PROJECT MANUAL

IRVINE • SAN DIEGO • SAN JOSE
SACRAMENTO DALLAS • SAN ANTONIO

911 MEMORIAL PARK

10597 Town Center Dr.

Issue for Bid

City Of Rancho Cucamonga

November 3, 2023

LPA Project No.: 3054801

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PROVIDED UNDER SEPARATE COVER

Article 1

General

1.1 Mutual Obligations

1.1.1 *District and Design Build Entity* commit at all times to cooperate fully with each other, and proceed on the basis of trust and good faith, to permit each party to realize the benefits afforded under the Contract Documents.

1.2 Basic Definitions

1.2.1 *Agreement* refers to the executed contract between District and Design Build Entity under DBIA Document No. 525, *Standard Form of Agreement Between Owner and Design Build Entity - Lump Sum* (2010 Edition).

1.2.2 *Basis of Design Documents* are as follows DBIA Document No. 525, *Standard Form of Agreement Between District and Design Build Entity – Lump Sum*, the Basis of Design Documents are the District's Project Criteria, Design Build Entity's Proposal and the Deviation List, if any.

1.2.3 *Construction Documents* are the documents, consisting of Drawings and Specifications, to be prepared or assembled by the Design Build Entity consistent with the Basis of Design Documents unless a deviation from the Basis of Design Documents is specifically set forth in a Change Order executed by both the District and Design Build Entity, as part of the design review process contemplated by Section 2.4 of these General Conditions of Contract.

1.2.4 *Day* or *Days* shall mean calendar days unless otherwise specifically noted in the Contract Documents.

1.2.5 *Design Build Entity* is comprised of the Design-Builder, the Design Consultant; and key Subcontractors identified by the Design Build Entity.

1.2.6 *Design Consultant* is a qualified, licensed design professional who is not an employee of Design Build Entity, but is retained by Design Build Entity, or employed or retained by anyone under contract with Design Build Entity, to furnish design services required under the Contract Documents. A Design Sub-Consultant is a qualified, licensed design professional who is not an employee of the Design Consultant, but is retained by the Design Consultant or employed or retained by anyone under contract to Design Consultant, to furnish design services required under the Contract Documents.

1.2.7 *Final Completion* is the date on which all Work is complete in accordance with the Contract Documents, including but not limited to, any items identified in the punch list prepared under Section 6.6.1 and the submission of all documents set forth in Section 6.7.2.

1.2.8 *Force Majeure Events* are those events that are beyond the control of both Design Build Entity and District, including the events of war, floods, labor disputes, earthquakes, epidemics, adverse weather conditions not reasonably anticipated, and other acts of God.

1.2.9 *General Conditions of Contract* refer to *Standard Form of General Conditions of Contract Between Owner and Design-Builder* (2010 Edition). Refer to Appendix G.

1.2.12 *Hazardous Conditions* are any materials, wastes, substances and chemicals deemed to be hazardous under applicable Legal Requirements, or the handling, storage, remediation, or disposal of which are regulated by applicable Legal Requirements.

1.2.13 *Legal Requirements* are all applicable federal, state and local laws, codes, ordinances, rules, regulations, orders and decrees of any government or quasi-government entity having jurisdiction over the Project or Site, the practices involved in the Project or Site, or any Work.

1.2.14 *District's Project Criteria* are developed by or for District to describe District's program requirements and objectives for the Project, including use, space, price, time, site and expandability requirements, as well as submittal requirements and other requirements governing Design Build Entity's performance of the Work. District's Project Criteria may include design documents, design criteria, design performance specifications, design specifications, planning and environmental documents, District's RFP, and CalGreen design criteria and other Project-specific technical materials and requirements.

1.2.15 *Site* is the land or premises on which the Project is located.

1.2.16 *Subcontractor* is any person or entity retained by Design Build Entity as an independent contractor to perform a portion of the Work and shall include materialmen and suppliers.

1.2.17 *Sub-Subcontractor* is any person or entity retained by a Subcontractor as an independent contractor to perform any portion of a Subcontractor's Work and shall include material persons and suppliers.

1.2.18 *Substantial Completion* or *Substantially Complete* means the date on which the Work, or an agreed upon portion of the Work, is sufficiently complete in accordance with the Contract Documents so that District can occupy and use the Project or a portion thereof for its intended purposes.

1.2.19 *Work* is comprised of all Design Build Entity's design , construction, and all other services including acquisition of all permits and approvals, required by the Contract Documents, including procuring and furnishing all materials, equipment, services and labor reasonably inferable from the Contract Documents, and necessary to complete the Project in accordance with the Contract Documents.

Article 2

Design Build Entity's Services and Responsibilities

2.1 General Services.

2.1.1 Design Build Entity's Representative shall be reasonably available to District and shall have the necessary expertise and experience required to supervise the Work. Design Build Entity's Representative shall communicate regularly with District and shall be vested with the authority to act on behalf of Design Build Entity. Design Build Entity's Representative may be replaced only with the mutual agreement of District and Design Build Entity.

2.1.2 Design Build Entity shall provide District with a bi-weekly status report detailing the progress of the Work, including (i) whether the Work is proceeding according to schedule, (ii) whether discrepancies, conflicts, or ambiguities exist in the Contract Documents that require resolution, (iii) whether health and safety issues exist in connection with the Work; (iv) and, (v) all other items that require resolution so as not to jeopardize Design Build Entity's ability to complete the Work for the Contract Price and within the Contract Time(s).

2.1.3 Unless a schedule for the execution of the Work has been attached to the Agreement as an exhibit at the time the Agreement is executed, Design Build Entity shall prepare and submit, at

least three (3) days prior to the meeting contemplated by Section 2.1.4 hereof, a schedule for the execution of the Work for District's review and response. The schedule shall indicate the dates for the start and completion of the various stages of Work, including the dates when District information and approvals are required to enable Design Build Entity to achieve the Contract Time(s). The schedule shall be revised as required by conditions and progress of the Work, but such revisions shall not relieve Design Build Entity of its obligations to complete the Work within the Contract Time(s), as such dates may be adjusted in accordance with the Contract Documents. District's review of, and response to, the schedule shall not be construed as relieving Design Build Entity of its complete and exclusive control over the means, methods, sequences and techniques for executing the Work.

2.1.4 The parties will meet within seven (7) days after execution of the Agreement to discuss issues affecting the administration of the Work and to implement the necessary procedures, including those relating to submittals and payment, to facilitate the ability of the parties to perform their obligations under the Contract Documents.

2.2 Design Professional Services.

2.2.1 Design Build Entity shall, consistent with applicable state licensing laws, provide through qualified, licensed design professionals employed by the Design Build Entity, or procured from qualified, independent licensed Design Consultants, the necessary design services, including architectural, engineering and other design professional services, for the preparation of the required drawings, specifications and other design submittals to permit Design Build Entity to complete the Work consistent with the Contract Documents. Nothing in the Contract Documents is intended or deemed to create any legal or contractual relationship between District and any Design Consultant.

2.3 Standard of Care for Design Professional Services.

2.3.1 The standard of care for all design professional services performed to execute the Work shall be the care and skill ordinarily used by members of the design profession practicing under similar conditions at the same time and locality of the Project.

2.4 Design Development Services.

2.4.1 Design Build Entity and District shall, consistent with any applicable provision of the Contract Documents, agree upon any interim design submissions that District may wish to review, which interim design submissions may include design criteria, drawings, diagrams and specifications setting forth the Project requirements. Interim design submissions shall be consistent with the Basis of Design Documents, as the Basis of Design Documents may have been changed through the design process set forth in this Section 2.4.1. On or about the time of the scheduled submissions, Design Build Entity and District shall meet and confer about the submissions, with Design Build Entity identifying during such meetings, among other things, the evolution of the design and any changes to the Basis of Design Documents, or, if applicable, previously submitted design submissions. Changes to the Basis of Design Documents, including those that are deemed minor changes under Section 9.3.1, shall be processed in accordance with Article 9. Minutes of the meetings, including a full listing of all changes, will be maintained by Design Build Entity and provided to all attendees for review. Following the design review meeting, District shall review and approve the interim design submissions and meeting minutes in a time that is consistent with the turnaround times set forth in Design Build Entity's schedule.

2.4.2 Design Build Entity shall submit to District Construction Documents setting forth in detail drawings and specifications describing the requirements for construction of the Work. The Construction Documents shall be consistent with the latest set of interim design submissions, as such submissions may have been modified in a design review meeting and recorded in the meetings minutes. The parties shall have a design review meeting to discuss, and District shall

review and approve, the Construction Documents in accordance with the procedures set forth in Section 2.4.1 above. Design Build Entity shall proceed with construction in accordance with the approved Construction Documents and shall submit one set of approved Construction Documents to District prior to commencement of construction.

2.4.3 District's review and approval of interim design submissions, meeting minutes, and the Construction Documents is for the purpose of mutually establishing a conformed set of Contract Documents compatible with the requirements of the Work. Neither District's review nor approval of any interim design submissions, meeting minutes, and Construction Documents shall be deemed to transfer any design liability from Design Build Entity to District.

2.4.4 To the extent not prohibited by the Contract Documents or Legal Requirements, Design Build Entity may prepare interim design submissions and Construction Documents for a portion of the Work to permit construction to proceed on that portion of the Work prior to completion of the Construction Documents for the entire Work.

2.5 Legal Requirements.

2.5.1 Design Build Entity shall perform the Work in accordance with all Legal Requirements and shall provide all notices applicable to the Work as required by the Legal Requirements.

2.5.2 The Contract Price and/or Contract Time(s) shall be adjusted to compensate Design Build Entity for the effects of any changes in the Legal Requirements, if any, enacted after the date of the Agreement affecting the performance of the Work. Such effects may include, without limitation, revisions Design Build Entity is required to make to the Construction Documents because of changes in Legal Requirements.

2.6 Government Approvals and Permits.

2.6.1 Design Build Entity shall obtain and pay for all necessary permits, approvals, licenses, government charges and inspection fees required for the prosecution of the Work by any government or quasi-government entity having jurisdiction over the Project.

2.7 Design Build Entity's Construction Phase Services.

2.7.1 Unless otherwise provided in the Contract Documents to be the responsibility of District or a separate contractor, Design Build Entity shall provide through itself and/or Subcontractors the necessary supervision, labor, inspection, testing, start-up, material, equipment, machinery, temporary utilities and other temporary facilities to permit Design Build Entity to complete construction of the Project consistent with the Contract Documents.

2.7.2 Design Build Entity shall perform all construction activities efficiently and with the requisite expertise, skill and competence to satisfy the requirements of the Contract Documents. Design Build Entity shall at all times exercise complete and exclusive control over the means, methods, sequences and techniques of construction.

2.7.3 Design Build Entity shall employ only Subcontractors who are duly licensed and qualified to perform the Work consistent with the Contract Documents. District may reasonably object to Design Build Entity's selection of any Subcontractor, provided that the Contract Price and/or Contract Time(s) shall be adjusted to the extent that District's decision impacts Design Build Entity's cost and/or time of performance. Design Build Entity will comply with Public Contract Code Section 22166 and all other applicable provisions of said Code in the selection of Subcontractors.

2.7.4 Design Build Entity assumes responsibility to District for the proper performance of the

Work of Subcontractors and any acts and omissions in connection with such performance. Nothing in the Contract Documents is intended or deemed to create any legal or contractual relationship between District and any Subcontractor or Sub-Subcontractor, including but not limited to any third-party beneficiary rights.

2.7.5 Design Build Entity shall coordinate the activities of all Subcontractors. If District performs other work on the Project or at the Site with separate contractors under District's control, Design Build Entity agrees to reasonably cooperate and coordinate its activities with those of such separate contractors so that the Project can be completed in an orderly and coordinated manner without unreasonable disruption.

2.7.6 Design Build Entity shall keep the Site reasonably free from debris, trash and construction wastes to permit Design Build Entity to perform its construction services efficiently, safely and without interfering with the use of adjacent land areas. Upon Substantial Completion of the Work, or a portion of the Work, Design Build Entity shall remove all debris, trash, construction wastes, materials, equipment, machinery and tools arising from the Work or applicable portions thereof to permit District to occupy the Project or a portion of the Project for its intended use.

2.8 Design Build Entity's Responsibility for Project Safety.

2.8.1 Design Build Entity recognizes the importance of performing the Work in a safe manner so as to prevent damage, injury or loss to (i) all individuals at the Site, whether working or visiting, (ii) the Work, including materials and equipment incorporated into the Work or stored on-Site or off-Site, and (iii) all other property at the Site or adjacent thereto. Design Build Entity assumes responsibility for implementing and monitoring all safety precautions and programs related to the performance of the Work. Design Build Entity shall, prior to commencing construction, designate a Safety Representative with the necessary qualifications and experience to supervise the implementation and monitoring of all safety precautions and programs related to the Work. Unless otherwise required by the Contract Documents, Design Build Entity's Safety Representative shall be an individual stationed at the Site who may have responsibilities on the Project in addition to safety. The Safety Representative shall make routine daily inspections of the Site and shall hold weekly safety meetings with Design Build Entity's personnel, Subcontractors and others as applicable.

2.8.2 Design Build Entity and Subcontractors shall comply with all Legal Requirements relating to safety, as well as any District-specific safety requirements set forth in the Contract Documents, provided that such District-specific requirements do not violate any applicable Legal Requirement. Design Build Entity will immediately report in writing any safety-related injury, loss, damage or accident arising from the Work to District's Representative and, to the extent mandated by Legal Requirements, to all government or quasi-government authorities having jurisdiction over safety-related matters involving the Project or the Work.

2.8.3 Design Build Entity's responsibility for safety under this Section 2.8 is not intended in any way to relieve Subcontractors and Sub-Subcontractors of their own contractual and legal obligations and responsibility for (i) complying with all Legal Requirements, including those related to health and safety matters, and (ii) taking all necessary measures to implement and monitor all safety precautions and programs to guard against injuries, losses, damages or accidents resulting from their performance of the Work.

2.9 Design Build Entity's Warranty.

2.9.1 Design Build Entity warrants to District that the construction, including all materials and equipment furnished as part of the construction, shall be new unless otherwise specified in the Contract Documents, of good quality, in conformance with the Contract Documents and free of defects in materials and workmanship. Design Build Entity's warranty obligation excludes defects caused by abuse, alterations, or failure to maintain the Work in a commercially reasonable

manner. Nothing in this warranty is intended to limit any manufacturer's warranty which provides District with greater warranty rights than set forth in this Section 2.9 or the Contract Documents. Design Build Entity will provide District with all manufacturers' warranties upon Substantial Completion.

2.10 Correction of Defective Work.

2.10.1 Design Build Entity agrees to correct any Work that is found to not be in conformance with the Contract Documents, including that part of the Work subject to Section 2.9 hereof, within a period of one year from the date of Substantial Completion of the Work or any portion of the Work, or within such longer period to the extent required by any specific warranty included in the Contract Documents.

2.10.2 Design Build Entity shall, within seven (7) days of receipt of written notice from District that the Work is not in conformance with the Contract Documents, take meaningful steps to commence correction of such nonconforming Work, including the correction, removal or replacement of the nonconforming Work and any damage caused to other parts of the Work affected by the nonconforming Work. If Design Build Entity fails to commence the necessary steps within such seven (7) day period, District, in addition to any other remedies provided under the Contract Documents, may provide Design Build Entity with written notice that District will commence correction of such nonconforming Work with its own forces. If District does perform such corrective Work, Design Build Entity shall be responsible for all reasonable costs incurred by District in performing such correction. If the nonconforming Work creates an emergency requiring an immediate response, the seven (7) day period identified herein shall be deemed inapplicable.

2.10.3 The one-year period referenced in Section 2.10.1 above applies only to Design Build Entity's obligation to correct nonconforming Work and is not intended to constitute a period of limitations for any other rights or remedies District may have regarding Design Build Entity's other obligations under the Contract Documents.

Article 3

District's Services and Responsibilities

3.1 Duty to Cooperate.

3.1.1 District shall, throughout the performance of the Work, cooperate with Design Build Entity and perform its responsibilities, obligations and services in a timely manner to facilitate Design Build Entity's timely and efficient performance of the Work and so as not to delay or interfere with Design Build Entity's performance of its obligations under the Contract Documents.

3.1.2 District shall provide timely reviews and approvals of interim design submissions and Construction Documents consistent with the turnaround times set forth in Design Build Entity's schedule.

3.1.3 District shall give Design Build Entity timely notice of any Work that District notices to be defective or not in compliance with the Contract Documents.

3.2 Furnishing of Services and Information.

3.2.1 Unless expressly stated to the contrary in the Contract Documents, District shall provide, at its own cost and expense, for Design Build Entity's information and use the following, all of which Design Build Entity is entitled to rely upon in performing the Work:

3.2.1.3 Temporary and permanent easements, zoning and other requirements and encumbrances affecting land use, or necessary to permit the proper design and construction of the Project and enable Design Build Entity to perform the Work;

3.2.1.4 A legal description of the Site;

3.2.1.6 To the extent available, environmental studies, reports and impact statements describing the environmental conditions, including Hazardous Conditions, in existence at the Site.

3.2.2 District is responsible for securing and executing all necessary agreements with adjacent land or property Districts that are necessary to enable Design Build Entity to perform the Work. District is further responsible for all costs, including attorneys' fees, incurred in securing these necessary agreements.

3.4 District's Representative.

3.4.1 District's Representative shall be responsible for providing District-supplied information and approvals in a timely manner to permit Design Build Entity to fulfill its obligations under the Contract Documents. District's Representative shall also provide Design Build Entity with prompt notice if it observes any failure on the part of Design Build Entity to fulfill its contractual obligations, including any errors, omissions or defects in the performance of the Work. District's Representative shall communicate regularly with Design Build Entity and shall be vested with the authority to act on behalf of District.

3.5 Government Approvals and Permits.

3.5.1 Design Build Entity shall obtain and pay for all necessary permits, approvals, licenses, government charges and inspection fees..

3.5.2 District shall provide reasonable assistance to Design Build Entity in obtaining those permits, approvals and licenses that are Design Build Entity's responsibility.

3.6 District's Separate Contractors.

3.6.1 District is responsible for all work performed on the Project or at the Site by separate contractors under District's control. District shall contractually require its separate contractors to cooperate with, and coordinate their activities so as not to interfere with, Design Build Entity in order to enable Design Build Entity to timely complete the Work consistent with the Contract Documents.

Article 4

Hazardous Conditions and Differing Site Conditions

4.1 Hazardous Conditions.

4.1.1 Unless otherwise expressly provided in the Contract Documents to be part of the Work, Design Build Entity is not responsible for any Hazardous Conditions encountered at the Site. Upon encountering any Hazardous Conditions, Design Build Entity will stop Work immediately in the affected area and duly notify Owner and, if required by Legal Requirements, all government or quasi-government entities with jurisdiction over the Project or Site.

4.1.2 Upon receiving notice of the presence of suspected Hazardous Conditions, District shall take the necessary measures required to ensure that the Hazardous Conditions are remediated or rendered harmless. Such necessary measures shall include DBE retaining qualified independent experts to (i) ascertain whether Hazardous Conditions have actually been encountered, and, if they have been encountered, (ii) prescribe the remedial measures that District or DBE must take either to remove the Hazardous Conditions or render the Hazardous Conditions harmless.

4.1.3 Design Build Entity shall be obligated to resume Work at the affected area of the Project only after Owner's expert provides it with written certification that (i) the Hazardous Conditions have been removed or rendered harmless and (ii) all necessary approvals have been obtained from all government and quasi-government entities having jurisdiction over the Project or Site.

4.1.4 Design Build Entity will be entitled, in accordance with these General Conditions of Contract, to an adjustment in its Contract Price and/or Contract Time(s) to the extent Design Build Entity's cost and/or time of performance have been adversely impacted by the presence of Hazardous Conditions.

4.1.5 Notwithstanding the preceding provisions of this Section 4.1, Owner is not responsible for Hazardous Conditions introduced to the Site by Design Build Entity, Subcontractors or anyone for whose acts they may be liable. To the fullest extent permitted by law, Design Build Entity shall indemnify, defend and hold harmless Owner and Owner's officers, directors, employees and agents from and against all claims, losses, damages, liabilities and expenses, including attorneys' fees and expenses, arising out of or resulting from those Hazardous Conditions introduced to the Site by Design Build Entity, Subcontractors or anyone for whose acts they may be liable.

4.2 Differing Site Conditions.

4.2.1 Concealed or latent physical conditions or subsurface conditions at the Site that (i) materially differ from the conditions indicated in the Contract Documents or (ii) are of an unusual nature, differing materially from the conditions ordinarily encountered and generally recognized as inherent in the Work are collectively referred to herein as "Differing Site Conditions." If Design Build Entity encounters a Differing Site Condition, Design Build Entity will be entitled to an adjustment in the Contract Price and/or Contract Time(s) to the extent Design Build Entity's cost and/or time of performance are adversely impacted by the Differing Site Condition.

4.2.2 Upon encountering a Differing Site Condition, Design Build Entity shall provide prompt written notice to District of such condition, which notice shall not be later than fourteen (14) days after such condition has been encountered. Design Build Entity shall, to the extent reasonably possible, provide such notice before the Differing Site Condition has been substantially disturbed or altered.

Article 5

Insurance and Bonds

5.1 Design Build Entity's Insurance Requirements.

5.1.1 Design Build Entity is responsible for procuring and maintaining the insurance for the coverage amounts all as set forth in the Insurance Exhibit to the Agreement. Coverage shall be secured from insurance companies authorized to do business in the state in which the Project is located, and with a minimum rating set forth in the Agreement.

5.1.2 Design Build Entity's insurance shall specifically delete any design-build or similar exclusions that could compromise coverages because of the design-build delivery of the Project.

