall be of an approved brand with a guaranteed chemical analysis as required by USDA regulations and shall be dry and (except for plant tabs) free flowing.
- E. Nitrogen Stabilized Organic Amendment: 0-1/4 inch nitrogen-fortified organic amendment contributing at least 270 pounds of organic matter per cubic yard. Consider using Composted Greenwaste Soil Amendment, such as Z-Best Organic Compost from Zanker Landscape Materials ([www.zankerlandscapematerials.com](http://www.zankerlandscapematerials.com)) or equal, if recommended by soil analysis laboratory. is acceptable if recommended by the soil testing laboratory (Lucchesi Plant & Soil Consulting, Waypoint Analytical California, Inc., or approved equal). Compost shall be obtained from a supplier participating in the Seal of Testing Assurance (STA) program of the U.S. Composting Council.
1. In order to comply with MWELO 492.6, 3. (C). Soil Preparation, Mulch and Amendments, at a minimum, compost shall be applied at a rate of four (4) cubic yards per 1,000 square feet of permeable area incorporated to a depth of six (6) inches into the soil. Soils with greater than 6% of organic matter in the top six (6) inches are exempt from adding compost.
  2. Nitrogen stabilized sawdust shall not be used.
- F. Soil Preparation: The following materials and quantities are given for bidding purposes only and Contractor shall amend soil using products, quantities and methods specified by Soil and Plant Laboratory, or approved equal.
1. Nitrogen stabilized organic amendment.
  2. 6-20-20 granular fertilizer.
  3. Soil sulfur.
- G. Planting Tablets: 21 gram controlled release fertilizer supplying nitrogen for up to 1 ½ years and 20-10-5 content.
- H. Backfill Mix: Shall be a mixture of on-site or import topsoil, nitrogen stabilized organic amendment soil conditioner and fertilizer. For bidding purposes, backfill mix shall include 2/3 topsoil and 1/3 soil conditioner with 6-20-20 granular fertilizer, quantity per manufacturer, according to container or root stock size, mixed thoroughly.

## 2.7 MULCHES

- A. Due to variations in mulch sizes, Contractor shall remove large bark mulch in excess of approximately ¾" x 1½" x 6" in size or 2.5 cubic inches in volume.



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- B. Organic Mulch for planting areas: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of untreated recycled wood chips from Wheeler Zamaroni Landscape Supply.

1. Address: 3500 Petaluma Hill Rd, Santa Rosa, CA 95404
2. Phone: (707) 543-8400
3. Website: <https://wzsupply.com/>
4. Email: sales@wzsupply.com
5. Submit sample to Owners Representative's for review and approval.

## 2.8 HERBICIDES

- A. Selective and non-selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.
- B. Contact Owner and obtain School District, Local, State and Federal policies and procedures for regulating application of chemical controls. Contractor shall comply with all applicable policies and/or procedures for application, posting and notifications.

## 2.9 WEED BLOCK FABRIC PRODUCTS

- A. WEED FABRIC/ WEED BLOCK FILTER FABRIC
1. Shall be Mirafi Mscape E (or approved equal) needle-punched, heat-treated, polypropylene, nonwoven landscape fabric designed specifically to act as a weed barrier, separator, and drainage filter. Product is inert to biological degradation and resistant to naturally encountered chemicals, alkalis, and acids.
    - a. Product thickness to be 38 mils (mm) per ASTM D5199
    - b. Roll Width to be 9 ft
    - c. Roll Length to be 300 ft
    - d. Apparent Opening Size (AOS) 40 U.S. Sieve (mm) per ASTM D4751
    - e. Flow Rate of 175 gal/min/ft<sup>2</sup>
    - f. UV Resistance after 500 hours to be 70% strength retention per ASTM D4355
- B. WEED BLOCK STAPLES:
1. Shall be 6-inch 9-gauge galvanized steel landscaping staples.

## STAKES AND GUYS

- C. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated Douglas Fir or Lodgepole Pine, free of knots, holes, cross grain, and other defects, two (2) inches in diameter by length required, and pointed at one end.
- D. Guy and Tie Wire: ASTM A 641/A 641M, Class 1, galvanized-steel wire, 2-strand, twisted, 0.106 inch in diameter.