5.1.3 Prior to commencing any construction services hereunder, Design Build Entity shall provide District with certificates and endorsements evidencing that (i) all insurance obligations required by the Contract Documents are in full force and in effect and will remain in effect for the duration required by the Contract Documents and (ii) no insurance coverage will be canceled, renewal refused, or materially changed unless at least thirty (30) days prior written notice is given to District. If any of the foregoing insurance coverages are required to remain in force after final payment are reasonably available, an additional certificate evidencing continuation of such coverage shall be submitted with the Final Application for Payment. If any information concerning reduction of coverage is not furnished by the insurer, it shall be furnished by the Design Build Entity with reasonable promptness according to the Design Build Entity's information and belief.

5.2 5.4 Bonds and Other Performance Security.

5.4.1 If District requires Design Build Entity to obtain performance and labor and material payment bonds, or other forms of performance security, the amount, form and other conditions of such security shall be as set forth in the Agreement.

5.4.2 All bonds furnished by Design Build Entity shall be in a form satisfactory to District. The surety shall be a company qualified and registered to conduct business in the state in which the Project is located.

Article 6

Payment

6.1 Schedule of Values.

6.1.1 Unless required by the District upon execution of this Agreement, within ten (10) days of execution of the Agreement, Design Build Entity shall submit for District's review and approval a schedule of values for all of the Work. The Schedule of Values will (i) subdivide the Work into its respective parts, (ii) include values for all items comprising the Work and (iii) serve as the basis for monthly progress payments made to Design Build Entity throughout the Work.

6.1.2 The District will timely review and approve the schedule of values so as not to delay the submission of the Design Build Entity's first application for payment. The District and Design Build Entity shall timely resolve any differences so as not to delay the Design Build Entity's submission of its first application for payment.

6.2 Monthly Progress Payments.

6.2.1 Prior to submittal of the monthly progress payment application, the Design-Builder and Owner shall review a "draft" payment application and review the Project completion status. On or before the date established in the Agreement, Design Build Entity shall submit for District's review and approval its Application for Payment requesting payment for all Work performed as of the date of the Application for Payment. The Application for Payment shall be accompanied by all supporting documentation required by the Contract Documents and/or established at the meeting required by Section 2.1.4 hereof.

6.2.2 The Application for Payment may request payment for equipment and materials not yet incorporated into the Project, provided that (i) District is satisfied that the equipment and materials are suitably stored at either the Site or another acceptable location, (ii) the equipment and

materials are protected by suitable insurance and (iii) upon payment, District will receive the equipment and materials free and clear of all liens and encumbrances.

6.2.3 All discounts offered by Subcontractor, Sub-Subcontractors and suppliers to Design Build Entity for early payment shall accrue one hundred percent to Design Build Entity to the extent Design Build Entity advances payment. Unless District advances payment to Design Build Entity specifically to receive the discount, Design Build Entity may include in its Application for Payment the full undiscounted cost of the item for which payment is sought.

6.2.4 The Application for Payment shall constitute Design Build Entity's representation that the Work described herein has been performed consistent with the Contract Documents, has progressed to the point indicated in the Application for Payment, and that title to all Work will pass to District free and clear of all claims, liens, encumbrances, and security interests upon the incorporation of the Work into the Project, or upon Design Build Entity's receipt of payment, whichever occurs earlier.

6.2.5 Refer to end of section for additional progress payment information.

6.3 Withholding of Payments.

6.3.1 On or before the date established in the Agreement, District shall pay Design Build Entity all amounts properly due. If District determines that Design Build Entity is not entitled to all or part of an Application for Payment as a result of Design Build Entity's failure to meet its obligations hereunder, it will notify Design Build Entity in writing at least five (5) days prior to the date payment is due. The notice shall indicate the specific amounts District intends to withhold, the reasons and contractual basis for the withholding, and the specific measures Design Build Entity must take to rectify District's concerns. Design Build Entity and District will attempt to resolve District's concerns prior to the date payment is due. If the parties cannot resolve such concerns, Design Build Entity may pursue its rights under the Contract Documents, including those under Article 10 hereof.

6.3.2 Notwithstanding anything to the contrary in the Contract Documents, District shall pay Design Build Entity all undisputed amounts in an Application for Payment within the times required by the Agreement.

6.4 Right to Stop Work and Interest.

6.4.1 If District fails to pay timely Design Build Entity any amount that becomes due, Design Build Entity, in addition to all other remedies provided in the Contract Documents, may stop Work pursuant to Section 11.3 hereof.

6.5 Design Build Entity's Payment Obligations.

6.5.1 Design Build Entity will pay Design Consultants and Subcontractors, in accordance with its contractual obligations to such parties, all the amounts Design Build Entity has received from District on account of their work. Design Build Entity will impose similar requirements on Design Consultants and Subcontractors to pay those parties with whom they have contracted. Design Build Entity will indemnify and defend District against any claims for payment and stop notices and mechanic's liens as set forth in Section 7.3 hereof.

6.6 Substantial Completion.

6.6.1 Design Build Entity shall notify District when it believes the Work, or to the extent permitted in the Contract Documents, a portion of the Work, is Substantially Complete. Within seven (7) days of District's receipt of Design Build Entity's notice, District and Design Build Entity will jointly inspect such Work to verify that it is Substantially Complete in accordance with the requirements of the Contract Documents. If such Work is Substantially Complete, District shall

prepare and issue a Certificate of Substantial Completion that will set forth (i) the date of Substantial Completion of the Work or portion thereof, (ii) the remaining items of Work that have to be completed before final payment, (iii) provisions (to the extent not already provided in the Contract Documents) establishing District's and Design Build Entity's responsibility for the Project's security, maintenance, utilities and insurance pending final payment, and (iv) an acknowledgment that warranties commence to run on the date of Substantial Completion, except as may otherwise be noted in the Certificate of Substantial Completion.

6.6.2 District, at its option, may use a portion of the Work which has been determined to be Substantially Complete, provided, however, that (i) a Certificate of Substantial Completion has been issued for the portion of Work addressing the items set forth in Section 6.6.1 above, (ii) Design Build Entity and District have obtained the consent of their sureties and insurers, and to the extent applicable, the appropriate government authorities having jurisdiction over the Project, and (iii) District and Design Build Entity agree that District's use or occupancy will not interfere with Design Build Entity's completion of the remaining Work.

6.7 Final Payment.

6.7.1 After receipt of a Final Application for Payment from Design Build Entity, District shall make final payment by the time required in the Agreement, provided that Design Build Entity has achieved Final Completion.

6.7.2 At the time of submission of its Final Application for Payment, Design Build Entity shall provide the following information:

6.7.2.1 An affidavit stating that there are no claims, obligations or liens outstanding or unsatisfied for labor, services, material, equipment, taxes or other items performed, furnished or incurred for or in connection with the Work which will in any way affect District's interests;

6.7.2.2 A general release executed by Design Build Entity waiving, upon receipt of final payment by Design Build Entity, all claims, except those claims previously made in writing to District and remaining unsettled at the time of final payment;

6.7.2.3 Consent of Design Build Entity's surety, if any, to final payment;

6.7.2.4 All operating manuals, warranties and other deliverables required by the Contract Documents; and

6.7.2.5 Certificates of insurance confirming that required coverages will remain in effect consistent with the requirements of the Contract Documents.

6.7.3 Deficiencies in the Work discovered after Substantial Completion, whether or not such deficiencies would have been included on the Punch List if discovered earlier, shall be deemed warranty Work. Such deficiencies shall be corrected by Design Build Entity under Sections 2.9 and 2.10 herein, and shall not be a reason to withhold final payment from Design Build Entity, provided, however, that District shall be entitled to withhold from the Final Payment the reasonable value of completion of such deficient work until such work is completed.

6.2 Monthly Progress Payments, cont.

6.2.5 AMG & Associates, Inc is requiring all subcontractors working on an AMG project to utilize Clamshell Construction Project Accounting Software for subcontractor billings, subcontractor releases, and other related project accounting data as available in the software. More information about Clamshell can be found here: www.clamshellinc.com [clamshellinc.com] . All subcontractors should contact the AMG accounting department prior to the start of your project to get set up with the software by calling 844-434-3994 or e-mail info@clamshellinc.com. AMG will provide the necessary training and tutorials for the use of Clamshell. There is no usage or license fee associated with the first project using Clamshell.

Article 7

Indemnification

7.1 Patent and Copyright Infringement.

7.1.1 Design Build Entity shall defend any action or proceeding brought against District based on any claim that the Work, or any part thereof, or the operation or use of the Work or any part thereof, constitutes infringement of any United States patent or copyright, now or hereafter issued. District shall give prompt written notice to Design Build Entity of any such action or proceeding and will reasonably provide authority, information and assistance in the defense of same. Design Build Entity shall indemnify and hold harmless District from and against all damages and costs, including but not limited to attorneys' fees and expenses awarded against District or Design Build Entity in any such action or proceeding. Design Build Entity agrees to keep District informed of all developments in the defense of such actions.

7.1.2 If District is enjoined from the operation or use of the Work, or any part thereof, as the result of any patent or copyright suit, claim, or proceeding, Design Build Entity shall at its sole expense take reasonable steps to procure the right to operate or use the Work. If Design Build Entity cannot so procure such right within a reasonable time, Design Build Entity shall promptly, at Design Build Entity's option and at Design Build Entity's expense, (i) modify the Work so as to avoid infringement of any such patent or copyright or (ii) replace said Work with Work that does not infringe or violate any such patent or copyright.

7.1.3 Sections 7.1.1 and 7.1.2 above shall not be applicable to any suit, claim or proceeding based on infringement or violation of a patent or copyright (i) relating solely to a particular process or product of a particular manufacturer specified by District and not offered or recommended by Design Build Entity to District or (ii) arising from modifications to the Work by District or its agents after acceptance of the Work. If the suit, claim or proceeding is based upon events set forth in the preceding sentence, District shall defend, indemnify and hold harmless Design Build Entity to the same extent Design Build Entity is obligated to defend, indemnify and hold harmless District in Section 7.1.1 above.

7.1.4 The obligations set forth in this Section 7.1 shall constitute the sole agreement between the parties relating to liability for infringement of violation of any patent or copyright.

7.2 Payment Claim Indemnification.

7.2.1 Design Build Entity shall indemnify, defend and hold harmless District from any and all claims, stop notices, and/or mechanic's liens brought or filed against District or against the Project as a result of the failure of Design Build Entity, or those for whose acts it is responsible, to pay for any services, materials, labor, equipment, taxes or other items or obligations furnished or incurred for or in connection with the Work. Within three (3) days of receiving written notice from District that such a claim, stop notice, or mechanic's lien has been filed, Design Build Entity shall commence to take the steps necessary to discharge said claim, stop notice, or lien, including, if necessary, the furnishing of a release bond. If Design Build Entity fails to do so, District will have the right to discharge the claim, stop notice or lien and hold Design Build Entity liable for costs and expenses incurred, including attorneys' fees.

7.3 Design Build Entity's General Indemnification.

7.3.1 <u>For Design Professional Services</u>: For Design Build Entity's Work hereunder that includes the performance of professional services by a "design professional," and to the fullest extent permitted by law, the Design Build Entity shall, at its sole cost and expense, indemnify and hold harmless the Rancho Cucamonga Fire Protection District, the City of Rancho Cucamonga,

and District's and City's officials, officers, employees, attorneys, and agents ("Indemnitees"), and each of them, from and against any and all damages, costs, expenses, liabilities, claims, demands, causes of action, proceedings, judgments, penalties, liens, and losses of any nature whatsoever, including fees of accountants and other professionals, and all costs associated therewith, and reimbursement of attorneys' fees and costs of defense, whether actual, alleged or threatened (collectively, "Claims"), to the extent arising out of, pertaining to, or relating to, in whole or in part, the negligence, recklessness or willful misconduct of the Design Build Entity, and/or its officers, principals, agents, servants, employees, subcontractors, contractors or their officers, agents, servants or employees (or any entity or individual for whom the Design Build Entity shall bear legal liability) in the performance of design professional services under this Agreement. Notwithstanding the foregoing and as required by Civil Code § 2782.8(a), in no event shall the cost to defend the Indemnitees that is charged to Design Build Entity, exceed Design Build Entity's proportionate percentage of fault.

For purposes of this Section 7.4.1, and in accordance with Civil Code Section 2782.8(a), "design professional" means only the following and only while performing professional design services: (i) an individual licensed as an architect pursuant to Business and Professions Code Section 5500, et seq., and a business entity offering architectural services in accordance with that Code section; (ii) an individual licensed as a landscape architect pursuant to Business and Professions Code Section 5615, et seq., and a business entity offering landscape architectural services in accordance with that Code section; (iii) an individual registered as a professional engineer pursuant to Business and Professions Code Section 6700, et seq., and a business entity offering professional engineering services in accordance with that Code section; and (iv) an individual licensed as a professional land surveyor pursuant to Business and Professions Code Section 8700, et seq., and a business entity offering professional land surveying services in accordance with that Code section

7.3.2 Other Indemnities. To the fullest extent permitted by law, Design Build Entity shall indemnify, hold harmless and defend the Indemnitees, and each of them, from and against all Claims including, but not limited to, losses, damages, liabilities, including attorneys' fees and expenses, for bodily injury, sickness or death, and property damage or destruction, to the extent resulting from or in connection with, the acts, omissions, or willful misconduct of the Design Build Entity, Design Consultants, Subcontractors, anyone employed directly or indirectly by any of them or anyone for whose acts any of them may be liable.

7.3.3 If an employee of Design Build Entity, Design Consultants, Subcontractors, anyone employed directly or indirectly by any of them or anyone for whose acts any of them may be liable has a claim against District, its officers, directors, employees, or agents, Design Build Entity's indemnity obligation set forth in Section 7.4.1 above shall not be limited by any limitation on the amount of damages, compensation or benefits payable by or for Design Build Entity, Design Consultants, Subcontractors, or other entity under any employee benefit acts, including workers' compensation or disability acts.

Article 8

Time

8.1 Obligation to Achieve the Contract Times.

8.1.1 Design Build Entity agrees that time is of the essence in every term of this Agreement, and that it will commence performance of the Work and achieve the Contract Time(s) in accordance with Article 5 of the Agreement.

8.2 Delays to the Work.

8.2.1 If Design Build Entity is delayed in the performance of the Work due to acts, omissions, conditions, events, or circumstances beyond its control and due to no fault of its own or those for whom Design Build Entity is responsible, the Contract Time(s) for performance shall be reasonably extended by Change Order. By way of example, events that will entitle Design Build Entity to an extension of the Contract Time(s) include acts or omissions of District or anyone under District's control (including separate contractors), changes in the Work, Differing Site Conditions, Hazardous Conditions, and Force Majeure Events. Normal anticipated weather for the geographical location of the Site is incorporated into the schedule referenced in Section 2.1.3, and shall not be a basis for extension pursuant to this Section.

8.2.2 In addition to Design Build Entity's right to a time extension for those events set forth in Section 8.2.1 above, Design Build Entity shall also be entitled to an appropriate adjustment of the Contract Price provided, however, that the Contract Price shall not be adjusted for Force Majeure Events unless otherwise provided in the Agreement.

Article 9

Changes to the Contract Price and Time

9.1 Change Orders.

9.1.1 A Change Order is a written instrument issued after execution of the Agreement signed by District and Design Build Entity, stating their agreement upon all of the following:

9.1.1.1 The scope of the change in the Work;

9.1.1.2 The amount of the adjustment to the Contract Price; and

9.1.1.3 The extent of the adjustment to the Contract Time(s).

9.1.2 All changes in the Work authorized by applicable Change Order shall be performed under the applicable conditions of the Contract Documents. District and Design Build Entity shall negotiate in good faith and as expeditiously as possible the appropriate adjustments for such changes.

9.2 Work Change Directives.

9.2.1 A Work Change Directive is a written order prepared and signed by District directing a change in the Work prior to agreement on an adjustment in the Contract Price and/or the Contract Time(s).

9.2.2 District and Design Build Entity shall negotiate in good faith and as expeditiously as possible the appropriate adjustments for the Work Change Directive. Upon reaching an agreement, the parties shall prepare and execute an appropriate Change Order reflecting the terms of the agreement.

9.3 Minor Changes in the Work.

9.3.1 Minor changes in the Work do not involve an adjustment in the Contract Price and/or Contract Time(s) and do not materially and adversely affect the Work, including the design, quality, performance and workmanship required by the Contract Documents. Design Build Entity

may make minor changes in the Work consistent with the intent of the Contract Documents, provided, however, that Design Build Entity shall promptly inform District, in writing, of any such changes and record such changes on the documents maintained by Design Build Entity.

9.4 Contract Price Adjustments.

9.4.1 The increase or decrease in Contract Price resulting from a change in the Work shall be determined by one or more of the following methods:

9.4.1.1 Unit prices set forth in the Agreement or as subsequently agreed to between the parties;

9.4.1.2 A mutually accepted lump sum, properly itemized and supported by sufficient substantiating data to permit evaluation by District;

9.4.1.3 Costs, fees and any other markups set forth in the Agreement; or

9.4.1.4 If an increase or decrease cannot be agreed to as set forth in items 9.4.1.1 through 9.4.1.3 above and District issues a Work Change Directive, the cost of the change of the Work shall be determined by the reasonable expense and savings in the performance of the Work resulting from the change, including a reasonable overhead and profit, as may be set forth in the Agreement.

9.4.2 If unit prices are set forth in the Contract Documents or are subsequently agreed to by the parties, but application of such unit prices will cause substantial inequity to District or Design Build Entity because of differences in the character or quantity of such unit items as originally contemplated, such unit prices shall be equitably adjusted.

9.4.3 If District and Design Build Entity disagree upon whether Design Build Entity is entitled to be paid for any services required by District, or if there are any other disagreements over the scope of Work or proposed changes to the Work, District and Design Build Entity shall resolve the disagreement pursuant to Article 10 hereof. As part of the negotiation process, Design Build Entity shall furnish District with a good faith estimate of the costs to perform the disputed services in accordance with District's interpretations. If the parties are unable to agree and District expects Design Build Entity to perform the services in accordance with District's interpretations, Design Build Entity shall proceed to perform the disputed services, conditioned upon District issuing a written order to Design Build Entity (i) directing Design Build Entity to proceed and (ii) specifying District's interpretation of the services that are to be performed. If this occurs, Design Build Entity shall be entitled to submit in its Applications for Payment an amount equal to fifty percent (50%) of its reasonable estimated direct cost to perform the services, and District agrees to pay such amounts, with the express understanding that (i) such payment by District does not prejudice District's right to argue that it has no responsibility to pay for such services.

9.5 Emergencies.

9.5.1 In any emergency affecting the safety of persons and/or property, Design Build Entity shall act, at its discretion, to prevent threatened damage, injury or loss. Any change in the Contract Price and/or Contract Time(s) on account of emergency work shall be determined as provided in this Article 9.

Article 10

Contract Adjustments and Disputes

10.1 Requests for Contract Adjustments and Relief.

10.1.1 If either Design Build Entity or District believes that it is entitled to relief against the other for any event arising out of or related to the Work or Project, such party shall provide written notice to the other party of the basis for its claim for relief. Such notice shall, if possible, be made prior to incurring any cost or expense and in accordance with any specific notice requirements contained in applicable sections of these General Conditions of Contract. In the absence of any specific notice requirement, written notice shall be given within a reasonable time, not to exceed twenty-one (21) days, after the occurrence giving rise to the claim for relief or after the claiming party reasonably should have recognized the event or condition giving rise to the request, whichever is later. Such notice shall include sufficient information to advise the other party of the circumstances giving rise to the claim for relief, the specific contractual adjustment or relief requested and the basis of such request.

10.2 Dispute Avoidance and Resolution.

10.2.1 The parties are fully committed to working with each other throughout the Project and agree to communicate regularly with each other at all times so as to avoid or minimize disputes or disagreements. If disputes or disagreements do arise, Design Build Entity and District each commit to resolving such disputes or disagreements in an amicable, professional and expeditious manner so as to avoid unnecessary losses, delays and disruptions to the Work.

10.2.2 Design Build Entity and District will first attempt to resolve disputes or disagreements at the field level through discussions between Design Build Entity's Representative and District's Representative which shall conclude within fourteen (14) days of the written notice provided for in Section 10.1.1 unless the District and Design Build Entity mutually agree otherwise.

10.2.3 If a dispute or disagreement cannot be resolved through Design Build Entity's Representative and District's Representative, Design Build Entity's Senior Representative and District's Senior Representative, then the procedures in Section 10.2.4 shall be followed. .

10.2.4 All claims arising out of or related to the Contract Documents or this Project, and the consideration and payment of such claims, are subject to the Government Claims Act (Government Code Section 810, et seq.) with regard to filing claims. All such claims are also subject to Public Contract Code Section 9204 and Public Contract Code Section 20104, et seq. (Article 1.5), where applicable. This Agreement hereby incorporates those provisions as though fully set forth herein. Thus, the Design-Builder or any subcontractor must file a claim in accordance with the Government Claims Act as a prerequisite to filing a construction claim in compliance with Section 9204 and Section 20104, et seq. (if applicable), and must then adhere to Section 9204 and Section 20104, et seq. (as applicable), pursuant to the definition of "claim" as individually defined therein.

10.3 Duty to Continue Performance.

10.3.1 Unless provided to the contrary in the Contract Documents, Design Build Entity shall continue to perform the Work and District shall continue to satisfy its payment obligations to Design Build Entity, pending the final resolution of any dispute or disagreement between Design Build Entity and District.

Article 11

Stop Work and Termination for Cause

11.1 District's Right to Stop Work.

11.1.1 District may, without cause and for its convenience, order Design Build Entity in writing to stop and suspend the Work. Such suspension shall not exceed sixty (60) consecutive days or aggregate more than ninety (90) days during the duration of the Project.

11.1.2 Design Build Entity is entitled to seek an adjustment of the Contract Price and/or Contract Time(s) if its cost or time to perform the Work has been adversely impacted by any suspension of stoppage of the Work by District.

11.2 District's Right to Perform and Terminate for Cause.

11.2.1 If Design Build Entity persistently fails to (i) provide a sufficient number of skilled workers, (ii) supply the materials required by the Contract Documents, (iii) comply with applicable Legal Requirements, (iv) timely pay, without cause, Design Consultants or Subcontractors, (v) prosecute the Work with promptness and diligence to ensure that the Work is completed by the Contract Time(s), as such times may be adjusted, or (vi) perform material obligations under the Contract Documents, then District, in addition to any other rights and remedies provided in the Contract Documents or by law, shall have the rights set forth in Sections 11.2.2 and 11.2.3 below.