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- E. Guy Cable: 5-strand, 3/16-inch- diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.
- F. Tree Ties: Z-Strap tree ties, or equal, made of one (1) inch wide by 1/4" thick, black rubber recycled tire rubber with pre-punched nail holes, a tensile strength of 400 psi, a breaking strength of 75 pounds per inch of width and resistant to ozone deterioration. Contact Sullivan & Mann Lumber Company, Inc. (800) 847-6562 ([www.sullivanandmann.com](http://www.sullivanandmann.com)).
- G. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long

2.10 LANDSCAPE EDGINGS/HEADERBOARD

- A. Of sizes shown, and as follows:
  - 1. Species: Construction Heart Redwood.
  - 2. Stakes: Construction heart redwood, 1 by 2 by 16 inches long in nominal size, with galvanized nails for anchoring edging.
  - 3. Splice Plate: Same species as edging, 1 by 6 by 24 inches long in nominal size, with galvanized nails for securing in place.

2.11 WATER

- A. Water shall be suitable for irrigation and free from ingredients harmful to planting areas.

2.12 MISCELLANEOUS PRODUCTS

- A. Tree Trunk Guard: nine (9) inch high by four (4) inch diameter plastic, corrugated tube, Arbor Guard + or equal.
- B. Tree Root Barriers: 18" high by 24" wide, interlocking panels of not less than 0.080" (2.032 mm) thickness, black in color, at least 50% recycled material, injection molded plastic product for linear applications with ultra-violet inhibitors with anti-lift ground lock tabs, vertical root deflecting ribs and double top edge consisting of two parallel, horizontal ribs on the top.
- C. Jute Netting: Biodegradable in two (2) to three (3) years from installation, absorbing water four to five times fabric weight, open area 60% to 65%, available in rolls four (4) feet in width. Use galvanized steel staples as recommended by manufacturer to secure netting in place.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Planting operations shall be performed when weather and soil conditions are suitable for planting.

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3.2 PREPARATION

- A. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.
- C. Install protective barriers and/or fencing as necessary.
- D. Contact and obtain Owner's Representative, Local, State and Federal policies and procedures for regulating application of fertilizers, fungicides, insecticides, pesticides and herbicides. Contractor shall comply with all applicable policies and/or procedures for application, posting and notifications.
- E. Do not excavate, place soils or amend soils during wet or saturated conditions.
- F. If lime treated soils have not been removed from proposed planting areas, remove and replace with acceptable topsoil.
- G. Verify depth of planting soil in proposed planting areas. If depth of planting soil is less than twelve (12) inches in depth, install additional planting soil to ensure twelve (12) inch minimum depth of topsoil.
- H. Import topsoil Installation:
  - 1. Remove and disposed of stones larger than one (1) inch in any dimension, vegetation and foreign inorganic material from surface to receive import topsoil.
  - 2. Scarify or plow the subgrade by crossripping or equivalent to a minimum depth of four (4) inches until it is loose and uncompacted to provide bonding of imported planting soil layer to subgrade.
  - 3. Place planting soil on loosened material in four (4) inch layers. Crossrip first import planting soil layer to a depth of eight (8) inches and blend import planting soil with loose native surface soil. Roll lightly with appropriate lawn roller to consolidate soil and compact to 85% density.
  - 4. Continue placement of planting soil after blending first layer with native soil in four (4) inch layers and rolling lightly to consolidate and compact each layer of soil and compact to 85% density.
  - 5. Place topsoil to the lines and grades in accordance with grading Drawings.
  - 6. Verify installation of topsoil to minimum depth of twelve (12) inches over subgrade soil and rough grading is completed to proper slopes and elevations.

3.3 SOIL AMENDING AND FINE GRADING (AMEND PER SOIL-TESTING LABORATORY RECOMMENDATIONS. THE FOLLOWING AMENDMENT RECOMMENDATIONS ARE GIVEN FOR BIDDING PURPOSES ONLY.)  
CONTRACTOR SHALL PREPARE AND AMEND SOIL OVER ENTIRE PLANTING AREAS AND AS RECOMMENDED FOR BACKFILL AT INDIVIDUAL PLANTING PITS.

- A. Soil Preparation: Loosen subgrade of planting beds by crossripping or equivalent cultivation to a minimum depth of ten (10) inches. Remove stones larger than one (1) inch in any dimension and sticks, roots, rubbish, and other extraneous matter in the top six (6) inches of soil and legally dispose of them off Owner's property.

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- B. Soil Amending: (Amend per Soil-Testing Laboratory recommendations. The following recommendations are provided for bidding purposes only. Contractor shall amend soil for over-all preparation and amendment recommendations and for planting pit preparation, amendments and backfill) Add the following and thoroughly till into the top eight (8) inches of planting soil at the following rates per 1,000 square feet. Till planting soil to a homogeneous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter. Float, rake and roll all planter areas to establish finished grades, maintaining drainage patterns and swales for grading and drainage plans, creating smooth, uniform surface plane.
1. 6 cubic yards nitrogen fortified organic soil amendment.
  2. 14 pounds all-purpose granular fertilizer (6-20-20).
  3. 15 pounds soil sulfur.
- C. Fine Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Refer to civil grading plans and conform to designed grades, drainage patterns, swales, and ridges.
1. There shall be no areas that hold water or drain toward buildings or structures, unless designed per civil grading plans.
  2. In planting areas, set finish grade of soil one and one half (1 1/2) inches below adjacent paved surfaces, utility boxes, tops of curbs, and the like to allow for installation of organic mulch top dressing above.
  3. Regrade as necessary to restore grades and drainage patterns after installation of plant material.

### 3.4 EDGING/HEADERBOARD INSTALLATION

- A. Redwood Headerboard: Install wood headers or edgings where indicated. Anchor with wood stakes spaced per detail, driven at least 1 inch below top elevation of header or edging. Use 2 galvanized nails per stake to fasten headers and edging; length as needed to penetrate both members and provide 1/2-inch clinch at point. Chamfer top of stakes as indicated on detail and pre-drill stakes if needed to avoid splitting

### 3.5 PLANT MATERIAL EXCAVATION

- A. Lay out individual tree and shrub locations and areas for multiple exterior plantings. Stake locations, outline areas, adjust locations when requested, and obtain Owner's Representative's acceptance of layout before planting. Make minor adjustments as required.
- B. Lay out exterior plants at locations directed by Owner's Representative. Stake locations of individual trees and shrubs and outline areas for multiple plantings.
- C. Pits and Trenches: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.
1. Excavate approximately planting pit sizes as indicated on planting details.
  2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots.
  3. Set rootball onto compacted native soil so that rootball sits one (1) inch above adjacent finish grade.

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- D. Obstructions: Notify Owner's Representative if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
- E. Drainage: Notify Owner's Representative if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.
- F. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

### 3.6 PLANT MATERIAL PLANTING

- A. Carefully remove root ball from container without damaging root ball or plant.
- B. Set container grown planting stock plumb and in center of pit or trench with top of root ball one (1) inch above adjacent finish grades. Face plant material for best appearance.
- C. Place amended backfill around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly.
- D. Place planting tablets in hole about one (1) to two (2) inches away from root tips. Refer to manufacturer's recommendation for exact quantity, but not less than:

Plant Size	Quantity	Plant Size	Quantity
1 Gallon Container	1	7-Gallon Container	5
2-Gallon Container	2	15-Gallon Container	8
3-Gallon Container	3	24" box container	20
5-Gallon Container	3	36" box container	30

- E. Finish placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil.

### 3.7 TREE AND SHRUB PRUNING

- A. Prune, thin, and shape trees and shrubs as directed by Owner's Representative.
- B. General Tree Pruning Procedures:
  - 1. Prune trees according to ANSI A300 (Part 1). Prune trees for long term structural integrity.
  - 2. Cut branches with sharp pruning instruments; do not break, tear or chop. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
  - 3. Do not apply pruning paint to wounds.
- C. Pruning Goals (Prune as per the following and under the direction of a Certified Arborist):
  - 1. Prune trees to remain to compensate for root loss caused by construction damage. Provide subsequent maintenance during landscape irrigation and planting maintenance period and until "final completion" as recommended by Certified Arborist.
  - 2. Prune to remove dead wood, promote proper structure, thin and open canopy and for general health for the specific tree species.
  - 3. Prune for clearance from structures, pathways and driveways and streets and for a balanced canopy.