11.2.2 Upon the occurrence of an event set forth in Section 11.2.1 above, District may provide written notice to Design Build Entity that it intends to terminate the Agreement unless the problem cited is cured, or commenced to be cured, within seven (7) days of Design Build Entity's receipt of such notice. If Design Build Entity fails to cure, or reasonably commence to cure, such problem, then District may give a second written notice to Design Build Entity of its intent to terminate within an additional seven (7) day period. If Design Build Entity, within such second seven (7) day period, fails to cure, or reasonably commence to cure, such problem, then District may declare the Agreement terminated for default by providing written notice to Design Build Entity of such declaration.

11.2.3 Upon declaring the Agreement terminated pursuant to Section 11.2.2 above, District may enter upon the premises and take possession, for the purpose of completing the Work, of all materials, equipment, scaffolds, tools, appliances and other items thereon, which have been purchased or provided for the performance of the Work, all of which Design Build Entity hereby transfers, assigns and sets over to District for such purpose, and to employ any person or persons to complete the Work and provide all of the required labor, services, materials, equipment and other items. In the event of such termination, Design Build Entity shall not be entitled to receive any further payments under the Contract Documents until the Work shall be finally completed in accordance with the Contract Documents. At such time, if the unpaid balance of the Contract Price exceeds the cost and expense incurred by District in completing the Work, such excess shall be paid by District to Design Build Entity. If District's cost and expense of completing the Work exceeds the unpaid balance of the Contract Price, then Design Build Entity shall be obligated to pay the difference to District. Such costs and expense shall include not only the cost of completing the Work, but also losses, damages, costs and expense, including attorneys' fees and expenses, incurred by District in connection with the reprocurement and defense of claims arising from Design Build Entity's default.

11.2.4 If District improperly terminates the Agreement for cause, the termination for cause will be converted to a termination for convenience in accordance with the provisions of Article 8 of the Agreement.

11.3 Design Build Entity's Right to Stop Work.

11.3.1 Design-Builder may, in addition to any other rights afforded under the Contract Documents or at law, stop the Work for the following reasons:

District**11.3.1.2** District's failure to pay amounts properly due under Design Build Entity's Application for Payment.

11.3.2 Should any of the events set forth in Section 11.3.1 above occur, Design Build Entity has the right to provide District with written notice that Design Build Entity will stop the Work unless said event is cured within seven (7) days from District's receipt of Design Build Entity's notice. If District does not cure the problem within such seven (7) day period, Design Build Entity may stop the Work. In such case, Design Build Entity shall be entitled to make a claim for adjustment to the Contract Price and Contract Time(s) to the extent it has been adversely impacted by such stoppage.

11.4 Design Build Entity's Right to Terminate for Cause.

11.4.1 Design Build Entity, in addition to any other rights and remedies provided in the Contract Documents or by law, may terminate the Agreement for cause for the following reasons:

11.4.1.1 The Work has been stopped for sixty (60) consecutive days, or more than ninety (90) days during the duration of the Project, because of court order, any government authority having jurisdiction over the Work, or orders by District under Section 11.1.1 hereof, provided that such stoppages are not due to the acts or omissions of Design Build Entity or anyone for whose acts Design Build Entity may be responsible.

11.4.1.2 District's failure to provide Design Build Entity with any information, permits or approvals that are District's responsibility under the Contract Documents which result in the Work being stopped for sixty (60) consecutive days, or more than ninety (90) days during the duration of the Project, even though District has not ordered Design Build Entity in writing to stop and suspend the Work pursuant to Section 11.1.1 hereof.

11.4.1.3 District's failure to cure the problems set forth in Section 11.3.1 above after Design Build Entity has stopped the Work.

11.4.2 Upon the occurrence of an event set forth in Section 11.4.1 above, Design Build Entity may provide written notice to District that it intends to terminate the Agreement unless the problem cited is cured, or commenced to be cured, within seven (7) days of District's receipt of such notice. If District fails to cure, or reasonably commence to cure, such problem, then Design Build Entity may give a second written notice to District of its intent to terminate within an additional seven (7) day period. If District, within such second seven (7) day period, fails to cure, or reasonably commence to cure, such problem, then Design Build Entity may declare the Agreement terminated for default by providing written notice to District of such declaration. In such case, Design Build Entity shall be entitled to recover in the same manner as if District had terminated the Agreement for its convenience under Article 8 of the Agreement.

11.5 Bankruptcy of Design Build Entity.

11.5.1 If the Design Build Entity institutes or has instituted against it a case under the United States Bankruptcy Code (such party being referred to as the "Bankrupt Party"), such event may impair or frustrate the Bankrupt Party's ability to perform its obligations under the Contract Documents. Accordingly, should such event occur:

11.5.1.1 The Bankrupt Party, its trustee or other successor, shall furnish, upon request

of the non-Bankrupt Party, adequate assurance of the ability of the Bankrupt Party to perform all future material obligations under the Contract Documents, which assurances shall be provided within ten (10) days after receiving notice of the request; and

11.5.1.2 The Bankrupt Party shall file an appropriate action within the bankruptcy court to seek assumption or rejection of the Agreement within sixty (60) days of the institution of the bankruptcy filing and shall diligently prosecute such action.

If the Bankrupt Party fails to comply with its foregoing obligations, the non-Bankrupt Party shall be entitled to request the bankruptcy court to reject the Agreement, declare the Agreement terminated and pursue any other recourse available to the non-Bankrupt Party under this Article 11.

11.5.2 The rights and remedies under Section 11.5.1 above shall not be deemed to limit the ability of the non-Bankrupt Party to seek any other rights and remedies provided by the Contract Documents or by law, including its ability to seek relief from any automatic stays under the United States Bankruptcy Code.

Article 12

Electronic Data

12.1 Electronic Data.

12.1.1 The parties recognize that Contract Documents, including drawings, specifications and three-dimensional modeling (such as Building Information Models) and other Work Product may be transmitted among District, Design Build Entity and others in electronic media as an alternative to paper hard copies (collectively "Electronic Data").

12.2 Transmission of Electronic Data.

12.2.1 District and Design Build Entity shall agree upon the software and the format for the transmission of Electronic Data. Each party shall be responsible for securing the legal rights to access the agreed-upon format, including, if necessary, obtaining appropriately licensed copies of the applicable software or electronic program to display, interpret and/or generate the Electronic Data. Electronic Data to be transmitted via Procore: www.procore.com

12.2.2 Neither party makes any representations or warranties to the other with respect to the functionality of the software or computer program associated with the electronic transmission of Work Product. Unless specifically set forth in the Agreement, ownership of the Electronic Data does not include ownership of the software or computer program with which it is associated, transmitted, generated or interpreted.

12.2.3 By transmitting Work Product in electronic form, the transmitting party does not transfer or assign its rights in the Work Product. The rights in the Electronic Data shall be as set forth in Article 4 of the Agreement. Under no circumstances shall the transfer of ownership of Electronic Data be deemed to be a sale by the transmitting party of tangible goods.

12.3 Electronic Data Protocol.

12.3.1 The parties acknowledge that Electronic Data may be altered or corrupted, intentionally or otherwise, due to occurrences beyond their reasonable control or knowledge, including but not limited to compatibility issues with user software, manipulation by the recipient, errors in transcription or transmission, machine error, environmental factors, and operator error.

Consequently, the parties understand that there is some level of increased risk in the use of Electronic Data for the communication of design and construction information and, in consideration of this, agree, and shall require their independent contractors, Subcontractors and Design Consultants to agree, to the following protocols, terms and conditions set forth in this Section 12.3.

12.3.2 Electronic Data will be transmitted in the format agreed upon in Section 12.2.1 above, including file conventions and document properties, unless prior arrangements are made in advance in writing.

12.3.3 The Electronic Data represents the information at a particular point in time and is subject to change. Therefore, the parties shall agree upon protocols for notification by the author to the recipient of any changes which may thereafter be made to the Electronic Data, which protocol shall also address the duty, if any, to update such information, data or other information contained in the electronic media if such information changes prior to Final Completion of the Project.

12.3.4 The transmitting party specifically disclaims all warranties, expressed or implied, including, but not limited to, implied warranties of merchantability and fitness for a particular purpose, with respect to the media transmitting the Electronic Data. However, transmission of the Electronic Data via electronic means shall not invalidate or negate any duties pursuant to the applicable standard of care with respect to the creation of the Electronic Data, unless such data is materially changed or altered after it is transmitted to the receiving party, and the transmitting party did not participate in such change or alteration.

Article 13

Miscellaneous

13.1 Confidential Information.

13.1.1 Confidential Information is defined as information which is determined by the transmitting party to be of a confidential or proprietary nature and: (i) the transmitting party identifies as either confidential or proprietary; (ii) the transmitting party takes steps to maintain the confidential or proprietary nature of the information; and (iii) the document is not otherwise available in or considered to be in the public domain. The receiving party agrees to maintain the confidentiality of the Confidential Information and agrees to use the Confidential Information solely in connection with the Project. Nothing herein shall affect either party's obligations under law concerning compliance with any subpoena, court order, civil discovery, or the California Public Records Act.

13.2 Assignment.

13.2.1 Neither Design Build Entity nor District shall, without the written consent of the other assign, transfer or sublet any portion or part of the Work or the obligations required by the Contract Documents.

13.3 Successorship.

13.3.1 Design Build Entity and District intend that the provisions of the Contract Documents are binding upon the parties, their employees, agents, heirs, successors and assigns.

13.4 Governing Law and Venue.

13.4.1 The Agreement and all Contract Documents shall be governed by the laws of the State of

California, without giving effect to its conflict of law principles. Venue for any legal action arising out of this Agreement shall be the Superior Court of the County of San Bernardino, or U.S. District Court, Central District, State of California.

13.5 Severability.

13.5.1 If any provision or any part of a provision of the Contract Documents shall be finally determined to be superseded, invalid, illegal, or otherwise unenforceable pursuant to any applicable Legal Requirements, such determination shall not impair or otherwise affect the validity, legality, or enforceability of the remaining provision or parts of the provision of the Contract Documents, which shall remain in full force and effect as if the unenforceable provision or part were deleted.

13.6 No Waiver.

13.6.1 The failure of either Design Build Entity or District to insist, in any one or more instances, on the performance of any of the obligations required by the other under the Contract Documents shall not be construed as a waiver or relinquishment of such obligation or right with respect to future performance.

13.7 Headings.

13.7.1 The headings used in these General Conditions of Contract, or any other Contract Document, are for ease of reference only and shall not in any way be construed to limit or alter the meaning of any provision.

13.8 Notice.

13.8.1 Whenever the Contract Documents require that notice be provided to the other party, notice will be deemed to have been validly given (i) if delivered in person to the individual intended to receive such notice, (ii) four (4) days after being sent by registered or certified mail, postage prepaid to the address indicated in the Agreement.

13.9 Amendments.

13.9.1 The Contract Documents may not be changed, altered, or amended in any way except in writing signed by a duly authorized representative of each party.

SECTION 01 01 50

CONTRACTOR'S USE OF PREMISES

PART 1 – GENERAL

1.01 SUMMARY

A. This Section applies to all situations in which the Contractor (Design Build Entity) or its representatives including, but not limited to, employees, subcontractors of any tier, suppliers, and field engineers, who enter the fire station facility (job site) Contractor shall coordinate its use of the premises under the direction of the Design Build Entity Project Manager and District's representative.

1.02 RELATED WORK

A. Documents affecting work of this Section include, but are not limited to, the General Conditions, and Sections in Division 01 of these Specifications.

1.03 QUALITY ASSURANCE

A. Promptly upon award of the Contract, notify all pertinent personnel regarding the requirements of this Section.

B. Require that all personnel who will enter the job site certify their awareness of and familiarity with the requirements of this Section.

1.04 ACCESS TO THE JOB SITE

A. As instructed by the DBE Project Manager and District Representative, Contractor shall restrict its representatives to the access route and to the immediate work areas at the Site, or as otherwise directed by the DBE Project Manager and District Representative.

1. Deliver materials, tools and equipment to the Site as directed by the DBE Project Manager and District Representative.

2. Contractor's representatives shall enter the work area as directed by the DBE Project Manager and District Representative and shall not go beyond the work area limits.

B. Contractor shall in no way block driveways and entrances to the work site. Use of such accesses will only be for the purposes of delivery and/or removal of materials, equipment, tools, vehicles, and rubbish and debris.

C. Such accesses shall be kept free of obstructions and maintained in a safe condition at all times during the performance of the Contract.

D. The CONTRACTOR shall provide the DISTRICT, the ARCHITECT and the inspector, access to the work in preparation and progress wherever located.

1.05 PARKING

A. Limited parking of the Contractor's vehicles will be allowed on the work site for the purposes of unloading materials and equipment. Areas for parking for Contractor's personnel will be within the lay down area only as designated by the DBE Project Manager and District Representative.

1.06 STORAGE

A. Project materials shall only be stored in areas designated by the DBE Project Manager and District Representative.

B. Contractor shall assume full responsibility for the protection and safekeeping of products, tools and equipment under this Contract stored on-site.

C. Contractor shall move any stored products under Contractor's control which interfere with the operation of the District.

D. Contractor is responsible for obtaining and paying for the use of any additional storage or work areas needed in the performance of the Work.

1.07 USE OF SANITARY FACILITIES AND UTILITIES

A. Contractor shall provide sanitary facilities and utilities for Contractor's representatives during the performance of the Work as defined by the Summary of Work. Use of District facilities and utilities is not permitted unless otherwise directed by the District or as otherwise provided in the Contract Documents.

1.08 SECURITY AND WORKERS CONDUCT

A. Contractor is responsible for ensuring proper identification and appropriate conduct of its representatives at all times while on the job site. Any instances of improper conduct by the Contractor's representatives will result in having such persons immediately removed from the job site and terminated from the Project.

B. No Contact with District's Representatives and Staff: Contractor's representatives shall not have unauthorized direct contact with the District's Representatives and Staff during the performance of the Work.

1. All Contractors are responsible for the behavior of their employees, subcontractors, and consultants.

2. All personnel, upon entering project sites, must report to the DBE Project Manager and District Representative's Job Site Trailer to notify that they will be working on job site.

3. Contractor shall erect and maintain a physical barrier around the storage and work areas as needed to limit contact between its representatives and District Staff. Barrier shall consist of a temporary six-foot high chain

link fence with windscreen attached, the location of which is to be coordinated with the District Representative.

C. Tobacco, Alcohol, and Firearms: In accordance with federal, state and local regulations, Contractor's representatives are not permitted to smoke or otherwise consume tobacco, consume alcoholic beverages or any illegal substance, or carry firearms in any area of the Project Site, including parking lots and adjacent sidewalks. Any person caught violating such regulations is subject to arrest by local authorities.

D. In accordance with District policy, Contractor's representatives are required to observe appropriate dress and language while on fire station facilities. Clothing which covers all tattoos must be worn at all times.

1.09 PROTECTION

A. Where necessary for the safety of the public and to insure no contact with District Staff, provide and maintain adequate protection, fences and/or barricades to separate work areas from other public areas, as directed by the District or other authorities having jurisdiction. All such protection shall remain in place during the performance of the Work or as otherwise directed by the District.

B. Protection of Existing Improvements: Provide barricades, coverings, or other types of protection necessary to prevent damage to existing improvements indicated to remain in place. Protect improvements on City/County properties as well as those on District property. Restore any improvements damaged by this work to their original condition as acceptable to the District or other authorities having jurisdiction.

C. Protection of New Improvements: Schedule work and provide security as needed to protect the new work from graffiti and vandalism.

D. Protection of Building and Furnishings: Maintain existing buildings in a weather-tight condition throughout the performance of the Work. Protect all furniture, equipment, and furnishings as necessary to prevent damage. Unless otherwise directed by the District, any furniture moved during the course of the workday must be restored to its original position each day prior to leaving the Site.

1.10 NOISE CONTROL

A. Contractor shall comply with the requirements of the City and County having jurisdiction with regard to noise ordinances governing construction sites and activities.

B. The Contractor shall be responsible for the installation of noise reducing devices on construction equipment. Construction equipment noise is subject to the control of the Noise Control Program of the Environmental Protection Agency (EPA) (Code of Federal Regulations, Title 40, Part 204).

C. At any point during the performance of the Work, and, in the District's reasonable discretion, the noise from any Work disrupts or disturbs the faculty or the normal operation of the fire stations, the District may request the Contractor to reschedule the Work or make other arrangements so that the Work does not cause such disruption or disturbance.

1.11 DUST CONTROL

A. Maintain all areas of the work site, outdoors and indoors, free from flying debris, grinding powder, sawdust, dirt and dust in general as well as any other product, product waste or work waste, that by becoming airborne may cause respiratory inconveniences to persons, particularly to District personnel. Contractor shall take specific care to avoid deposits of airborne dust or other elements that may accumulate on top of equipment, on walls, floors, furniture and/or any other permanent or movable items. Contractor shall be solely responsible to clean up and remove any and all deposits of dust and other elements.

B. Prior to commencing the Work, Contractor shall determine the probabilities of creating such an environment and provide all of the necessary protective equipment and/or items to contain the dust or airborne elements under a complete and secured control. Such protection devices, systems or methods shall be in accordance with the regulations set forth by the EPA and OSHA, and other applicable State and/or Federal regulations.

C. If the fire station is in session at any point during the performance of the Work, and, in the District's reasonable discretion, the airborne elements from any Work disrupts or disturbs the faculty or the normal operation of the fire stations, the District may request the Contractor to reschedule the Work or make other arrangements so that the Work does not cause such disruption or disturbance.

1.12 REPAIR OF DAMAGES

A. Repair or replace any damage to existing construction, including damage to walls and floors, as caused by the Contractor's operations, at Contractor's expense with no extension of the Contract Time.

B. Repair or replace damaged work with new materials as necessary to restore the damaged areas or surfaces to a condition equal to and matching such conditions existing prior to the damage to the full satisfaction of the District.

C. Repair any damaged item or part thereof and professionally clean any and all items that might become covered or partially covered by dust and other airborne elements, at Contractor's expense with no extension of the Contract Time.

END OF SECTION

SECTION 01 10 50

PHASING OF THE WORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements for phasing of work, required submittals related to project phasing, and intermediate milestones.

1.2 RELATED SECTIONS

A. Section 01 01 00: Summary of Work

B. Section 01 31 00: Project Coordination and Meetings

C. Section 01 32 20: Construction Project Schedule

D. Section 01 50 00: Temporary Facilities and Controls

E. Section 01 71 00: Cleaning

F. Section 01 71 20: Field Engineering

G. Section 01 73 90: Cutting and Patching

H. Section 01 77 00: Closeout Procedures

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.1 SUBMITTALS

A. Prior to the issuance of construction permits, this Contractor (Design Build Entity) shall prepare and submit to the City of Rancho Cucamonga Building & Safety Services Department a **fugitive dust control plan**, which shall require watering of exposed ground surfaces and disturbed areas a minimum of every three hours on the construction site and a minimum of three times per day during the entirety of the construction duration. This watering requirement shall be in addition to the existing requirements for fugitive dust control under South Coast Air Management District Rule 403. The Building & Safety Services Department shall verify that this measure is implemented during normal construction site inspections. **This is required prior to issuance of Grading and/or Building Construction Permits. Proof of compliance is achieved by**

submitting to Building & Safety Services Department a fugitive dust control plan.

B. Prior to the issuance of any permits for grading, a construction-related **noise mitigation plan** shall be submitted by this Design Build Entity to the City of Rancho Cucamonga Planning and Engineering Department for review and approval. The site plan shall depict the location of the construction equipment and how the noise from this equipment would be mitigated during construction. **This is required prior to issuance of Grading Permit. Proof of compliance is achieved by providing a noise mitigation plan to the Planning and Engineering Departments.**

1. The Design Build Entity shall orient all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest the project site. **This is required prior to issuance of Grading and/or Building Construction Permits. Proof of compliance is achieved by submitting a Site (logistics) Plan to the Planning Department showing the location of the subject construction equipment.**

    a. The Design Build Entity shall locate equipment staging in areas that will create the greatest distance between construction-related noise sources and noise-sensitive receptors nearest the project site throughout the duration of project construction.

    b. Construction and grading noise levels shall not exceed the standards specified in Development Code Section 17.66.050, as measured at the property line. The project applicant shall hire a consultant to perform weekly noise level monitoring as specified in Development Code Section 17.66.050. Monitoring at other times may be required by the City's Building Official. Said consultant shall report their findings to the Building Official within 24 hours; however, if noise levels exceed the above standards, then the consultant shall immediately notify the Building Official. If noise levels exceed the above standards, then construction activities shall be reduced in intensity to a level of compliance with above noise standards or halted.

2. Prior to issuance of any permits for grading and/or construction, the construction contractor shall provide a map of the haul truck routes to the Planning and Engineering Department for review and approval. The planned haul truck routes shall avoid residential areas to the maximum extent feasible. **This is required prior to issuance of Grading and/or Building Construction Permits. Proof of compliance is achieved by providing a map to the Engineering and Planning Departments showing the haul truck routes.**

    a. Haul truck deliveries shall not take place between the hours of 8:00 p.m. and 6:30 a.m. on weekdays, including Saturday, or at any time on Sunday or a national holiday. Additionally,

if heavy trucks used for hauling would exceed 100 daily trips (counting both to and from the construction site), then the project applicant shall prepare a noise mitigation plan denoting any construction traffic haul routes and include appropriate noise mitigation measures. To the extent feasible, the plan shall denote haul routes that do not pass sensitive land uses or residential dwellings.

C. Contractor shall conduct a meeting to coordinate site logistics. Contractor shall be responsible for developing and submitting a Project Site Logistics Plan in accordance with the requirements of this Section.