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- D. Shrubs, Vines and Ground Covers:
  - 1. Prune, thin and shape shrubs according to standard horticultural practices.
  - 2. Prune to remove injured or dead branches from shrubs.

3.8 GUYING AND STAKING

- A. Upright Staking and Tying: Unless detailed otherwise, use a minimum of 2 stakes of length required to penetrate at least six (6) inches below bottom of backfilled excavation and to extend at least 72 inches above grade. Set vertical stakes and space to avoid penetrating root balls or root masses. Brace tree stakes with wood horizontal bracing screwed in place. Support trees with two rubber tree tie sections at contact points with the tree trunk installed in a "figure 8" wrap. Allow enough slack to avoid rigid restraint of tree. Trim stakes below tree canopy and to matching heights. Use the number of stakes as follows:
  - 1. Use 2 stakes for trees up to 12 feet high and 2-1/2 inches or less in caliper.
  - 2. Use 3 stakes for trees more than 12 feet high and up to 4 inches in caliper. Space stakes equally around trees.
  - 3. Use 3 stakes for trees of all sizes if detailed otherwise on Drawings.
- B. Guying and Staking: Guy and stake trees exceeding 14 feet in height and more than 3 inches in caliper, unless otherwise indicated. Securely attach no fewer than 3 guys to stakes 30 inches long, driven to grade.
  - 1. For trees more than 6 inches in caliper, anchor guys to pressure-preservative-treated deadmen 8 inches in diameter and 48 inches long buried at least 36 inches below grade. Provide turnbuckles for each guy wire and tighten securely.
  - 2. Attach flags to each guy wire, 30 inches above finish grade.
  - 3. Paint turnbuckles with luminescent white paint.

3.9 TREE ROOT BARRIERS

- A. Install root barriers where trees are planted within six (6) feet of any pavement or structures.
- B. A linear root barrier shall be installed flush with the vertical edge of pavement or structure, one half (1/2) inch below the top of the pavement and shall extend six (6) feet in each direction for a total of twelve (12) feet in length. Contractor shall remove concrete spillage if necessary to install barrier flush against vertical concrete edge.

3.10 TREE TRUNK GUARD: INSTALL TO PROTECT NEWLY PLANTED TREE TRUNKS PLANTED IN LAWNS ACCORDING TO MANUFACTURER RECOMMENDATIONS.

3.11 RAISED PLANTERS

- A. Fill raised planters with amended planting soil. Place planting soil in twelve (12) inch deep, compacted layers to 85% relative density to an elevation of four (4) inches below the top of the raised planter (unless detailed otherwise on Drawings).

3.12 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants spaced as indicated on planting legend.

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- B. Dig holes large enough to allow spreading of roots, and backfill with planting soil.
- C. Work planting soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.13 WEED BLOCK FABRIC

- A. Prior to installing mulch in planting beds, install weed block filter fabric per manufacturer recommendations over entire shrub and tree planting beds. Rake grade to receive fabric to a smooth and uniform surface. Roll fabric over surface and over-lap seems 12" on sides. When installing on a slope, lay fabric lengthwise up and down the slope. Fabric shall lay flush with grade without wrinkles or loose edges and installed in such a manner that fabric is completely concealed beneath mulch surfacing material.
- B. Do not install weed block filter fabric within 2" of (n) or (e) plant stems and 6" of (n) or (e) tree trunks.
- C. Secure weed block fabric using 6-inch, 9-gauge galvanized steel landscaping staples. Staples to be installed at 18" O.C. max in all directions.

3.14 JUTE NETTING

- A. Install jute netting on slopes exceeding 3:1 ratio slope. Apply jute netting after preparing planting soil for planting and fine grading. Secure jute netting starting at the top of the slope by laying six (6) inches of fabric below grade to a minimum depth of six (6) inches. Roll jute netting down slope and terminate where grade becomes level by folding six (6) inches of fabric underneath. Overlap seems four (4) to six (6) inches. Secure in place using staples placed eighteen (18) inches on center spacing. After completion of planting operations, install top dressing organic mulch as specified herein.