3.2 SITE LOGISTICS

A. Prior to commencement of Work, Contractor shall prepare and submit to District Representative, a detailed Project Site Logistic Plan, in same size and scale of Drawings, setting forth Contractor's plan of work. Plan shall include, but is not limited to, the following items:

1. Haul route in accordance with local ordinances to and from Project Site.
2. Identification of any overhead wire restrictions for power, street lighting, telecommunications or cable.
3. Local sidewalk access and street closure requirements.
4. Protection of sidewalk pedestrians and vehicular traffic.
5. Project site fencing and access gate locations and site signage.
6. Construction parking.
7. Material and equipment staging or delivery areas.
8. Material storage areas.
9. Temporary trailer(s) locations.
10. Temporary service location, proposed routing of all temporary utilities.
11. Location of temporary or accessible fire protection.
12. Trash removal and location of dumpsters.
13. Concrete pumping locations.
14. Crane locations.

15. Location of portable sanitary facilities.

16. Concrete mixer truck washout locations.

17. Traffic control signage.

18. Perimeter and site lighting.

19. Storm Water Pollution Prevention Plan BMPs

20. Stockpile or lay down areas.

21. Security lighting.

22. Site signage.

B. Contractor is responsible for securing and/or obtaining all approvals and permits from authorities having jurisdiction relative to any activities set forth in Section 3.02 A above.

3.3 PHASING OF THE WORK

A. Project will be constructed in single phase, unless otherwise approved or directed by District, all activities of this phase shall be completed according to the approved Baseline Schedule prior to commencement of subsequent phase. Contractor shall incorporate into the Phasing and Construction Schedule related work under separate contracts.

3.4 GENERAL REQUIREMENTS

A. Contractor shall prepare Construction Schedule in order to complete Work and related activities in accordance with Milestones as set forth per Section 01 32 20. Contractor shall include all costs to complete all Work within Milestones and Contract Time.

B. The District will be seriously damaged by not having all Work completed within Milestones or Contract Time. It is mandatory Work be complete within Milestones or Contract Time.

C. Contractor to include one float day for District's Groundbreaking Ceremony as noted per Section 01 32 20.

3.5 PROGRESS AND COMPLETION OF THE WORK

A. Progress Time of Essence. Time limits stated in the Contract Documents are of the essence. By executing the Agreement, the Contractor confirms that the

Contract Time is a reasonable period for performing and achieving Substantial Completion of the Work. The Contractor shall employ and supply a sufficient force of workers, material and equipment, and prosecute the Work with diligence so as to maintain progress, to prevent Work stoppage and to achieve Substantial Completion of the Work within the Contract Time.

B. Substantial Completion. Substantial Completion is that stage in the progress of the Work when the Work is complete in accordance with the Contract Documents, including but not limited to start-up and testing, so the District can occupy or use the Work for its intended purpose. Substantial Completion shall be determined by the Architect, and the District's Inspector upon request by the Contractor in accordance with the Contract Documents Section 01 7700 Closeout Procedures. The good faith and reasonable determination of Substantial Completion by the District, City Inspector, and the Architect shall be controlling and final.

C. Correction or Completion of the Work After Substantial Completion. Upon achieving Substantial Completion of the Work, the District, and the Contractor shall jointly inspect the Work and prepare a comprehensive list of items of the Work (punch list) to be corrected or completed by the Contractor. The exclusion of, or failure to include, any item on such list shall not alter or limit the obligation of the Contractor to complete or correct any portion of the Work in accordance with the Contract Documents. In the event that the Contractor shall fail or refuse, for any reason, to complete all punch list items within the Contract Time, Contractor shall be subject to assessment of Liquidated Damages in accordance with the specifications. If the Contractor fails or refuses to complete all items of the Work within the Contract Time, the District may, in its sole and exclusive discretion and without further notice to Contractor, elect to cause the completion of such items of the Work, provided, however, that such election by the District is in addition to, and not in lieu of, any other right or remedy of the District under the Contract Documents or at law. If the District elects to complete items of the Work, Contractor shall be responsible for all costs incurred by the District in connection therewith and the District may deduct such costs from the Contract Price then or thereafter due the Contractor; if these costs exceed the remaining Contract Price due to the Contractor, the Contractor and the Performance Bond Surety are liable to District for any such excess costs.

D. Final Completion. Final Completion is that stage of the Work when all Work has been completed in accordance with the Contract Documents, including without limitation, the performance of all punch list items noted upon Substantial Completion, and the Contract has been otherwise fully performed by the Contractor. Final Completion shall be determined by the Architect and the District's Inspector upon request of the Contractor. The good faith and reasonable determination of Final Completion by the District's Inspector and the Architect shall be controlling and final.

E. Contractor Responsibility for Multiple Inspections. In the event the Contractor shall request determination of Substantial or Final Completion, and it is determined by the District that the Work does not then justify certification of

Substantial or Final Completion, as applicable, and re-inspection is required at a subsequent time to make such determination, the Contractor shall be responsible for all costs of such re-inspection, including without limitation, the fees of the Architect and the salary of the District's Inspector. The District may deduct such costs from the Contract Price then due or thereafter due to the Contractor.

F. Final Acceptance. Final Acceptance of the Work shall occur upon approval of the Work by the District's Board of Trustees. Such approval shall be submitted for adoption at the next regularly scheduled meeting of the District's Board of Trustees after the determination of Final Completion. The commencement of any warranty or guarantee period under the Contract Documents shall be deemed to be the date upon the District's Board of Trustees approves of the Final Acceptance of the Work.

END OF SECTION

SECTION 011000 - SUMMARY

PART 1 GENERAL

1.1 PROJECT

A. Project Name: Rancho Cucamonga Memorial Park

B. Owner's Name: City of Rancho Cucamonga.

C. The Project consists of the construction of a new 911 Memorial Park. Work will include fine grading, concrete flatwork, decomposed granite paving, asphalt paving and striping, steel overhead shade canopy, all memorial items, lighting, planting, irrigation, and site furnishings.

1.2 CONTRACT DESCRIPTION

1.3 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.4 CONTRACTOR USE OF SITE AND PREMISES

A. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

B. Controlled Substances: Use of tobacco products and other controlled substances within the exisitng building is not permitted.

1.5 WORK SEQUENCE

END OF SECTION

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SECTION 012300 - ALTERNATES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description of Alternates.

B. Documentation of changes to Contract Price and Contract Time.

1.2 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.3 SCHEDULE OF ALTERNATES

A. Alternate No. 01 - PA Audio System around Structure:
   1. Base Bid Item: Section N/A and Drawing number N/A including nothing included in base bid.
   2. Alternate Item: Section N/A and Drawing number N/A including all PA Audio scope is designed & provided by GC.

B. Alternate No. 02 - PA Audio System around Structure and Landscape Areas:
   1. Base Bid Item: Section N/A and Drawing number N/A including nothing included in base bid.
   2. Alternate Item: Section N/A and Drawing number N/A including all PA Audio scope designed & provided by GC.

C. Alternate No. 03 - Central Canopy Structure:
   1. Base Bid Item: Section N/A and Drawing number L1.01, L1.02 including nothing included in base bid.
   2. Alternate Item: Section 031000-Concrete Forming and Accessories, 032000-Concrete Reinforcing, 033000-Cast-in-Place Concrete,& 051200-Structural Steel Framing and Drawing number L1.01A, L2.01A, L5.07, S2.01B & S2.02B including referenced plan & details, with high-performance coating finish.

D. Alternate No. 04 - Concrete walkways in lieu of Decomposed Granite (DG):
   1. Base Bid Item: Section N/A and Drawing number L1.01, L1.02 including keynote 02.
   2. Alternate Item: Section 323353-Architectural Site Concrete and Drawing number L1.01A & L2.01A including keynote 06.

E. Alternate No. 05 - Perimeter BOK Fencing in lieu of Perimeter Planting
   1. Base Bid Item: Section 329300-Landscape Work and Drawing number L7.01.

2. Alternate Item: Section 323119-Tube Steel Fences and Gates and 323353-Architectural Site Concrete and Drawing numbers L1.01A & L2.01A including BOK fencing concrete base per keynote 21.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Procedural requirements for product or execution substitutions.

1.02 RELATED REQUIREMENTS

A. Submittal Procedures

1.03 SUBSTITUTIONS

A. Formal requests must be made for substitutions of products or work processes in place of those specified, in accordance with the General Conditions.

B. It is the intent of the DISTRICT to have this Project constructed with materials, products and systems originally designed and specified for in the Contract Documents. This opportunity to request substitutions is not for the convenience of the Design Build Entities to submit bids for materials, products and systems which may be more familiar to them or have a lesser cost. DISTRICT shall receive full benefit of any cost reductions as a result of any request for substitution.

C. One Product Specified. Unless the specifications state that no substitution is permitted, whenever in the contract documents any specific article, device, equipment, product, material, fixture, patented process, form, method or type of construction is indicated or specified by name, make, trade name or catalog number, with or without the words “or equal,” such specification shall be deemed to be used for the purpose of facilitating description of material, process or article desired and shall be deemed to be followed by the words “or equal.” CONTRACTOR (Design Build Entity) may, unless otherwise stated, offer any material process or article, which shall be substantially equal or better in every respect to that so indicated or specified and will completely accomplish the purpose of the contract documents.

D. Two or More Products Specified. When two or more acceptable products are specified for an item of the work, the choice will be up to the CONTRACTOR (Design Build Entity). CONTRACTOR (Design Build Entity) shall utilize the same product throughout the project. If the required notice is not provided and an “or equal” substitution is requested, the DISTRICT, at its sole discretion, may refuse to consider the substitution unless the product specified is no longer commercially available.

E. Requests for substitutions must be expeditiously forwarded for consideration in accordance with the following:

1. Substitution Request Form. Requests for substitutions of products, materials, or processes other than those specified must be made on the substitution request form available from the DISTRICT within twelve (12) calendar days PRIOR to the final acceptance of the cost proposal. Consideration of substitution does not modify the project schedule regarding shop drawing submission date. Any requests submitted after the twelve (12) calendar days will not be considered, except as noted in paragraph 1.03.D or at the sole discretion of the DISTRICT. A substitution request must be accompanied by evidence as to whether or not the proposed substitution: is equal in quality and serviceability to the specified item; will entail no changes in detail and construction of related work; will be acceptable in consideration of the required design and artistic effect; will provide no cost disadvantage to DISTRICT; and will require no excessive or more expensive maintenance, including adequacy and availability of replacement parts. The burden of proof of these facts shall be upon the CONTRACTOR (DBE). The CONTRACTOR (DBE) shall furnish with its request all drawings, specifications, samples, performance data, calculations, and other information as may be required to assist the the DISTRICT in determining whether the proposed substitution is acceptable. The final decision shall be the DISTRICTs. DISTRICT may condition its approval of the substitution upon delivery to DISTRICT of an extended warranty or other assurances of adequate performance of the substitution. All risks of delay due to the City of Rancho Cucamonga Planning Department's, or any other governmental agency having jurisdiction, approval of a requested substitution shall be on the requesting party.

F. Notification of decisions concerning acceptance or rejection will be in writing, and are final without need for clarification.

G. Submit a separate request for each substitution, using the Substitution Request Form included in this Section (five (5) copies). Support each request with an explanation for the request, and include:

1. Complete data substantiating compliance of proposed substitutions with requirements stated in Contract Documents:

a. Product identification, including manufacturer's name and address.

b. Manufacturer's literature, including product description, reference standards, performance and test data.

c. Samples, as applicable

d. Name and address of similar projects on which product has been used and date of each installation, as well as servicing agency and installer.

2. Itemized comparison of the proposed substitution with products specified, listing significant variations.

3. Data relating to changes in the construction schedule, if any.

4. Effect of substitution on separate contracts, if any.

5. Any effect of substitution on in-place construction or other materials and systems to be installed.

6. Accurate cost data comparing proposed substitution with product specified.

7. Designation of required license fees or royalties.

8. Designation of availability of maintenance services and sources of replacement materials.

H. Substitutions will not be considered for acceptance when:

1. Lesser material cost is the sole reason for request.

2. They are indicated or implied on shop drawings or product data submittals without formal request.

3. Acceptance may require revision of Contract Documents.

I. Substitute products shall not be ordered or installed without written acceptance and authorization of DISTRICT.

1.04 REGULATORY REQUIREMENTS

A. It shall be the responsibility of the entity requesting the substitution to obtain all regulatory approvals required for proposed substitutions, including any additional agency review fees.

B. Substitutions of materials or work procedures which affect the health, safety disabled access and welfare of the public shall have prior approval of the City of Rancho Cucamonga Building Department.

1.05 REPRESENTATIONS

A. In making a legitimate, authorized formal request for substitution, represent that:

1. A thorough investigation has been made of the proposed product or process, and it has been determined that it is equal to or superior in all respects to that specified.

2. The same warranties or bonds and guarantees will be provided as for the product specified.

3. Installation of the accepted substitution will be coordinated with the Work; and changes to work in-place, ordered materials and products, or other work to be performed prior to installation of the requested substitutions, will be performed without any additional cost to DISTRICT.

1.06 LIST OF MANUFACTURERS AND PRODCUTS REQUIRED

A. The subcontractor shall prepare and submit to the CONTRACTOR (Design Build Entity) within thirty-five (35) calendar days of Notice of Award, comprehensive lists, of the manufacturers and products proposed for the project, including information on materials, equipment, and fixtures required by the contract documents, as may be required for CONTRACTOR's or DBE ARCHITECT's preliminary approval. Approval of such lists of products shall not be construed as a substitute for the shop drawings, manufacturer's descriptive data and samples, which are required by the contract documents, but rather as a base from which more detailed submittals shall be developed for the final review of the CONTRACTOR and the DISTRICT REPRESENTATIVE.

1.07 DEFERRED APPROVALS OF SUBSTITUTION

A. Deferred approvals shall be submitted and processed pursuant to the requirements of the contract documents and 01 33 00 Submittal Procedures. All risks of delay due to the CITY OF RANCHO CUCAMONGA PLANNING DEPARTMENT, LOCAL FIRE DEPARTMENT and DBE ARCHITECT/ENGINEER or any other governmental agency having jurisdiction, approval of a deferred approval shall be on the requesting party.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION (Form Attached)

SUBSTITUTION REQUEST FORM

Date: _____

Project: Fire Station 178

Architect: _____

Submit To: TBD

Project Manager

DB Entity

_____

_____

_____

_____

Request From: _____

Title _____

Company _____

Address _____

_____

Phone # _____

_____

The undersigned requests consideration of the following substitution:

Specified Item: _____ Section _____ Page _____ Paragraph _____ Description

Proposed Substitution:

_____

_____

_____

Statement of Cause:

_____

_____

_____

We have attached the following for your use (check box):

☐ Product description, specifications, drawings, photographs, performance and test data adequate for evaluation of the requests; applicable portions of the data are clearly identified.

- ☐ Complete documentation of all regulatory approvals required by the Contract Documents for the proposed substitution.
- ☐ Itemized comparison of proposed substitution with that of the specified product.
- ☐ Detailed cost summary of the change to the Contract Sum (if no change, state so).
- ☐ Evaluation of the effect of the proposed substitution on the construction schedule.
- ☐ Description of changes to the Contract Documents which proposed substitution will require for its proper installation.
- ☐ Manufacturer's Warranty comparison between the specified manufacturer and the proposed manufacturer.

The undersigned states that the following paragraphs, unless modified on the attachments, are correct:

1. The proposed substitution does not affect dimensions shown on the Drawings.
2. The undersigned will pay all costs for changes to the building design, including architectural or engineering design, detailing, and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse effect on other trades or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.

The undersigned further states that the function, appearance and quality of the proposed substitution is equivalent or superior to the specified item.

Submitted By:

Signature: _____ Print: _____

Company: _____ Date: _____

SECTION 01 2613 – REQUESTS FOR INTERPRETATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requests for Interpretation (RFI) procedures.

1.2 RELATED REQUIREMENTS

A. All general requirements are per the original specification project manual - Appendix G

1.3 REFERENCE STANDARDS

A. Abbreviations and Acronyms:
   1. RFI: Contractor's Request for Interpretation

B. Definition: A request seeking one of the following:
   1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
   2. A resolution to an issue which has arisen due to field conditions and affects design intent.

1.4 REQUIREMENTS

A. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
      a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
      b. Do not forward requests which solely require internal coordination between subcontractors.
   2. Prepare using an electronic version of the form appended to this section.
   3. Prepare using software provided by the Electronic Document Submittal Service.
   4. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

C. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.

1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
   a. Approval of submittals (use procedures specified elsewhere in this section).
   b. Approval of substitutions (see Section - 01 6000 - Product Requirements)
   c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
   d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.

1.5 SUBMITTALS

A. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
   1. Official Project name and number, and any additional required identifiers established in Contract Documents.
   2. Owner's, Architect's, and Contractor's names.
   3. Discrete and consecutive RFI number, and descriptive subject/title.
   4. Issue date, and requested reply date.
   5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
   6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
   7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

B. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

C. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
   1. Indicate current status of every RFI. Update log promptly and on a regular basis.
   2. Note dates of when each request is made, and when a response is received.
   3. Highlight items requiring priority or expedited response.
   4. Highlight items for which a timely response has not been received to date.

5. Identify and include improper or frivolous RFIs.

D. Review Time: Architect will respond and return RFIs to Contractor within five working days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
   1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

E. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
   1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with a numerical ("###-1", -2, etc.) suffix to the original number.
   2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
   3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
   4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 012613.01

REQUEST FOR INTERPRETATION

Project Name:	Job No.: RFI No:
To: Architect: LPA, Inc.	Contractor:
Subject:	

Specification Section	Paragraph No.	Drawing No.	Detail No.

Category:

- ☐ Need for Clarification.
- ☐ Unforeseen Condition.
- ☐ Conflict Within Documents.
- ☐ Coordination Problem.
- ☐ Other.

Description:

Contractor's Proposed Resolution:

- ☐ Attachments:
- ☐ Estimated Cost Impact" $
- ☐ Estimated Time Impact:

Contactor Signature: Date:

Architect's Response:

Refer to RFI procedures specified in Section 012613 – Administrative Requirements. This RFI, when completed is not authorization for change to the Contract Documents. Changes to the Contract Documents are authorized only by properly executed Construction Change Directives or Change Order.

- ☐ Attachments:

Architect's Signature: Date:

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electronic document submittal service.
B. Preconstruction meeting.
C. Site mobilization meeting.
D. Progress meetings.
E. Construction progress schedule.
F. Progress photographs.
G. Coordination drawings.
H. Submittals for review, information, and project closeout.
I. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 77 00 – Closeout Submittals: Project record documents

1.03 PROJECT COORDINATION

A. Cooperate with the District Representative in allocation of mobilization areas of site, for field offices and sheds, for site access, traffic, and parking facilities.

B. During construction, inform the use of site and facilities with the District Representative.

C. Develop procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts acceptable to the District Representative.

D. Coordinate field engineering and layout work.

E. Make the following types of submittals to DBE Architect or Engineer through the DBE Project Manager and following District procedures as directed:

a. Requests for interpretation.
b. Requests for substitution.
c. Shop drawings, product data, and samples.
d. Test and inspection reports.
e. Design data.
f. Manufacturer's instructions and field reports.
g. Applications for payment and change order requests.
h. Progress schedules.
i. Coordination drawings.

j. Correction Punch List and Final Correction Punch List for Substantial Completion.
k. Closeout submittals.

F. Coordinate scheduling, submittals, and Work of various Sections Contract Documents to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format and transmitted via an online document managment program proposed by the Contractor (Design Build Entity) and acceptable to the District. The Internet-based program should receive, log and store documents, provides electronic stamping and signatures, and notifies addressees via email between construction team members. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time. The electronic submittal process is not intended for color samples, color charts, or physical material samples.

a. Besides submittals for review, information, and closeout, this procedure applies to requests for information (RFIs), progress documentation, contract modification documents (e.g., supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punch list, and any other document any participant wishes to make part of the project record.
b. Contractor and DBE Architect are required to use this service.
c. It is Contractor’s responsibility to submit documents in PDF format and transmit in a format acceptable to District.
d. Subcontractors, suppliers, DBE Project Manager and District Representative and District’s consultants are to be permitted to use the service at no extra charge.
e. Users of the service need an email address, Internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
f. Paper document transmittals will not be reviewed unless paper documents are requested by the DBE Project Manager and District Representative. Emailed PDF documents will not be reviewed unless emailed PDF documents are requested by the DBE Project Manager and District Representative, Architect or Owner.
g. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

h. DBE Architect / DBE Engineer / District Representative review comments will be made available on the On-line program website for downloading. DBE Project Manager will receive email notice of completed review.
i. Distribution of reviewed submittal to subcontractors and suppliers is the responsibility of the Contractor.
j. Contractor to provide paper copies of reviewed submittals to DBE Project Manager and District Representative, as requested by DBE Project Manager and District Representative.

B. Cost: The full cost of the on-line document control service is to be paid by Contractor. This cost shall be included in the Contract Amount.

C. Training: Contractor to provide and pay for the on-line document control service staff to conduct One (1), training session for all design and construction team members including DBE Project Manager and District Representative; further training is the responsibility of the user of the service. Contractor to provide the construction team members with access to the selected on-line document exchange program staff for ongoing support by phone and e-mail.

D. Project Closeout: DBE Project Manager and District Representative will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for District.

3.02 MEETINGS

A. Refer to Section 01 31 00 Project Coordination and Meetings for project meeting responsibilities.

3.03 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations of Work, with a general outline for remainder of Work to DBE Project Manager and District Representative.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

a. Include written certification that major subcontractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

3.04 PROGRESS PHOTOGRAPHS

A. Photographer: Engage qualified photographer to take construction photographs.

B. Do not permit prints to be issued for any purpose without specific written authorization from the Architect.

C. Digital Images: Provide images in uncompressed TIFF format, produced by a digital camera with minimum sensor size of 4.0 megapixels, and at an image resolution of not less than 1024 by 768.

a. Provide 2 sets (USB flash drives) of copies to Owner.

D. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.

a. Identify each print with job name, location from which photograph was taken, photographer's name address and photograph number.

E. Pre- Construction Photographs: Before starting construction, take four (4) color photographs of Project site and surrounding properties from different vantage points. Show existing conditions adjacent to property.

F. Periodic Construction Photographs: Take four (4) color photographs monthly, coinciding with cutoff date associated with each Application of Payment. Photographer shall select vantage points to best show status of construction and progress since last photographs were taken. Take photographs same time of day.

a. Field Office Prints: Retain one (1) set of prints of periodic photographs in field office at Project site available at all times for reference. Identify photographs same as for those submitted to Architect.

b. Final Completion Construction Photographs: Take eight (8) color photographs after date of Substantial Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points.

c. Submit Construction Photographs to Owner monthly via the DBE Project Manager and District Representative’s procedure, submit before respective Application for Payment.

3.05 COORDINATION DRAWINGS

A. Submit drawings that indicate routing, locations sizes, types, and number of components in concealed spaces where potential conflict may occur between structures, mechanical, electrical, Automatic Fire Sprinkler System (AFSS), communications and ceiling suspension systems.

B. Submit submittals in accordance with Section 01 33 00 -Submittal Procedures.

3.06 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   a. Product data.
   b. Shop drawings.
   c. Samples for selection.
   d. Samples for verification.
   e. Mock- ups

B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. Samples will be reviewed only for aesthetic, color, or finish selection.

D. Submit submittals in accordance with Section 01 33 00 -Submittal Procedures and record documents as described in Section 01 77 00 - Closeout Procedures.

3.07 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:

   a. Design data.
   b. Certificates.
   c. Test reports.
   d. Inspection reports.
   e. Manufacturer's instructions.
   f. Manufacturer's field reports.
   g. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner. No action will be taken.

C. Submit submittals in accordance with Section 01 33 00 -Submittal Procedures.

3.08 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit closeouts in accordance with Section 01 77 00 – Closeout Procedures, 01 78 60 – Warranties, Guarantees, and Bonds, and 01 78 90 – Project Record Documents.

3.09 SPECIAL PROCEDURES- ACCELERATION OF WORK

A. If, in judgement of DBE Project Manager and District Representative, it becomes necessary at any time to accelerate Work or portion thereof, Contractor, when ordered or directed by District Representative, shall deploy workers in such

portions of Project where directed to enable others to properly engage and carry on their work.

a. If circumstances require that entire Work or portion thereof be completed at date earlier than Contract Completion Date as adjusted by change orders, Contractor, when ordered or directed by DBE Project Manager and District Representative, shall increase his forces, equipment, hours of work, and/or number of shifts and shall expedite delivery of materials to meet the altered completion date or dates ordered or directed. Any increase in cost to Contractor in compliance with such orders or directives will be adjusted in accordance with Contact Documents.

B. If, in judgment of DBE Project Manager and District Representative, Work is behind schedule and rate of placement of work is inadequate to regain scheduled progress so as to ensure timely completion of Work or separable portion thereof, Contractor, when so informed District Representative, shall immediately take action to increase rate of Work placement.

a. This shall be accomplished by any one or combination of following or other suitable measures:
    i. An increase in working forces,
    ii. An increase in equipment or tools,
    iii. An increase in hours of work or number of shifts,
    iv. Expediting delivery of materials.

b. Contractor shall, within ten (10) calendar days after being so informed, notify DBE Project Manager and District Representative of specific measures taken and/or planned to increase rate of progress together with estimate of when scheduled progress will be regained. Should plan of action be deemed inadequate by Architect or Owner or DBE Project Manager and District Representative, Contractor will take additional steps or make adjustments as necessary to his plan of action until it meets with Architect's or Owner's approval.

c. Acceleration of Work will continue until schedules progress is regained. Scheduled progress shall be established from latest revised approved progress for Project.

d. Timely completion will be understood as Contract Completion Date as revised by all time extensions granted at time acceleration is undertaken.

e. Contractor shall not be entitled to additional compensation for additional effort he applies to Work under terms of this sub-paragraph.

C. Any directive or order to accelerate Work will be in writing. Any directive or order terminating accelerated Work will be in writing.

3.10 PRECEDENCE

A. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

B. In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:

a. The Agreement.
b. Addenda, with those of later date having precedence over those of earlier date.
c. The Supplementary Conditions.
d. The General Conditions of the Contract for Construction.
e. "Contract Documents".
f. In the case of an inconsistency within the Contract Documents not clarified by addendum, the more stringent, higher quality and greater quantity of Work shall be provided in accordance with the District's interpretation.
g. Any work called for in the Drawings and not mentioned in the Specifications, or vice versa, shall be performed as though fully set forth in both.
h. Contractor shall secure written permission from, DBE Architect before proceeding with work affected by omission or discrepancies in the Contract.

C. Separate sections of this Specification are arranged only for convenience of Contractor, and nothing stated herein should be misconstrued as suggesting jurisdiction over items of work by any different building trades.

END OF SECTION

SECTION 01 30 50

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Section covers general requirements for codes and standards pertaining to the Work and is supplementary to the codes and standards mentioned or referenced elsewhere in the Contract Documents.

1.02 CODES AND STANDARDS

A. Requirements of Regulatory Agencies: Pertaining ordinances, laws, rules, codes, regulations, standards, and orders of public agencies having jurisdiction of the Work are intended wherever reference is made in either the singular or plural to Code or Building Code except as otherwise specified, including, but not limited to, those in the following listing. Contractor (Design Build Entity) shall make available at the site such copies of the listed documents applicable to Work as District may request, including mentioned portions of the California Code of Regulations (CCR).

1. California Administrative Code (CAC).
2. CCR, Title 5, Education Code.
3. CCR,Title 8, Industrial Relations, Chapter 4, Division of Industrial Safety, Safety Orders (CAL/OSHA).
4. CCR,Title 19, Public Safety Code.
5. CCR. Title 21, Public Works Code.
6. CCR,Title 24, California Building Code (CBC), 2019 Edition.
7. CCR, Title 24, California Mechanical Code (CMC), 2019 Edition.
8. CCR, Title 24, California Plumbing Code (CPC), 2019 Edition.
9. CCR, Title 24, California Electrical Code (CEC), 2019 Edition.
10. CCR, Title 24, California Energy Code, 2019 Edition.
11. CCR, Title 24, California Fire Code (CFC), 2019 Edition.
12. National Fire Protection Association (NFPA) with California Amendments.
13. State and Local Public Health Codes.
14. All other laws, regulations, rules, orders, codes, and ordinances specified in other Sections of these Specifications or bearing on the Work.
15. Americans with Disabilities Act (ADA).
16. Division of the State Architect Interpretation of Regulations (IR)
17. Water Department Standards as included in this section.

B. Standard and Reference Type Specifications:

1. Specifying by reference to standard and reference type specification documents or to another portion of the Contract Documents shall be the same as if the referenced document or portion referred to were exactly repeated at the place where reference is made.

2. In case of conflict between the requirements of regulatory agencies and the referenced standard or reference type specification documents, the Contractor shall conform to the most restrictive requirement if such conformance is legal.

3. The standard or reference type specification documents shall be those of the current issue at the time the Construction Documents Phase, defined in general conditions, is completed, unless otherwise specified. Contractor shall make available at the site such copies of referenced standard or reference type specification documents as the District may request.

END OF SECTION

SECTION 01 30 50

REGULATORY REQUIREMENTS – ATTACHMENT "A"

4.04.010 - General Provisions.

1. Purpose and Policy. This ordinance sets forth requirements and procedures for potable water service from the District, establishes and/or sets forth fees and rates for water connection, water use, construction, maintenance and inspection, and enables the District to comply with all applicable State and Federal laws and regulations.

   The objectives of this ordinance are:

   (a) To provide for equitable distribution of the cost for operation and maintenance of the District's potable water distribution system;

   (b) To provide for equitable recovery of costs for construction of distribution system capital improvements;

   (c) To establish the District's rights and responsibilities regarding inspection and maintenance of potable water connection facilities;

   (d) To ensure a safe, reliable, healthful and maintainable water distribution system for consumption, fire suppression, irrigation, recreation, and other domestic, commercial and municipal services and activities.

   This ordinance shall apply within the service area of the District and to persons outside the District who are, by contract or agreement with the District, users of the District's Potable Water Distribution System.

2. Definitions.

   (a) "Area of service:" Any and all area, land, or property where water service is provided or is able to be provided by the Cucamonga Valley Water District.

   (b) "Automated meter reading device:" A specified device installed with metered services within new development and replacement meters that transmits meter read information electronically to a remote receiving device.

   (c) "Board of directors:" The elected governing body of the Cucamonga Valley Water District.

   (d) "Charges and fees:" All fees, rates, deposits and other charges provided for in this ordinance.

   (e) "Construction water service:" Temporary water service obtained from the District for construction purposes on any new facilities or structures.

   (f) "Customer:" Any individual, firm, association, partnership, corporation, trust, joint-venture, or other legal entity who receives water service from the District.

   (g) "Developer:" Any individual, firm, association, partnership, corporation, trust, joint-venture, or other legal entity who desires water service which requires the installation of new, improved or expanded water service facilities.

   (h) "District:" Cucamonga Valley Water District of San Bernardino County, State of California, a public agency.

(i) "Domestic water service:" Delivery of potable water through an authorized service connection designated primarily for potable and sanitation uses, and other associated uses.

(j) "Fire service:" Standby and delivery of water through an authorized service connection designated exclusively for fire protection including automatic sprinklers and fire hydrants.

(k) "General manager:" The individual, or his duly authorized representative, appointed as such by the Board of Directors as its executive officer and agent designated by the District to supervise the operation of the public water system and who is charged with certain duties and responsibilities, as set forth by this ordinance.

(l) "Landscape water service:" The delivery of water through an authorized service connection designated exclusively for irrigating designated landscape areas.

(m) "Master plan:" A five-year water system master plan which is used as a guideline by the District to determine when, where and which new water service facilities are required.

(n) "Off-site water service facilities:" Mater service facilities, not including service connections, which are necessary to transport water from a designated remote location of the District to a point of distribution and connection to a parcel of land, or the subdivision of a parcel of land.

(o) "On-site water service facilities:" Water service facilities, including service connections, which are necessary to distribute water to a parcel of land, or the subdivision of a parcel of land. The On-Site Water Service Facilities are commonly owned and operated by the Customer.

(p) "Reconnection": Opening of a valve to permit water to flow through a service connection as a result of water disconnection by means of a turn-off.

(q) "Person:" Any individual, firm, association, partnership, corporation, trust, joint-venture, or other legal entity.

(r) "Refund agreement:" An agreement between the District and a Developer to refund the cost of construction of any or all portions of the Off-Site Water Service Facilities installed by said Developer that benefit parcels, or subdivisions of said parcels adjoining said water facilities, where said real property is not owned by Developer and/or is not the subject of Developer's request for water service. The amount refunded will be based on the cost of said Off-Site Water Service Facilities installed and pursuant to the terms and conditions of the applicable Reimbursement Agreement. All parcels located within the area adjoining the Off-Site Water Service Facilities, and receiving a direct benefit of such facilities shall be charged an amount based on the applicable fee and charge for connection of said parcel to the Off-Site Water Service Facilities.

(s) "Reimbursement agreement:" An agreement between the District and a Developer which sets forth the terms and conditions upon which the Developer will be eligible to receive a refund of the costs of Off-Site Water Service Facilities installed by said Developer that are deemed to be oversized and thereby eligible for a refund. The reimbursement amount shall be based on the differential cost between the cost of the Off-Site Water Service Facilities with the oversized portion and the cost of the Off-Site

Water Service Facilities necessary to serve the Developer's property pursuant to the Developer's application for service.

(t) "Service connection:" The water pipe, or pipes, and appurtenances installed by the developer to transport water from adjoining District facilities located within a public right-of-way or easement to the developer's parcel of land. Said service connections shall terminate at the customer side of the meter and meter box located at a specified place approved by the District.

(u) "Subdivision:" The division, by a developer, of any part of portion of a parcel of land, within the service area of the District, into two or more separate parcels or units for sale or lease for residential, commercial, or industrial purposes.

(v) "Transmission facilities:" Any designated District facilities, and appurtenances, considered to be the backbone infrastructure that transports large quantities of water within the District to and from the storage facilities and the District treatment/processing plants. Such facilities shall not be used as, nor be deemed to be, part of the On-Site Water Service Facilities which are required for the connection and delivery of water service to a Customer or Developer.

(w) "Turn-off:" Closing of valves that prevent water flow through a service connection as a result of non-payment of a bill, improper application for service, a non-sufficient fund payment, voluntary disconnection, or any other act, physical or otherwise, that causes disconnection of service.

(x) "Uniform plumbing code" means specifically the 2003 Uniform Plumbing Code developed and published by IAPMO [International Association of Plumbing and Mechanical Officials].

(y) "Water system capacity fee:" A charge imposed upon any property or subdivision of property prior to the installation of any physical connection to any District facilities for the purpose of receiving domestic and/or landscape water service. The purpose of said fee is for funding the necessary increased capacity needs of the system created by the new service connection.

(z) "Benefitted property:" All the property, or any portion thereof, located within six hundred sixty (660) feet either side, measured at right angles, of any District facilities installed by the Developer which are subject to a Refund Agreement.

(aa) "Water service facilities:" Any water mains, including appurtenances, used for providing water service to any parcels of land or subdivision of said parcels of land, excluding designated transmission facilities.

3. Abbreviations. The following abbreviations shall have the designated meanings:

AMR = Automated Meter Reading Device

CVWD = Cucamonga Valley Water District

HCF = Hundred Cubic Feet

IEUA = Inland Empire Utilities Agency, a Municipal Water District

UPC = Uniform Plumbing Code (as defined in subsection 2)

4. Construction.

   (a) Wherever in this ordinance "shall" is used, the word is mandatory. When "may" is used, the word is permissive.

   (b) The masculine gender shall include the feminine, the singular shall include the plural where indicated by the context.

(Ord. No. 30-H, § 1, 8-27-2013)

4.04.020 - Water service application and turn on procedure, deposit requirements, and miscellaneous charges.

1. Establishing Service. Any person desiring water service shall apply for service in person at the District offices or by telephone, fax or website, and pay a nonrefundable turn-on processing charge as established in subsection 13 of this section. It is recommended that the customer be present when the water service is being turned on to insure that water is not running on the property. If water is running when the turn-on is being made, the service will be turned off to avoid potential property damage. A notice that the service is in the off position, due to flow will be left at the property. The subsequent return to the property to turn-on the service will be subject all turn-on, same day turn-on and after hour turn-on fees as established in subsection 13.

   The District will ask all applicants to provide their Social Security Number, Driver's License number, and provide a telephone number at the time of application to properly identify all new service applicants, prior to the establishment of water service, to ensure credit worthiness, as well as to insure proper billing and collection of the account and its charges. New businesses requesting service shall provide a taxpayer ID number. If the information provided by the customer is deemed to be incorrect, if they are not willing to provide the information, or if they do not have the pertinent required information they will be required to come into the District offices in person to establish their identification and they will be required to provide the appropriate deposit as outlined in subsection (4) up front prior to the account being activated.

2. Responsibility of Charges and Fees. A person, who applies for and establishes a specified water service, shall be responsible for all charges and fees, which accrue on the account until the account is closed. The customer is responsible for notifying the District of the date that water service should be discontinued in their name.

   (a) Landlord/Tenant Requirements: Any person desiring water service from the District shall identify themselves as an owner (landlord) or tenant (renter).

   In cases where a service connection supplies multiple tenants, the property owner or manager cannot allocate a tenant to be responsible for the account. These types of accounts including domestic, landscape, or fire services must remain in the name of the property owner or manager.

   Provided that there are no unpaid water charges and as long as the service supplies only the tenant's location, water service may be requested and established on the account of either the tenant or the property owner. Tenants may be required to file an affidavit with the District, signed by the owner of the premises.

(b) Delinquent Accounts in the Name of the Property Owner: If the water service to a commercial or residential rental property becomes delinquent due to non-payment by a property owner, landlord or manager, the District shall make every good faith effort to inform the tenant(s), by means of written notice that service will be terminated in ten (10) days. The notice will further inform the tenants/actual users that they have the right to become customers of the District without being required to pay the amount due on the delinquent account. Said opportunity and requirements for becoming a customer will be in accordance with Government Code Section 60370 et seq. and other applicable requirements.

(c) Delinquencies on Accounts in the Name of a Commercial or Residential Tenant: In the event that a tenant of a residential or commercial rental property, where water service is furnished in the tenant's name, leaves delinquent and unpaid water charges when the tenant vacates the premises, the District will require any future service to be only in the name of the property owner and not in the name of any subsequent tenant.

3. Deposit Requirements: The District will require a deposit at the time of the application if an applicant's credit is considered unacceptable based on the following circumstances:

(a) The credit check developed from the critical information used to establish service deems the customer an unacceptable credit risk.

(b) The applicant is not willing to provide the District with the critical information required to start service or if the information provided is deemed incorrect by the credit check, the customer must come into the office in person to establish service and all deposits will need to be paid up-front before the service can be activated.

(c) The applicant has had a prior water service discontinued due to non-payment of a bill or returned payments for nonsufficient funds.

(d) The applicant has a history of submitting nonsufficient fund payments to the District.

(e) The applicant has a previous outstanding delinquent balance owed to the District.

The District may apply all, or part, of said deposit to eliminate any unpaid delinquent charges as described in subsection 3(e).

4. Calculation of Deposit: All District service accounts shall be subject to deposit requirements except governmental agencies (i.e., federal, state and local) and pre-sale developer services. The deposit requirements according to customer class are as follows:

(a) Construction: As set forth in Exhibit "A".

(b) Agricultural: As set forth in Exhibit "A".

(c) Fire Service: Deposits for fire service shall be twice the monthly standby fee as set forth in Exhibit "A".

(d) Sewer Only Class: As set forth in the Sewer Ordinance.

(e) All Other Classes:

(1) Existing Accounts: The deposit requirement for existing accounts shall be dependent on the billing history of each account and shall be calculated each month. The deposit for each account shall be the second highest bill in the billing history file for the account rounded down to the nearest multiple of five dollars ($5.00). If there is insufficient billing history data available to meet this criterion, the deposit shall be one hundred dollars ($100.00).

(2) New Accounts: The deposit requirement for new residential accounts (single-family dwellings) shall be determined by the following calculation:

Deposit = 5 (x) Bimonthly Water Service Charge for service location meter size

(+)

Bimonthly Sewer Charges (if any)

(+)

Average Bimonthly water usage for that service location

(See Exhibit "A" of this Water Ordinance for the water service charges set forth, and Exhibit "A" of the Sewer Ordinance for the sewer charge).

The deposit requirement for all other customer classes shall be determined by analyzing each account on an individual basis. From the analysis, the average bimonthly water usage and sewer charges will be estimated. The deposit required for each account shall be the sum of the bimonthly water service charge, the estimated water usage charge, and the estimated sewer charge, if any, with the total rounded down to the nearest multiple of five dollars ($5.00).

5. Return of Deposit: A customer's deposit will be credited to the customer's account after two years of acceptable payment history. An acceptable payment history is defined as never having service disconnected for non-payment, never having a payment returned for nonsufficient funds, or never appearing on the list for service termination. Any customer meeting these criteria shall have the deposit immediately credited to his or her account, and the customer's next bill shall indicate this action. Any customer not qualifying for return of deposit in this manner after two years shall continue to be tested each month thereafter.

   Any credit balance of ten dollars ($10.00) or more on the closing bill will be mailed to the customer within thirty (30) working days if a valid forwarding address is available. Any credit balance of less than ten dollars ($10.00) will have to be claimed by the customer at the District office. Any remaining credit balance under these conditions that is not claimed within twelve (12) months after the discontinuance of service will be forfeited by the customer.

6. Customer Review of Deposit: Upon applying for water service, any customer may request a review by Customer Service of the calculated deposit amount. If an error has been made, or the customer has valid projection of lower water usage, the Customer Service staff may adjust the deposit amount with the approval of the General Manager or his designee.

7. Transferring Accounts: Any deposit made for water service by a person remains the property of that person unless that person gives written authorization to the District to transfer the deposit to another person assuming responsibility for the account in question. When a person moves from one service location to another within the District and has had the original deposit returned in accordance with Subsection 5, a new deposit for the new premises shall not be required if the customer meets the criteria for "an acceptable payment history," as defined in Subsection 5, at the time of the move.

8. Returned Payment and Bankruptcy Policy: When a customer has had two nonsufficient fund payments within the preceding 12-month period or files bankruptcy, the customer shall deposit with the District an amount equal to twice the deposit amount as described in Subsection 4.

9. Illegally Obtaining Water Service: Any person who obtains water without establishing service as outlined in Subsection 1 will be liable for the required deposit and all charges for water services rendered. The amount of water delivered may be determined by the District from the meter, or on the basis of estimated consumption for the length of time service was rendered without proper application. Upon the discovery that a water service has not been properly established, the District will discontinue water service immediately. In such an event, the District will collect a reconnection charge as set forth in Exhibit "A" in addition to the deposit required and water charges, before water service is resumed. In addition, the District may pursue any and all legal and equitable remedies as may be applicable.

10. Customer Letter of Agreement: Customers that have had their service turned off for non-payment and request that their water service is turned on after normal business hours must sign a "Letter of Agreement" with the District. The "Letter of Agreement" stipulates that the customer agrees to pay all charges for reinstating service. As part of this agreement the customer must come to the District the next business day before noon to pay by cash, money order or credit card for their charges the amount due and owing for delinquent charges and charges for reconnection.

11. Delinquent Accounts: When the District sends a reminder notice to a customer concerning a delinquent bill, a delinquent charge will be added to the amount of the delinquent bill, which shall be paid with the delinquent bill. If it is necessary for the District to mail a notice of service disconnection to a customer with a delinquent account, a Termination Notice Charge will be added to the amount of the delinquent account, which shall be paid with the delinquent account.