3.15 PLANTING BED MULCHING

- A. Apply three (3) inch minimum thickness of organic mulch, unless specified otherwise on Drawings, continuously throughout planting areas. Do not place mulch within two (2) inches of stems and six (6) inches of tree trunks.

3.16 CLEANUP AND PROTECTION

- A. During exterior planting, keep adjacent paving and construction work area in a clean and orderly condition.
- B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation treat, repair, or replace damaged exterior planting.
- C. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

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3.17 MAINTENANCE SCHEDULE

- A. Protection: Protect work from damage, erosion and trespass. Maintain temporary fencing and/or barriers in proper condition. Remove temporary fencing and/or barriers prior to final completion and at end of maintenance period.
- B. Water: Contractor shall be solely responsible for ensuring that all planting is sufficiently watered to promote vigorous growth. Test and inspect irrigation system on a regular basis. Adjust and repair the irrigation system and its components as necessary for plant establishment and growth and for watering efficiency. Check and adjust any obstructions to emission devices.
- C. Fertilizing recommendations (confirm with the soil testing laboratory): Immediately after completion of planting, fertilize landscape areas with ammonium sulfate (21-0-0) fertilizer at a rate of five (5) pounds per 1000 square feet. Fertilize with specified fertilizer after 45 days, prior to end of maintenance period. After landscape becomes well-established, fertilize in fall and spring with (16-6-8) commercial fertilizer at a rate of six (6) pounds per 1000 square feet.
- D. Weed Control: Maintain planting beds (planted or not) in a weed-free condition to be performed weekly during maintenance period. Weeding may be done manually or by the use of selective herbicides. (Contractor shall obtain written approval from project owner prior to application of herbicide) No herbicide shall be used without the Owner Representative's prior consent. Use only approved herbicides, use in accordance with manufacturer's recommendations and per Pest Control Advisor's recommendations. If selective herbicides are used, extreme caution shall be observed so as not to damage any other plants. Spraying shall be done only under windless conditions.
- E. Disease, Pest and Insect Control: Disease, pest (including, but not limited to, birds and rodents) and insect damage shall be controlled by the use of fungicides, insecticides pesticides, poisons and/or mechanical means. (Contractor shall obtain written approval from project owner prior to application of fungicides, insecticides or pesticides or mechanical methods). Review and perform weekly during maintenance period.
- F. Plant Material: Maintain trees, shrubs and other plants by pruning, cultivating and weeding as required for healthy growth. Restore planting pits as necessary. Tighten and repair stake supports and reset trees and shrubs to proper grades or vertical position as required. Review and perform weekly during maintenance period.
- G. Organic Mulch: Re-apply organic mulch top dressing after initial settling and again prior to end of maintenance to ensure specified depth is achieved.
- H. End of maintenance shall be reviewed and approved in writing by Owner's Representative. Upon approval, Contractor shall notify Owner's Representative in writing when maintenance is complete with a date which maintenance transfers to Owner.



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3.18 FIELD QUALITY CONTROL, SUBSTANTIAL COMPLETION AND FINAL COMPLETION

- A. Owner's Representative shall inspect and approve the following prior to proceeding with subsequent work:
  - 1. Preparation: at completion of finish grading and prior to planting, grading tolerances and soil preparation shall be checked for conformance to Drawings and as specified herein.
  - 2. Layout: Layout of all plants, headerboard and other major elements shall be directed and/or approved by Owner's Representative.
  - 3. Substantial Completion Review: At substantial completion of this Section, work shall be reviewed for conformance with the Drawings and Contractor shall make recommended repairs and/or corrections in a timely manner.
  - 4. Final Completion Review: After substantial completion repairs and/or corrections have been completed, work shall be reviewed for final completion and approved by Owner's Representative in writing.
- B. Re-inspections required due to Contractor not being prepared or non-conformance to Drawings shall be back charged to the Contractor.
- C. Contractor shall remove protective fencing and/or barriers prior to final completion review.

END OF SECTION 32 90 00

(Revised 9/19/2024)