12. Extensions: A customer may request an extension on the payment of an account only after they have received their reminder notice. The District may grant an extension, in its sole discretion, and any such extension may not exceed two weeks from the shut-off date. An extension less than or equal to seven days past the shut-off date will be subject to the extension fee as described in Subsection 13. An extension of eight days up to or equal to fourteen (14) days will be subject to a second extension fee as described in Subsection 13. Customers are not eligible to receive any extension greater than fourteen (14) days past the shut-off date. An extension is never to be granted when two or more bills are outstanding.

13. Other Customer Service Charges: Under the conditions indicated, customers shall be subject to the following miscellaneous charges as set forth in Exhibit "A". None of these charges are refundable unless an error in applying the charges has been made by the District.

Turn-on Processing Charge	The charge required to initiate any water service.
Refund Charge	The charge required for refunding overpayments for water service when the overpayment is due to an error on the part of the customer. This charge is not applicable to closing bills or closed account overpayments.
Disconnect Processing Charge	The charge required once a customer has been processed for disconnect due to being delinquent on their account.
"After Hours" Reconnection Charge	The charge required to resume water service after being turned-off during the hours of 5:30 p.m. to 7:30 a.m., Monday through Friday, and on weekends and District-observed holidays.

Extension Charge	The charge required if a customer requests and is granted an extension of time beyond the final cutoff date. The extension must not exceed a period of more than ten (10) days beyond the final cutoff date. A payment must be received by the end of this extension period in order for water service to continue uninterrupted.
Returned Payment Charge	The charge required if a customer's payment for water and/or sewer service is returned by the bank.
Delinquent Charge	The charge added to a customer's unpaid bill if the bill becomes delinquent.
Termination Notice Charge	The charge required if a notice is mailed or delivered to the customer prior to service disconnection due to an unpaid bill.
Broken or Missing Lock Charge	The charge required if a meter lock is either broken or removed by other than District personnel.
Broken Angle Meter Stop Charge	The charge required if the angle stop of the meter is either broken or damaged by other than District personnel.
Broken or Missing Meter Register Charge	The charge required if the meter register is either broken or removed by other than District personnel.
Broken AMR Equipment	The charge required if the AMR equipment is broken or damaged by other than District personnel.

(Ord. No. 30-H, § 2, 8-27-2013)

4.04.030 - New and existing service connections.

1. Application For Service Connection. An application for a service connection must be made on a form furnished by the District. The applicant shall specify the size of the water meter that is desired; however the District ultimately reserves the right to determine the size of the service connection as outlined in Subsection 6. The applicant shall also specify the location of the service connection along the frontage of the property to be served, and the purpose for which the water is to be used. The information supplied by the applicant in such application shall be considered as authoritative and final. If any error in such application shall cause installation of a service connection that is improper, either in size or location, the cost of all changes required shall be borne by the applicant.

   When the proper application for water service has been completed and signed, all associated development fees and charge paid, a service connection is installed, the meter set, and the water turned on, the charge for water service shall begin. If water service is not required when the service connection is installed, the water meter will not be installed. The angle meter stop governing the supply will be left shut off and locked. When service is required, the applicant must make proper contacts with the District for water service pursuant to Subsection 1.

2. Automated Meter Reading Devices. All new development shall install automated meter reader device as the standard meter for all new metered services. The cost of the installation for these devices shall be paid by the Developer as set forth in Exhibit "A".

3. Connection Charges and Advance Payment. Where a charge has been fixed (Exhibit "A") for the installation of the size of the service connection desired, such charge shall be paid when service is requested by the applicant. Where no such charge is fixed, the District reserves the right to require applicant to deposit an amount equal to the estimated cost of the installation of such service connection.

4. Conditions of Service. By acceptance of water service, every customer accepts and consents to such conditions of pressure and service as may, from time to time, exist under the current operating practice of the District prevailing at the location of the service connection; and waives any claim against the District for damages caused by, or arising from low pressure, high pressure, fluctuations in pressure, or interruptions of service.

5. Service Connection Property Limits. The District reserves the right to limit the number of houses, buildings, or the area of the land, under one ownership, to be supplied by one service connection. A service connection shall not be used to supply adjoining property, or to supply property of the same owner on opposite sides of a public street or alley.

   When property provided with a service connection is subdivided, the service connection shall be considered as belonging to the lot, or parcel of land, which it directly enters.

6. Determining Service Connection Size. The District reserves the right to determine the size of the service connection, and its location in relation to the boundaries of the premises to be served. The customer's pipe to the outlet side of the meter should not be installed until the service connection is completed. In the event the customer's pipe is installed to the outlet side of the meter prior to the time the service connection is installed, and its location does not correspond with that of the service connection specified on the application form, then the customer shall pay the additional cost for completing the service connection from the outlet side of the meter to the customer's pipe. The service connection and all equipment appurtenant thereto, including the meter and meter box, shall be the sole property of the District, and no part of the cost thereof shall be refunded to the applicant.

7. Service Connection Specifications. Every new service connection, whether installed by the District or the customer, shall be equipped with an angle meter stop, or valve, on the inlet side of the meter. Such angle meter stop or valve is intended for the exclusive use of the District in controlling the use of water through the service connection and/or meter. If an angle meter stop, or valve, is for any reason damaged by the customer to the extent it requires replacement, the District shall have the right to charge the customer for the cost to replace or repair such valve or angle meter stop.

8. Customer Performed Improvements. Any customer making improvements or changes necessitating the cutting and refitting for the raising or lowering of a service connection, water main, fire hydrant, stand pipe, meter, valve, or other part of the District's water system, will be required to agree in writing to indemnify the District for all costs incurred by the customer in making such changes. All improvements or changes must be approved by the District and associated fees paid prior to starting the work. All work shall be performed by a licensed, bonded contractor under the supervision of the District.

9. Moving Customer Meter. When the location of a meter is changed at the customer's request, the responsibility and cost of making such change will be borne by the customer. If requested work is performed by District forces, all necessary costs and/or fees will be paid

in advance of said work being started. Whether, and to what extent, the District elects to perform any such work shall be determined in the District's absolute discretion.

10. District Responsibility. All service connections, including water meters and meter boxes, and/or vaults installed by either the Developer's contractor or the District forces shall be maintained at the District's expense, except as otherwise provided for herein.
11. Backflow Prevention Assembly. The District reserves the right to require an approved backflow prevention assembly to be installed on any service connection, including single-family residences with multiple service connections. The District may make this determination at any time. Any such device shall be installed as set forth in the CVWD Cross-Connection Ordinance 29-A.
12. Prohibition of Service. No service connection shall be installed on the private side of any service lateral that is intended to service joint or adjacent parcels of land.
13. Master Meters. For any apartments, condominiums, or townhouses that are master metered the meter size shall be determined by the District based on the required fire flow demands as set forth by the applicable fire protection agency.
14. Commercial and Industrial Meters. Each new commercial and industrial building shall be served by individual meters for domestic use. Each service shall include an approved backflow prevention assembly as set forth in the CVWD Cross-Connection Ordinance 29-A. Existing services that do not comply with the requirements of Ordinance 29-A shall be required to upgrade all services in question to current minimum requirements when significant improvements or changes are made to said facility or as the District may otherwise determine in its discretion.
15. Landscape Meters. Separate service connections shall be installed for irrigation service on all commercial, industrial, and institutional lots or developments. Where applicable, master meter landscape services shall be allowed to service master planned complexes. Each service shall include an approved backflow assembly as determined in the CVWD Cross-Connection Ordinance 29-A. Existing services that do not comply with the requirements of Ordinance 29-A shall be required to upgrade all services in question to current minimum requirements when significant improvements or changes are made to said facility or as the District may otherwise determine in its discretion.

(Ord. No. 30-H, § 3, 8-27-2013)

4.04.040 - New facility installation other than service connection.

1. Application for Water Service. Every Developer shall file a written application for water service on a form furnished by the District.
2. Installation of Off-Site Water Facilities. Whenever the General Manger determines that new Off-Site Water Service Facilities must be installed in order to transport water to a parcel of land or the subdivision of a parcel of land, the Developer shall be responsible for construction, or having constructed, such Off-Site Water Service Facilities as deemed necessary. Off-Site Water Service Facilities shall only be constructed following District approval of plans submitted by the Developer in an approved format as required by the Engineering Department.
3. Developer Responsibilities for On-Site Water Facilities. The Developer shall be responsible for construction, or having constructed, such onsite water service facilities as are required

by the District. On-Site Water Service Facilities shall only be constructed following District approval of plans submitted by Developer in a format as required by the Engineering Department. Under no circumstances will such construction take place unless streets are well defined, both in plan and elevation. The water mains and service connections shall be installed following the construction of curb and gutter or as otherwise determined by the General Manager.

The Developer shall be required to pay a "Water System Capacity Fee" based on the size of the meter(s) supplying their development as defined by the Water System Capacity Fee Table in Exhibit "A.

The Developer shall be responsible for relocating any existing water service facilities that are found to be in conflict with the design of the proposed development. Relocation of water service facilities shall only be contingent upon the District approval of the plans, which are to be submitted by Developer in a format as required by the Engineering Department. Under no circumstances will such relocation take place unless streets are well defined, both in plan and elevation. The water mains and service connections shall be installed following the construction of curbs and gutters unless otherwise granted in writing by the Engineering Department.

The Developer is responsible for the abandonment of any existing facilities that, through the plan checking process, are deemed unnecessary or inadequate for usage by the new construction. Any abandonment will be done in accordance with the approved plans in conjunction with the construction of the new facilities or in a manner as directed by the District inspector. At all times the contractor will coordinate all work with the District to minimize waterline shut downs.

Street sub-grade must be established and well defined in new subdivisions before the water mains and services are installed. If, recently installed mains and services are required to be removed, relocated or adjusted to grade as a result of changes requested by the developer or, because of incorrect survey information as to the grade of curbs and street, location of property lines or other utilities etc., all expenses incurred by making said changes shall be borne by the Developer. For newly surfaced streets, all trench restoration and resurfacing charges shall be paid by the Developer.

4. Off-Site Water Facilities. At the request of the Developer, and pursuant to the eligibility requirements set forth in the applicable rules and regulations, the District will enter into a ten-year Refund Agreement for qualifying Off-Site Water Service Facilities, wherein the District shall agree to collect from all new connections, and refund to the Developer, the proportional costs of the Off-Site Water Service Facilities listed in the approved refund agreement. Such refunds shall not include interest, permit or development fees, or facilities specifically required for a Developer's development.

   The amount to be refunded, with respect to any new connections to such facilities, will be from the proceeds of the applicable fee or charge which is imposed and collected from the property owners/applicants who apply for service to be provided from the subject Off-Site Water Service Facilities, as established in the agreement, served by the installation of said off-site water service facilities. Said sums will be payable with respect to the connections made to the offsite water service facilities in the preceding twelve (12) months. The District may waive the above provisions and enter into different contractual arrangements with Developers only by action of the Board of Directors.

When the District requires over-sizing of pipelines larger than eight-inches, and the increased size is not required to meet the needs of the particular development which has applied for service, the District will reimburse the Developer, through an established reimbursement agreement as set forth herein for the additional costs incurred to increase the line size. The Developer shall provide comparable cost estimates for the facilities that are required to be installed as a basis in determining the costs to be reimbursed pursuant to the applicable reimbursement agreement.

5. Refund Agreements. Refund Agreements may be assigned, or transferred, providing such assignments, or transfers, are accomplished in a manner approved by the District and upon proper notice to the District as to the successors and assigns. In the event such approval and/or notice are not provided and refunds become available under a refund agreement, any heir, successor or assign of the Developer shall be required to claim refunds within sixty (60) days after the same become due and payable under the refund agreement in order to be eligible to receive said payment. If the original Developer is a partnership or corporation, the District shall pay any refunds to the successor in title to the assets of such partnership or corporation, provided due proof is made of the right to receive the same, and claim therefore is made within sixty (60) days after the same becomes due. If claims by successors in interest of a Developer are not made within the prescribed time, the right to refund shall terminate.

6. Easements. No water main shall be installed in any street or other location not formally dedicated for public use, except by consent of the property owner and the District. Such consent shall be prepared by the developer, reviewed and approved by the District, in an approved easement deed format prepared by the District, and recorded in favor of the District.

7. Title of Water Facilities. Title to all Off-Site Water Service Facilities, whether installed by the District or a Developer, shall be vested in the District upon completion of all work, testing, chlorination, inspection and acceptance for use.

8. Automatic Fire Sprinklers. When an Automatic Fire Sprinkler Service Connection is installed, the control valve thereon will be left closed and sealed until a request to turn on the water is received from the customer. After the water is turned on, the District shall not be liable for damages of any kind, whatsoever, that may occur on or to the premises served by reason of the installation, maintenance, or use of such service connections, or because of fluctuation of pressure, or interruption of water supply. The District shall bill the customer a bimonthly standby fire service charge as set forth in Exhibit "A" herein.

   Water is not to be used through an Automatic Fire Sprinkler Service Connection for any purpose other than the extinguishing of fires, or a related purpose. The District reserves the right to discontinue service to the premises through such service connections if water is being used for other than the intended purpose.

   The District shall require the customer's contractor to install on all new Automatic Fire Sprinkler Service Connections, a double check valve detector assembly (D.C.D.A.) or a reduced pressure detector assembly (R.P.D.A.) of a type approved by the National Board of Fire Underwriters and the Foundation for Cross-Connection Control and Hydraulic Research, and may require said valve to be equipped with a by-pass meter.

(Ord. No. 30-H, § 4, 8-27-2013)

4.04.050 - Water system capacity fee.

1. Each developer making written application for water service from the District shall pay a "Water System Capacity Fee" in an amount determined based on the size and number of meters installed for the Developer's development pursuant to the Water System Capacity Fee Table contained in Exhibit "A" of this ordinance, or in the amount determined in a Refund Agreement, whichever is greater.
2. The primary purpose of the Water System Capacity Fee is to recover the costs of current and future facilities and assets needed to provide utility service to new or expanded service connections to the District's water system. Such costs shall include the repayment of any debt incurred by the District to construct such facilities.

   Revenues from the Water System Capacity Fee shall also fund master planning and studies related to water facilities, the capital facilities and equipment necessary to operate and maintain the water system, and an allocated share of costs related to general facilities and equipment required to administer the overall operations of the District.
3. The principal basis of the determination of the amount of the Water System Capacity Fee is to recover costs for capital assets, including existing and/or future facilities that provide benefit to new connections to the District's water system. The Fee to users is designed to recognize the value of providing the capacity necessary to serve additional users.

   The method for calculating the Water System Capacity Fee is based on the combination approach (Buy-In methodology + Incremental Fee methodology). The Water System Capacity Fees includes the value of the existing system assets, minus accumulated depreciation and contributed assets to calculate the Buy-In component of the Capacity Fee. The cost of planned, future improvements is used to calculate the Incremental Fee component of the Capacity Fee. The sum of these two components is the total cost basis, which is allocated to existing and future users. The total costs for existing and future assets allocated to future users is divided by the number of future customers, measured in equivalent dwelling units (equivalent to a ¾-inch size meter) that are expected to connect to the system.
4. The Water System Capacity Fee shall be reviewed biennially and will be adjusted according to the outcome of the biennial review.

(Ord. No. 30-H, § 5, 8-27-2013)

4.04.060 - Rates and billings.

1. Water Rates & Monthly Service Charge. Rates for water service shall be adjusted from time to time by Ordinance of the Board of Directors of the District, and attached hereto as Exhibit "A".

   Bills for the several classes of water service shall be based on meter size and meter readings at such intervals as shall be fixed from time to time by Ordinance of the Board of Directors of the District. The interval shall appear on Exhibit "A."
2. Due Date, Disconnection and Delinquency Charge. Bills for water service are due and payable upon presentation, and become past due on the date indicated on the customer billing statement. Reminder notices shall be sent for any bills with an outstanding balance of fifty dollars ($50.00) or more on the past due date, and shall specify a final due date on which turn-off procedures will commence. For any bills with an outstanding balance of fifty dollars ($50.00) or more on the final due date, a turn-off notice shall be submitted to the

customer pursuant to Government Code Section 60373 as follows: A notice of the delinquency and impending termination shall be given, at least ten (10) days prior to the proposed termination, by means of a notice mailed, postage prepaid, to the customer to whom the service is billed not earlier than nineteen (19) days from the date of mailing the District's bill for service, and the 10-day period shall not commence until five days after the mailing of the notice. District shall make a reasonable, good faith effort to contact an adult person residing at the premises of the customer by telephone or in person at least forty-eight (48) hours prior to any termination of service except that whenever telephone or personal contact cannot be accomplished, the District will give, by mail or by posting in a conspicuous location on the premises, a notice of termination of service, at least forty-eight (48) hours prior to termination. For any bills with an outstanding balance of fifty dollars ($50.00) or more on the turn-off date water service shall be discontinued. Any customer requiring reconnection after turn-off shall be subject to reconnection charges as set forth in Exhibit "A" in addition to the outstanding balance of the bill. These procedures conform to the existing government code as to notification requirements. Payments shall be made at the offices of the District.

3. Bill Pro-Rating. Whenever service is initiated or discontinued within the service period, at the request of the customer, the water service charge shall be pro-rated as set forth in Exhibit "A."

4. Dispute of Charges. Whenever the accuracy of any bill for water service is questioned, the District will cause an investigation to be made. Bills reflecting clerical or meter errors shall be adjusted, taking into consideration the volume of business, seasonal demand, and any other factors that may assist in determining an equitable charge.

(Ord. No. 30-H, § 6, 8-27-2013)

4.04.070. - Maintenance, testing and inspection of water system.

1. Interruptions in Service. The District reserves the right at any and all times to shut off the water for the repairing, extending, or altering, of water mains, the repairing and placing of hydrants, the repairing and renewing of water service connections, or the changing and testing of water meters or detector check valves, etc.

   When the water supply is to be shut off for any of the above reasons, the District will make a reasonable effort to deliver a notice of the shut off to the customer or to some responsible interested person on the premises, but it does not assume any liability for the failure of the customer to receive or understand such notice.

2. Water System Responsibility. The District assumes no responsibility for the maintenance and operation of a customer's water system beyond the service connection and point of ownership by the District.

3. Unauthorized Tampering with Water System. Except to shut off water to prevent damage as in Subsection 1, no person, other than an authorized District employee, shall at any time or in any manner operate, or cause to be operated, any valve connected with, a water main, service connection or fire hydrant, or tamper or otherwise interfere with any water meter, AMR equipment, detector check valve, or other part of the water system. In the event a person for any reason digs out or uncovers a curb stop or valve controlling a water supply, or lifts or removes a meter cover, or its centerpiece, or causes or suffers any such act to be

done, such person will be held liable to the District for any injury or damage occasioned thereby or resulting there from.

4. Authorization. Authorized inspectors, agents and employees of the District shall have the right of entry and access, at all reasonable times, in, to, and upon any and all customer's buildings, grounds, or premises, or any part or parts thereof (including any and all plumbing, water piping, fixtures and connections located, used, maintained or operated therein or thereon), for the purpose of:

   (a) Testing, changing, or reading water meters installed, maintained, and operated by District.

   (b) Inspecting any and all such buildings, grounds, and premises, including any and all plumbing, water piping, fixtures, and connections therein, or thereon to determine:

      (1) The manner and quantity of such use, or

      (2) The existence of any condition causing, or likely to cause, affecting, or likely to affect, the furnishing or receipt of water service.

   (c) Determining the existence, operation, maintenance, and/or use in, on, or about said buildings, grounds, or premises of:

      (1) Any plumbing or water piping, or any plumbing or water fixtures, or connection which may now or hereafter cause, create or permit backflow, backsiphonage, or any other condition affecting, or likely to affect, the purity and/or potability of the water supply furnished by District.

      (2) Any source of water supply which may now, or hereafter, be connected with the water supply system of District.

      (3) Any source of pressure, vacuum, contamination, or pollution (including any and all equipment, fixtures, or appliances connected or used therewith or therefore) affecting, or likely to affect the purity and/or potability of said water supply of District.

   (d) Facilitate the enforcement, from time to time, by District, of any and all of its applicable Rules and Regulations. Each such inspector, agent or employee shall be furnished with and, upon request of the customer, shall display appropriate evidence of identification.

5. Water Meter Testing. Water meters will be tested on the following basis:

   (a) Prior to installation, each meter will be tested by the manufacturer, or the District.

   (b) A customer may, by giving at least one weeks' notice, request the District to test the meter serving his premises. The District will require the customer to deposit an amount to cover the reasonable cost of the test (see Exhibit "A").

      A written report giving the results of the test will be given to the customer within fourteen (14) days after completion of the test. If the test results determine the meter is registering three percent faster than under the conditions of normal operations, the District will refund to the customer the full amount of the overcharge based on corrected meter readings for a period, not to exceed six months that the meter was in use, in addition to the deposit used for the testing.

6. Correcting Meter Reads. When a water meter is found to be out of order, the charge for water will be based, at the option of the District, either on the average monthly consumption for the last preceding six (6) months during when the meter is known to have registered correctly, or on the consumption as registered by a "substitute meter." Consideration will also be given to volume of business, seasonal demand and any other factors that may assist in determining an equitable charge.

(Ord. No. 30-H, § 7, 8-27-2013)

4.04.080. - Construction water service.

1. Persons desiring water for construction purposes shall request a temporary water meter for connection to a District fire hydrant, and shall be subject to the fees and deposits as set forth in Exhibit "A" of this Ordinance. Any construction meter issued to a customer shall become the sole responsibility of said customer. It will be the responsibility of the customers to identify the approximate location or fire hydrant where the meter connection shall be made and shall notify District personnel of any changes to said location. The customer shall be responsible for any damage and repair to the meter while in their possession. In the event that a meter is lost or stolen, any deposit placed with the District by the customer for the meter shall be forfeited. If a replacement meter is requested, a new deposit and application shall be required for the replacement meter.

   All construction meters will be installed by District staff and secured to the desired fire hydrant with a District locking device and lock. These meters will remain at this location until such time the responsible person requests it to be removed. The responsible person can request the meter to be relocated at a maximum number of four times per billing period. Requests for removal or re-location will be accomplished the same day provided the request is made prior to 1:00 p.m. Any request made after 1:00 p.m. may be completed the following day. All damages and loss attributed to theft or vandalism shall be the responsibility of the customer.

(Ord. No. 30-H, § 8, 8-27-2013)

4.04.090. - Sanitation.

1. Unauthorized Connections. No physical connection shall hereafter exist, or be installed, located, maintained or operated, between the water supply system of this District (including its appurtenant mains, pipes, fixtures, equipment or appliances) and any other water supply system or any sewer or drainage system, or any steam, gas or chemical line, pipe or conduit, or any device, boiler tank or container whereby a contamination or pollution or any dangerous, impure, unsanitary or unpotable substance (solid, liquid or gaseous or any combination thereof) may now, or hereafter be introduced into any portion of said water supply system of said District by backflow, backsiphonage, or any other method, manner, means, or cause whatsoever.
2. Backflow Prevention Assemblies. When deemed necessary by the District, the customer, at his expense, shall install a water protection system in accordance with the CVWD Cross-Connection Ordinance No. 29-A.

(Ord. No. 30-H, § 9, 8-27-2013)

4.04.100. - Violations and enforcement.

1. Noncompliance with Ordinance. The recital of specified instances in this ordinance wherein the District is authorized to discontinue service to the customer is not to be construed as limiting the authority of said District to the instances specified. The District shall have the general right to discontinue service to any customer upon failure of compliance with, or violation or infraction of the ordinance, or any amendments or additions thereto, or any Rules and Regulations adopted by the District in amplification hereof, which may then be in force, after notice has been given where the noncompliance with, or violation or infraction of this ordinance by the customer results, or is likely to result, in a dangerous or unsanitary condition on the customer's premises, or in the District's water system or elsewhere, or where discontinuance of service is necessary to protect the District from fraud, imposition, loss or abuse.

(Ord. No. 30-H, § 10, 8-27-2013)

END OF SECTION

SECTION 01 31 00

PROJECT COORDINATION AND MEETINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Design and Coordination Drawings.
B. Pre-construction meetings.
C. Progress meetings.
D. Pre-installation meetings.

1.02 RELATED SECTIONS

A. Construction Progress Schedule.
B. DIR Labor Compliance Coordination.
C. Submittal Procedures
D. Closeout Procedures
E. Field Engineering

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1.02 COORDINATION

A. Coordinate design meetings to ensure an efficient and orderly completion of the design documents with sufficient input from all design disciplines for coordination and clash detection between the building systems.
B. Coordinate scheduling, submittals and work of the various portions of the Contract Documents to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
C. Work closely with the DISTRICT, where applicable, to coordinate work of the District's Contractors to maintain the Construction Progress Schedule.
D. Verify that utility-requirements of equipment to be installed are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment, as well as work of utility companies.
E. During construction, coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on drawings. Follow routing shown for pipes, ducts and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance and for repairs.
F. In finished areas, except as otherwise indicated, conceal pipes, ducts and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
G. In locations where several elements of mechanical and electrical work must be sequenced and positioned with precision in order to fit into available space, prepare Coordination Drawings showing the actual conditions required for the installation prior to purchasing, fabricating or installing the elements required to

be coordinated. Submit Coordination Drawings to DISTRICT.

H. Closing up of walls, partitions or furred spaces, backfilling and other covering up operations shall not proceed until all enclosed or covered work and inspections have been completed. Verify before proceeding.

I. Coordinate completion and cleanup of work of separate sections in preparation for substantial completion, including portions of work designated for DISTRICT's full and/or partial occupancy).

J. After DISTRICT occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, in a manner to minimize disruption of DISTRICT's activities.

1.03 PRE-DESIGN AND CONSTRUCTION MEETING

A. The DISTRICT will schedule a Design and Pre-construction meeting immediately after receipt of the Notice of Award.

B. Mandatory attendance includes DISTRICT Representative, DBE Project Manager, PROJECT INSPECTOR, Testing Laboratory Representative, DBE ARCHITECT, Prime CONTRACTOR(s) and Prime Contractors' Job Superintendents.

C. Optional Attendance includes DBE Architect's consultants, subcontractors, and utility company representatives.

D. The DBE Project Manager and District Representative will preside at the conference, and the DBE Project Manager will record meeting minutes and distribute copies in a timely manner.

E. Agenda:

1. Contract Agreement:
   a. Execution of Agreement between DISTRICT and each CONTRACTOR (Design Build Entity).
   b. Issue Notice to Proceed for Design and Construction Services.
   c. Submission of executed bonds and insurance certificates.
   d. Distribution of Contract Documents, Notice of Award,
2. Receive documentation from Contractor:
   a. Design Schedule
   b. Construction Schedules
   c. Schedule of Values
   d. List of Subcontractors with addresses and phone numbers
   e. List of Submittals and estimated date of submittal.
3. Project Administration:
   a. Designation of responsible personnel representing the parties.
   b. Procedures for processing of field decisions, submittals, substitutions, applications for payments, proposal requests, change orders, construction directives, and contract closeout procedures.
   c. Preliminary Design and Construction Progress Schedule
   d. Critical work sequencing
   e. Submittals, substitutions

f. Procedures and forms for preparation and maintenance of project record/as-built documents
g. Use of the Project site and parking availability
h. Temporary facilities
i. Equipment deliveries and priorities
j. Safety procedures
k. Security
l. Housekeeping
m. Working hours
n. Labor Compliance Presentation
o. Insurance Services
p. Environmental Health and Safety
q. Review of Logistics Plan
r. Progress payments
s. Communications procedures
t. Plan Check and Construction permits
u. Inspections and tests
v. SWPPP
w. Project meetings

1.04 DESIGN MEETING

A. Attendance Required:
1. Contractor (Design Build Entity Lead).
2. DBE Project Manager and DBE Architect
3. District Representative.
4. Bridging Architect

B. Agenda:
1. Review of Contract Documents.
2. Potential Substitution Requests
3. Design and Permitting Schedule review.

C. DBE Project Manager and District Representative shall record minutes and distribute copies within two days after meeting to participants.

1.05 SITE MOBILIZATION MEETING

A. Attendance Required:
1. Contractor.
2. DBE Project Manager and DBE Architect
3. District Representative.
4. Contractor's Superintendent
5. Major Subcontractors.

B. Agenda:
4. Use of premises by District and Contractor.
5. Owner's requirements and occupancy prior to completion.
6. Construction facilities and controls provided by District.
7. Survey and building layout.
8. Security and housekeeping procedures.
9. Schedules.
10. Application for payment procedures.

11. Procedures for testing.
12. Procedures for maintaining record documents.
13. Requirements for start-up of equipment.
14. Inspection and acceptance of equipment put into service during construction period.

C. DBE Project Manager and District Representative shall record minutes and distribute copies within two days after meeting to participants.

1.06 PROGRESS MEETINGS

A. DBE Project Manager will schedule and administer progress meetings throughout progress of the work at regular intervals, typically weekly, or more frequently if needed.
B. DBE Project Manager will make arrangements for meetings, prepare agenda and preside at meetings, record minutes, and distribute copies.
C. Attendance required: DBE Project Manager and District Representative, DBE Architect, Prime CONTRACTOR(s) Superintendent and Construction Project Manager.
D. Agenda:

1. Review minutes of previous meetings.
2. Review work progress.
3. Field observations, problems and decisions.
4. Identification of problems which impede planned progress.
5. Review of submittals' status and schedule of submittals.
6. Review of off-site fabrication progress and delivery schedules.
7. Maintenance of Progress Schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and workmanship standards.
12. Proposed changes and effect on progress schedule and coordination.
13. Other business appropriate to the status of the Project.

1.07 PRE-INSTALLATION MEETING

A. When required in individual Specification Sections, convene a pre-installation meeting prior to commencing work of the Section.
B. Require attendance of parties directly affecting, or affected by, work of the specific section, including but not limited to the DBE ARCHITECT, DBE Project Manager and District Representative, Project Inspector, CONTRACTOR, and affected sub-contractors, manufacturers and fabricators.
C. Notify DISTRICT and DBE ARCHITECT through DBE Project Manager at least five (5) days in advance of meeting date.
D. DBE Project Manager to prepare agenda, preside at conference, record minutes and distribute copies within four (4) days after conference to participants.
E. Review and discuss pre-installation conditions, preparation, installation procedures, coordination with related work, and orientation of Maintenance and Operations personnel.

F. DBE Project Manager shall record minutes and distribute copies within three days after meeting to participants and those affected by decisions made.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 32 20

CONSTRUCTION PROJECT SCHEDULE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section consists of furnishing a computerized, time scaled, Critical Path Method (CPM) Construction Schedule, showing in detail how the Contractors (known as Design Build Entity's) plan to execute and coordinate the Work and provide schedule updates and revisions.

B. The Contractor (DBE) shall employ the services of at least one full time scheduling consultant, fully qualified in P6 critical path scheduling on projects of similar size and complexity, for the duration of the Project. Any variation from the approach specified herein may be used only with the prior approval of the D-BE Project Manager and District Representative. Construction scheduling requirements are to be performed in order to provide the Contractor, D-BE Project Manager and District Representatives with the necessary scheduling services to mitigate any impacts, delays, or disruptions to construction progress by developing work-around schedules and/or recovery schedules as may be necessary. The scheduling consulting services will be included in the Contractor's scope and will be managed by the D-BE Project Manager and District Representative for the duration of the entire project.

C. The Contractor shall provide (using P6) all information as it pertains to the work of the project for development of the Master Construction Schedule in accordance with the requirements of this Article. The purpose of the Master Construction Schedule shall be to:

1. Assure adequate planning, scheduling, and reporting of all activities by all parties related to the execution of the Work by all Contractors for the duration of the Project.

2. Assure coordination of the Work by Contractor and their various Subcontractors, all tiers, and all other parties attendant to the successful execution of the Work.

D. Contractor's Schedule shall employ the Critical Path Method (CPM) using Primavera Project Planner 6 for the planning, scheduling, and reporting of the progress of the Work. Any variation from the approach specified herein may be used only with the prior approval of the D-BE Project Manager and District Representative.

E. Related items and Sections include the following:

1. Submittal Procedures.
2. Monthly construction schedule updates.
3. Weekly construction schedule reports.
4. Weekly schedule meetings.
5. Material location reports.
6. Field condition reports.
7. Special reports.
8. Division 1 Section “Phasing of the Work” for application of construction Work sequence recommended phases, milestones, and calendar constraints identified by Owner.
9. Division 1 Section "Project Coordination and Meetings" for submitting and distributing meeting and conference minutes.
10. Division 1 Section "Submittal Procedures" for submitting schedules and reports.
11. Division 1 Section "Quality Control" for submitting a schedule of tests and inspections.
12. Division 1 Section "Closeout Procedures" for Project Record Documents at Project closeout.

1.03 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times designated.

2. Predecessor activity is an activity that must be completed before a given activity can be started.

B. Calendar Days (CDS): The total number of days in a year (365). Project duration and milestone schedule are provided in calendar days, include weekends, and holidays.

C. CPM: Critical Path Method is a method of planning and scheduling a construction project where activities are arranged based on critical activity relationships. Network calculations determine when these activities can be performed and thereby establish the ”Critical Path” of Project.

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

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

F. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either District, D-BE Project Manager or Contractors, but is a jointly owned, expiring Project resource

available to both parties as needed to meet schedule milestones and the Contract completion date.

2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.

3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

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

H. Major Area: A story of construction, a separate building, or a similar significant construction element or portion.

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

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

1.04 SUBMITTALS

A. Assigned Scheduler's Qualification Data:

1. Years of experience.
2. A list of completed projects with project names and addresses.
3. The D-BE Project Manager and District Representative reserve the right to accept or reject any Scheduler the Contractor proposes. It will be incumbent on the Contractor to expediently provide a replacement Scheduler candidate, should the proposed Scheduler be rejected. The approval process will then start again.
4. Other information as requested.

B. Submittals Schedule: Submit three copies of the Submittals Schedule. Arrange the following information in a tabular format:
1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for Architect's and Construction Administrator's final release or approval.

C. Initial Construction Schedule: Submit two printed copies; one, a single sheet of reproducible media, and one, a print to each recipient.

D. Initial Network Diagram: Submit one P6 digital copy and two printed copies; one, a single sheet of reproducible media, and one, a print. Both large enough to show the entire network for entire construction period to each recipient.

E. Contractor's Preliminary CPM Construction Schedule (Schedule): Submit one P6 digital copy and two printed copies of the Schedule; one, a reproducible print and one, a color-line print. Both large enough to show entire schedule for the entire construction

period to each recipient. This Contractor to submit a preliminary CPM schedule to the D-BE Project Manager and District Representative for review within 14 days from Notice to Proceed. Once the preliminary schedule is reviewed and approved by the D-BE Project Manager and District Representative, Contractor to incorporate the submittal comments into the Baseline schedule.

F. Contractor's Baseline CPM Construction Schedule (Schedule): Submit one P6 digital copy and two printed copies of the Schedule; one, a reproducible print and one, a color-line print. Both large enough to show entire schedule for the entire construction period to each recipient. After the preliminary schedule is reviewed and approved by the D-BE Project Manager and District Representative, this Contractor is responsible to create the Baseline Schedule. Once approved, the baseline schedule will be updated monthly by this Contractor and their scheduling representative.

G. CPM Reports: Concurrent with CPM Schedule, submit one P6 digital copy and three printed copies of each of the following (1-4) computer-generated reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.

2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.

3. Total Float Report: List of all activities sorted in ascending order of total float.

4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

5. Monthly Summary Report: Written narrative of major activities that occurred in the past month, including milestones, problems, or delays, and out of sequence work.

H. Daily Construction Reports: Submit two copies at weekly intervals.

I. Material Location Reports: Submit two copies at weekly intervals.

J. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

K. Special Reports: Submit two copies at time of unusual event.

L. When Change Orders (including Bulletins or Proposed Change Orders) are initiated, delays are experienced, or the Contractor desires to revise their Construction Schedule, the Contractor shall submit to the D-BE Project Manager and District Representative a written narrative Time Impact Analysis illustrating the influence of each Change Order, delay, or Contractor request on the current Contract completion date. Such Time Impact Analysis shall clearly and completely show all activities,

means, methods, and measures proposed by the Contractor to recover the original schedule such that the Work is completed by the original Contract completion date, or as near to the original Contract completion date as is reasonable and feasible.

M. Each narrative Time Impact Analysis shall include a Fragmentary Network (Fragnet) demonstrating how the Contractor proposes to incorporate the Bulletin, Change Order, delay, or Contractor request into the Construction Schedule. The narrative Time Impact Analysis shall demonstrate the time impact based on the date the Change Order (including a Bulletin or Proposed Change Order) is given to the Contractor or the date the delay occurred, the status of construction at that point in time, and the event time computation of all affected activities. The event times used in the Time Impact Analysis shall be those included in the latest accepted Construction Schedule update or as adjusted by mutual agreement.

N. Activity delays shall not automatically mean that an extension of the Contract Time is warranted or due the Contractor. It is possible that a Change Order or delay will not affect existing critical activities or cause non-critical activities to become critical. A Change Order or delay may result in only absorbing a part of the available total float that may exist within an activity chain of the network schedule, thereby not causing any effect on the Contract completion date.

O. Float is not for the exclusive use or benefit of either the District or the Contractor. Contract Time extensions will be granted only to the extent the equitable time adjustments to the activity or activities affected by the Change Order or delay exceeds the total float of a critical activity (or path of activities) and extends the Contract completion date.

P. Four (4) copies of each narrative Time Impact Analysis shall be submitted within seven (7) calendar days after the commencement of a delay or the notice of direction for a Change Order (including a Proposed Change Order) is given to the Contractor.

Q. In cases where the Contractor does not submit a Time Impact Analysis within (14) calendar days, it is mutually agreed that the particular Change Order (including a Proposed Change Order), delay, or Contractor request does not require a Contract Time extension.

R. No extended overhead, general condition money, impact costs, out-of-sequence money, or any other type of compensation, by any name or characterization, shall be paid to the Contractor for delay to any activity not designated as a critical path item on the latest accepted Construction Schedule. If any delay occurs to any critical path item, such compensation shall only be payable to the Contractor in accordance with the terms and provisions of this Section 01310 and of the General Conditions.

1.05 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting.

B. Pre-scheduling Conference: Conduct conference at Project site to comply with requirements in Division 1. Review methods and procedures related to the Preliminary

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

1. Review software limitations, content, and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including work stages, interim milestones, and partial Owner occupancy.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review time required for review of submittals and re-submittals.
7. Review requirements for tests and inspections by independent testing and inspecting agencies.
8. Review time required for completion and startup procedures.
9. Review and finalize list of construction activities to be included in schedule.
10. Review submittal requirements and procedures.
11. Review procedures for updating schedule.

1.06 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities incorporating the scheduling and reporting the complete work scope of the project.

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

1. Secure time commitments for performing critical elements of the Work from all parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

C. Contractor’s construction schedule shall indicate the durations of the activities in his scope of work. Submit within the time specified in Section 011050 Phasing of the Work. The Contractor’s construction schedule will include submittal and procurement schedule for all material and equipment included within the scope of work of their respective scopes. Activity durations and milestones shall comply with the requirements established by the Preliminary Construction Master Schedule and the requirements of Section 011050 Phasing of the Work.

D. A Construction Schedule Meeting will be conducted on a monthly basis (separate from the weekly progress meetings) by the D-BE Project Manager and District Representative for the purpose of coordinating the sequence of work scope of the project for each Segment of work, and to coordinate durations required to complete the work within that Segment.

E. Contractor is responsible for providing P6 digital updates of their progress to the CM’s Scheduling Representative on a weekly basis to be incorporated in the Weekly Progress Schedule and Monthly updates.

1.07 GENERAL SCHEDULING REQUIREMENTS

A. The Contractor shall develop and maintain the Baseline CPM Construction Schedule (Schedule) for the scope of work contained in the Contract. The purpose of the Construction Schedule shall be to:
   1. Assure adequate planning, scheduling, and reporting during execution of the construction and related activities so they may be prosecuted in an orderly and expeditious manner, within the Contract Time and the Milestones stipulated by the Contract.
   2. Assure coordination of the work of the Contractor and the various subcontractors and suppliers at all tiers.
   3. Assist in the preparation and evaluation of the Contractor's monthly progress payments.
   4. Assist in monitoring the progress of the work and evaluating proposed changes to the Contract and the Construction Schedule; and,
   5. Assist in detecting problems for the purpose of taking corrective action and to provide a mechanism or tool for determining and monitoring such corrective actions.

B. The Work shall be prosecuted such that it will insure meeting the specified Project Milestones and meet the Contract Time. By execution of the Contract, the Contractor represents he has analyzed the work, the materials and methods involved, the systems of the building, availability of qualified labor, restrictions of the site, constraints imposed, their own workload and capacity to perform the work, and agrees that the specified times are reasonable considering the existing conditions prevailing in the locality of the work, including weather conditions, and other factors, with reasonable allowance for variations from average or ideal conditions.

C. The work under this Contract will be planned, scheduled, executed, and reported using the Precedence Diagraming Technique of the Critical Path Method (hereinafter referred to as CPM).

D. The Contractor shall employ a Scheduling Manager (not the Project Manager, Project Engineer, Foreman or Superintendent) fully qualified in critical path scheduling of projects of similar size and scope for the duration of the Contract.

E. Any and all milestones listed in these specifications, or elsewhere in the Contract Documents, represent only the major items of construction work. The milestone completion dates indicated are considered essential to the satisfactory performance of this Contract and to the coordination of all work on the project. The D-BE Project Manager and District Representative reserves the right to require the Contractor to prosecute the work in accordance with the specified milestone dates.

PART 2 - PRODUCTS

2.01 SUBMITTALS SCHEDULE

A. Contractor shall provide one full version license of Primavera Project Planner 6 to be installed and used by the D-BE Project Manager and District Representative. Software

to be installed on a computer as specified under Construction Facilities Attachment A and be used by the D-BE Project Manager and District Representative.

B. Contractor shall provide a minimum of sixteen hours of hands-on P6 training in Primavera P6 for the D-BE Project Manager and District Representatives. Training to cover; creating a project, add activities and relationships, adjusting the schedule to reflect actual project conditions.

C. Contractor shall submit a Schedule of Submittals, arranged in chronological order by dates required by the Construction Schedule. Include time required for review of minimum 14 to maximum 30 calendar days, re-submittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

2.02 PRELIMINARY CONSTRUCTION SCHEDULE

A. The Contractor shall use Primavera (P6) scheduling software. With each schedule submittal, Contractor shall provide electronic copies of the P6 schedule files on a flash drive to include the entire schedule with back-up files. PDF's of the schedule are acceptable for historical record only.

B. Within fourteen (14) calendar days after the date of the Notice to Proceed to the Construction Services Phase of the project, the Contractor shall submit for the D-BE Project Manager and District Representative's review and acceptance a Preliminary Baseline Schedule. This schedule shall show the general plan for the work to be completed in the first ninety (90) calendar days of the Agreement and list the major milestones for the remaining calendar days. Indicate each significant activity separately and identify the first workday of each week with a continuous vertical line. Include a Summary Bar diagram for the remainder of the Work showing major milestones and summary activities with a cash requirement prediction based on required activities.

C. The Preliminary Baseline Schedule shall define milestones for the Construction Phase of the Project. The milestones shall include, but are not limited to:
1. NOTICE TO PROCEED.
2. Start Construction.
3. Groundbreaking Ceremony.
4. Approve Construction Baseline Schedule.
5. Obtain Licenses, Fees, Permits.
6. Temporary Power Available.
7. D-BE Project Manager and District Representatives On-Site Field Office set-up and available for use.
8. Complete Mass Grading, Import, and Compaction (65 cds from Notice to Proceed).
9. Facility Watertight.
10. Permanent Power Available.
11. All Utilities Available (400 cds from Notice to Proceed).
12. Start Functional Testing.
13. Start FFE & MSF Installation (500 cds from Notice to Proceed).
14. Start Training and Demonstrations, closeout.
15. Complete commissioning.
16. Completion of Work (548 cds from Notice to Proceed).

D. Proposed Procurement Activities to be accomplished during the first ninety (90) calendar days of the Contract.
   1. Procurement activities shall include mobilization, major shop drawing and sample submittals and the fabrication and delivery of key and long-lead procurement elements and shall indicate intended submittal, review and approval, and realistic delivery dates for fabrication and delivery activities.
   2. Procurement activities shall later be incorporated into the Detailed Construction Baseline Schedule (discussed hereinafter) including all requested revisions.

E. Proposed Construction Activities to be accomplished during the first ninety (90) calendar days of the Contract.
   1. Activity durations shall be in units of whole calendar days and shall be limited to a maximum of twenty-one (21) calendar days for each activity.
   2. Construction activities shall later be incorporated into the Detailed Construction Baseline Schedule (discussed hereafter) including all requested revisions.

F. Summary Activities not included above which are necessary to properly indicate:
   1. The approach to scheduling the remaining work areas or phases of the work. The work for each phase or area must be represented by at least one summary activity such that they cumulatively indicate the entire Construction Baseline Schedule.
   2. The duration for each summary activity shall be shown on the Preliminary Schedule.

G. The Preliminary Construction Schedule shall be updated on a monthly basis while the Detailed Final Construction Baseline Schedule is being developed. The monthly updating of the Preliminary Construction Schedule shall be consistent with the procedures and requirements described in the “Schedule Updating” section of this specification section.

H. Within seven (7) calendar days after receipt by the D-BE Project Manager and District Representative (CM) of the Preliminary Construction Schedule, the CM shall make recommendations to the Contactor as to adjustments to the Preliminary Construction Schedule. These recommendations, if accepted by both the CM and Contractor, will be incorporated into the development of the Detailed Final Construction Baseline Schedule. The Contractor shall provide a response to the concerns of the CM, to the satisfaction of the CM, before the submittal of the Detailed Final Construction Baseline Schedule.

2.03 CONSTRUCTION BASELINE SCHEDULE

A. Within sixty (60) calendar days after receipt of the Contract Award, Contractor shall submit four (4) copies of its Network CPM Baseline Schedule to the D-BE Project Manager and District Representative. The schedule shall cover the entire Contract Time and shall be neatly organized and be displayed on a time scale from left to right on legal size or larger size sheets. The Contractor's schedule shall consist of, but is not limited to, the following:
   1. Design Phase and Permitting
   2. Mobilization
   3. Construction and temporary facilities

4. Procurement activities including: shop drawings and sample submittals, approval, and realistic fabrication/delivery dates of key and long-lead procurement elements, and all deferred approval items.
5. Construction activities
6. Permanent Power
7. All Utilities Available
8. Start-up and testing activities
9. Owners FF&E Installation and MSF
10. Contractor's pre-punch, owners Punch List, and Punch List correction activities by building, floor, and areas of the site work.
11. Completion of Work

B. The proposed Detailed Final Baseline Construction Schedule shall conform with the requirements outlined in the in this specification section.

C. The proposed Detailed Final Baseline Construction Schedule shall be reviewed in the following manner:

1. Within fourteen (14) calendar days after receipt by the D-BE Project Manager and District Representative of the proposed Detailed Final Baseline Construction Schedule, the D-BE Project Manager and District Representative shall notify the Contractor of any concerns the D-BE Project Manager and District Representative may have in regard to the Schedule.

2. If the D-BE Project Manager and District Representative questions the Contractor's proposed activities, logic, durations, or manpower, the Contractor shall, within seven (7) calendar days after receipt of the D-BE Project Manager and District Representative's request, provide a satisfactory revision to, or adequate justification for, these activities, logic, durations, or manpower, to the satisfaction of the D-BE Project Manager and District Representative.

3. In the event the Contractor fails to define any element of work, activity or logic and the D-BE Project Manager and District Representative review does not detect this omission or error, such omission or error, when discovered by the Contractor or D-BE Project Manager and District Representative, shall be corrected by the Contractor at the next monthly Schedule Update and or weekly progress meeting, (discussed hereinafter) and shall not affect the Contract Time.

D. Upon the acceptance of the changes to the proposed Detailed Final Baseline Construction Schedule by the D-BE Project Manager and District Representative, the Contractor and D-BE Project Manager and District Representative shall demonstrate their mutual acceptance by signing the front of the Detailed Final Baseline Construction Schedule.

E. Upon acceptance, the construction schedule shall be utilized as a BASELINE SCHEDULE for evaluation of all work yet to be performed.

F. No accepted activity shall be deleted from the Detailed Final Baseline Construction Schedule. In the event that an activity is no longer appropriate to the plan, either by change order or otherwise, it shall be statused with "zero duration."

G. Acceptance by the D-BE Project Manager and District Representative of the Contractor's Detailed Final Baseline Construction Schedule will be a condition precedent to the making of any progress payments under the Contract after the first ninety (90) calendar days of the Contract.

H. Acceptance by the D-BE Project Manager and District Representative of the Contractor's Detailed Final Baseline Construction Schedule does not relieve the Contractor of any of Contractor's responsibility whatsoever for the accuracy or feasibility of the Detailed Construction Schedule, or of the Contractor's ability to meet the Contract completion date or milestone dates, nor does such acceptance acknowledge or admit the reasonableness of the activities, logic, or durations of the Contractor's Detailed Final Baseline Construction Schedule.

I. Project Duration: All Work shall be completed within 485 consecutive calendar days from the Notice to Proceed. All project milestones shall be completed within the project duration and a 30-day abnormal weather allowance shall be included within the project duration. Should any portion of the Work not be completed within this timeframe, Liquidated Damages shall apply. The Contractor shall pay to the District the sum of $2,500.00 per calendar day for each and every calendar day delay in achieving the Completion of Work milestone under the Contract beyond the Contract Time.

J. Weather: Abnormal Weather shall be anticipated by the Contractor and this contract shall include an allowance of 30 days for abnormal weather conditions. Contractor must provide documentation in accordance with the Specifications that any claims for delays caused by weather are abnormal compared to historical weather statistics for the project location. The allowance time for Abnormal Weather shall be completed within the Completion of Work milestone.

K. The following shall be depicted on the schedule for each activity:

1. Activity ID numbers – the Contractor shall utilize either numeric or alpha-numeric designations to identify each and every activity.
2. Activity Duration: Define activities so no activity is longer than 20 days with the exception of non-construction activities, including mobilization, shop drawing and sample submittals and fabrication/delivery of materials and equipment.
3. A location code referencing the building and/or floor numbers, site preparation, underground installations, site finishes, etc. to be used for the grouping (banding) of the schedule.
4. Startup and Testing Time: Include not less than 14 days for startup and testing.
5. There may be only one critical path for the project on the baseline schedule.
6. Final Completion: Indicate Construction Completion in advance of date established for Final Completion and allow time for Construction Administrator's administrative procedures necessary for certification of Final Completion.

L. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on the schedule by phase.

2. Owner: Include one float day to be used by the District.

3. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
   a. Subcontract awards.
   b. Submittals.
   c. Purchases.
   d. Mockups.
   e. Fabrication.
   f. Sample testing.
   g. Deliveries.
   h. Installation.
   i. Tests and inspections.
   j. Adjusting.
   k. Curing.
   l. Startup and placement into final use and operation.

M. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Submittals, Complete Mass Grading and Over-Excavation, All Utilities Available, FF&E and MSF, Substantial Completion, Construction completion, Punch, and Final Completion of Work.

N. Contract Modifications/Change Order: For each proposed Contract Modification/Change Order and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule, if time is affected. The absence of a time impact analysis will confirm that there is no anticipated time impact to the change.

O. If the D-BE Project Manager and District Representative or District questions the Contractor's proposed activities, logic, or durations, the Contractor shall, within fourteen (14) calendar days of receipt of the D-BE Project Manager and District Representative request, provide a satisfactory revision to, or adequate justification for, the activities, logic, or durations to the satisfaction of the D-BE Project Manager and District Representative.

P. The schedule shall include one float day to be used by the District for the purpose of a Groundbreaking Ceremony. No other work shall be scheduled this day.

2.04 DESIGN AND CONSTRUCTION SCHEDULE UPDATING

A. The Construction Schedule shall be updated on a weekly basis throughout the entire Design and Construction Services Phase of the Contract duration. Contractor’s representative and Scheduling representative shall meet with the D-BE Project Manager and District Representative monthly during the design phase and each week during construction at a mandatory Schedule Update Meeting to review actual progress made through the data date of the Schedule, including the dates that activities started or finished, the percentage of Work completed, and remaining duration for each activity in progress.

B. In case of disagreements at the Schedule Update Meeting concerning actual progress to date, the D-BE Project Manager and District Representative determination shall govern.

C. Upon completion of the Schedule Update Meeting, the Contractor, based upon the D-BE Project Manager and District Representative input, will correct the Construction Schedule to reflect progress as of the date of the schedule update and any agreed-upon changes to the Construction Schedule.

D. Each weekly Construction Schedule update shall be forwarded to the D-BE Project Manager and District Representative and will include four (4) copies of the following:

1. Prints of the updated schedule indicating the progress made up to the date of the schedule update and indicating any revisions to the schedule.

2. The computer-produced schedule update shall include the same information, and be prepared in the same format, as described under article 2.2 and 2.3 Baseline Schedule.

3. A narrative report is required with the schedule update submittals to define problem areas, anticipated delays, and any impact on the Construction Schedule. The report shall also identify any corrective action taken, or proposed actions to be taken, and the effect of that action on the schedule.

4. The weekly updating of the Construction Schedule shall be an integral part and basic element of the percentage of completion estimate upon which progress payments will be made. If, in the judgment of the D-BE Project Manager and District Representative, the Contractor fails or refuses to provide information required to accomplish a complete Construction Schedule update or revision, as specified hereinafter, the Contractor shall be deemed to have not provided the required estimate upon which progress payment may be made, and shall not be entitled to progress payments until it has furnished the information necessary for a complete a schedule update to the satisfaction of the D-BE Project Manager and District Representative.

5. At each weekly meeting, the Contractor shall prepare a four-week Look Ahead Schedule referencing the CPM schedule activities and shall show one (1) week of actual and three (3) weeks of forecasted progress. The schedule shall be used as a basis for discussing progress and Work planned during the following three (3) weeks.

6. The Contractor shall submit a four-week Look Ahead Schedule to the CM, 48 hours prior to the weekly meeting date.

7. The schedule option setting to be utilized in the automated scheduling system is "Progress Override" versus "Retained Logic", and the float calculation as "Most Critical" versus "Finish Float". Any variation to this setting requires justification, and then approval by the District.

2.05 CONSTRUCTION SCHEDULE REVISIONS

A. Updating the Construction Schedule to reflect actual progress made up to the date of a schedule update shall not be considered revisions to the Construction Schedule.

B. If, as a result of the weekly schedule update, it appears the Construction Schedule no longer represents the actual prosecution and progress of the Work, the D-BE Project Manager and District Representative will request, and the Contractor shall submit, a revision to the Construction Schedule.

C. The D-BE Project Manager and District Representative may also request revisions to the Construction Schedule in the event the Contractor's planning for the Work is revised. If the Contractor desires to make changes in the Construction Schedule to reflect revisions in its method of operating and scheduling of the Work, the Contractor shall describe the revision(s) in its narrative report, stating the reason for the proposed revision.

PART 3 - EXECUTION

3.01 RESPONSIBILITY FOR COMPLETION

A. Contractor shall furnish sufficient forces, offices, facilities, and equipment, and shall work such hours including night shift and overtime operations, as necessary to ensure the prosecution of the Work in accordance with the current monthly Construction Schedule update. If, in the opinion of the D-BE Project Manager and District Representative, the Contractor falls behind in meeting the Construction Schedule as presented in the current monthly schedule update, the Contractor shall take such steps as may be necessary to improve its progress, and the D-BE Project Manager and District Representative may require it to increase the hours of work, the number of shifts, overtime operations, and/or the amount of construction plant and equipment without additional cost to the District. The provisions of this paragraph shall not be construed as prohibiting work on Saturdays, Sundays, and holidays, if the Contractor so elects and gives advanced notice as required by the Contract documents and obtains all necessary approvals to do so.

B. Failure of the Contractor to comply with the requirements of this subsection shall be a basis for determination by the D-BE Project Manager and District Representative that the Contractor is not prosecuting the Work with such diligence as will ensure completion within the Contract Time. Upon such determination, the District may terminate the Contractor’s right to proceed with the Work or any separable part thereof, in accordance with the provisions of the General Conditions, or may take such other actions as may be deemed appropriate.

C. The D-BE Project Manager and District Representative may elect throughout or at any time during the Project to record the number of workers and construction equipment working on each schedule activity in each area of the Project and give a copy of this log to the Contractor who shall be responsible for advising the D-BE Project Manager and District Representative, without additional cost to the District, of any error in this work history, in writing, within seven (7) calendar days of receipt of same. This information will be used by the D-BE Project Manager and District Representative in its evaluation of the adequacy of the Contractor’s performance and on-site manpower staffing, as well as in the evaluation of any Contractor claims.

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittal Procedures
B. Shop Drawing Submittals
C. Product Data Submittals
D. Samples Submittals
E. Manufacturers' Instruction Submittals
F. Manufacturers' Certificate Submittals
G. Coordination Drawing Submittals
H. City of Rancho Cucamonga Fire Department Deferred Approvals

1.02 ARCHITECT'S DIGITAL DATA FILES

A. ARCHITECT is defined as DBE Architect of Record.

B. Upon written request ARCHITECT's electronic CAD files will be provided for use in connection with preparation of shop drawings subject to the acceptance of the ARCHITECT's standard terms and conditions for electronic file transfer.

1.03 SUBMITTAL PROCEDURES

A. Provide submittals wherever required by other sections. Transmit each submittal in conformance with requirements of this section.

B. Assemble complete submittal package in a single indexed Portable Document Format (PDF) file with transmittal form prescribed by the DBE Project Manager and District Representative.

C. Each submittal shall identify the Project, the submittal number, the CONTRACTOR, the subcontractor or material supplier; pertinent Drawing and detail number(s), specification Sections, as well as name and telephone number of individual who may be contacted for further information.

D. Provide links enabling navigation to each item of submittal package.

E. Transmit electronic submittals as PDF files via the approved document management site or as instructed by DBE Project Manager and District Representative. Provide six (6) hard copies of each submittal when requested by the ARCHITECT, DBE Project Manager, and District Representative.

F. Determine and verify all field dimensions and conditions, materials, catalog numbers and similar data.

G. Provide space for CONTRACTOR, ARCHITECT and DBE Project Manager and District Representative review stamps.

H. Apply CONTRACTOR's dated stamp with CONTRACTOR's original signature or initials, certifying that review, verification of Products, field dimensions, adjacent construction Work and coordination of information is in accordance with the requirements of the Work and Contract Documents. Stamped signatures or initials are not acceptable.

I. Each subcontractor shall submit all shop drawings, samples and manufacturer's descriptive data for the review of the DISTRICT, the CONTRACTOR and the ARCHITECT through the CONTRACTOR. By submitting shop drawings, product data and samples, the CONTRACTOR represents that it has determined and verified all materials, field measurements, catalog numbers, related field construction criteria, and other relevant data in connection with each such submission, and that it has checked, verified and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

J. Identify clearly, on the submittal and the transmittal form, any changes or variations from the Contract Documents. State effect of changes on Construction Progress Schedule and changes required in other Work or products (including "no effect"). Any change not so noted, even though stamped reviewed, will not be considered approved. Specific written approval by the ARCHITECT must be provided for any deviation from the Contract Documents.

K. At the time of submission, any deviation in the shop drawings, product data or samples from the requirements of the Contract Documents shall be narratively described in a transmittal accompanying the submittal. However, submittals shall not be used as a means of requesting a substitution, the procedure for which is defined in section "Substitutions."

L. Coordinate as required with all trades and all public agencies involved.

M. Unless otherwise specifically authorized by ARCHITECT, make all submittals in groups containing all associated items. ARCHITECT may reject partial submittals as not complying with the provisions of this section.

N. As used herein, the term "manufactured" applies to standard unit usually mass-produced, and "fabricated" means items specifically assembled or made out of selected materials to meet individual design requirements.

O. Any submission, which in ARCHITECT's opinion is incomplete, contains numerous errors, or has been checked only superficially will be returned un-reviewed by the ARCHITECT for resubmission by the CONTRACTOR.

P. Revise and resubmit submittals as required; identify all changes made since previous submittal. Re-submittals to include all associated items for a complete submittal. Professional services required for more than one (1) re-review of

required submittals of shop drawings, product data, or samples are subject to charge to the CONTRACTOR pursuant to Section 00 70 00 General Conditions, Paragraph 4.4.

Q. Approval Prior to Commencement of Work. No portion of the Work requiring a shop drawing or sample submission shall be commenced until the submission has been reviewed by DISTRICT and approved by ARCHITECT unless specifically directed in writing by the DISTRICT. All such portions of the Work shall be in accordance with approved shop drawings and samples.

1.04 SCHEDULES FOR SUBMITTALS

A. Schedule submittals in accordance with the Construction Progress Schedule, far enough in advance of scheduled dates of installation to provide required time for the review and approval process, including possible revision and re-submittal and for placing orders and securing delivery.

B. Within five (5) days from the Notice to Proceed, or in accordance with the Project Schedule, whichever is sooner, submit to the DBE Project Manager and District Representative, the ARCHITECT for review and acceptance a “Schedule for Submission of Shop Drawings, Product Data, and Samples” (“Submittal Schedule”) listing all submittals with planned dates of submission and return approved.

C. CONTRACTOR shall obtain and shall submit all required shop drawings and samples in accordance with CONTRACTOR’S “Schedule for Submission of Shop Drawings, Product Data, and Samples” as required in Division 1 of the Specifications with such promptness as to cause no delay in its own Work or in that of any other CONTRACTOR or subcontractor but in no event later than thirty-five (35) calendar days after the Notice of Award for Product Data and Samples, and sixty (60) calendar days after the Notice of Award for Shop Drawings, unless noted otherwise. No extensions of time will be granted to CONTRACTOR or any subcontractor because of its failure to have shop drawings and samples submitted in accordance with the schedule.

D. Submittal Schedule will be incorporated into the Construction Progress Schedule. Update and submit revised schedule not less often than monthly.

E. Architect will respond and return submittals to Contractor within fifteen working days of receipt. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 5 working days. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 25 working days. For the purpose of establishing the start of the mandated response period, submittals received after 12:00 noon will be considered as having been received on the following regular working day. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

1.05 SHOP DRAWINGS

A. Shop Drawings shall include fabrications and installation drawings, erection, layout and setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:

1. Dimensions.
2. Identification of products and materials included.
3. Compliance with specified standards.
4. Notation of coordination requirements.
5. Notation of dimensions established by field measurement.

B. CONTRACTOR shall obtain and submit with the shop drawings all seismic and other calculations and all product data from equipment manufacturers.

C. Shop drawings shall establish the actual detail of all manufactured or fabricated items, indicate proper relation to adjoining work, amplify design details of mechanical and electrical systems and equipment in proper relation to physical spaces in the structure, and incorporate minor changes of design or construction to suit actual conditions.

D. Shop drawings, for each section of the Work, shall be numbered consecutively, and the numbering system shall be retained throughout all revisions. Each drawing shall have a clear space for the stamps of ARCHITECT and CONTRACTOR. Only shop drawings required to be submitted by the Contract Documents shall be reviewed. All submittals are to be forwarded to the DISTRICT.

E. Sheet Size: Except for templates, patterns and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 inch x 11 inch, but not larger than 30 inch x 42 inch.

F. Stamp: Review by DISTRICT and ARCHITECT shall not relieve the CONTRACTOR or any subcontractor from its responsibility in preparing and submitting proper shop drawings in accordance with the Contract Documents. CONTRACTOR'S review and approval of shop drawings shall include the following stamp:

"The Contractor has reviewed and approved the construction criteria and has also made written notation regarding any information in these shop drawings that does not conform to the Project Contract Documents. The Contractor shall verify actual dimensions. This shop drawing has been coordinated with the Contract Documents, and all other Shop Drawings within this Contractor's scope of work. The duty of coordination has not been delegated to the Contractor's subcontractors, material suppliers, the Architect or the Engineers."

G. Review Process: Make initial submittal of five (5) copies and one reproducible of each shop drawing. Comments or corrections will be noted on the reproducible and returned to the CONTRACTOR.

H. If re-submittal is required, the CONTRACTOR shall make any corrections required by ARCHITECT and shall resubmit as required by ARCHITECT the required number of corrected copies of shop drawings or new samples until approved. CONTRACTOR shall direct specific attention in writing or on

resubmitted shop drawings to revisions other than the corrections required by the ARCHITECT on previous submissions.

I. ARCHITECT will stamp or note drawings as follows:

1. “NO EXCEPTION TAKEN” indicating that construction or fabrication may proceed.
2. “MAKE CORRECTIONS NOTED” indicating that no re-submittal is required contingent upon corrections being made.
3. “REJECTED” or “REVISE & RESUBMIT” indicating that corrections shall be made and drawings resubmitted for review.

After the final review, the CONTRACTOR shall copy and distribute the stamped drawings to the ARCHITECT.

J. In reviewing shop drawings, the ARCHITECT will not verify dimensions and field conditions. The ARCHITECT will review and approve shop drawings, product data and samples for aesthetics and for conformance with the design concept of the Work and the information given in the Contract Documents. The ARCHITECT’s review shall neither be construed as a complete check nor relieve the CONTRACTOR, 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 the CONTRACTOR has, in writing, called the ARCHITECT’s attention to the deviations at the time of submission. The ARCHITECT’s review shall not relieve the CONTRACTOR or subcontractors from responsibility for errors of any sort in shop drawing or schedules, for proper fitting of the Work or from the necessity of furnishing any Work required by the Contract Documents, which may not be indicated on shop drawings when reviewed. CONTRACTOR and subcontractors shall be solely responsible for any quantities, which may be shown on the shop drawings.

K. The ARCHITECT's review of shop drawings shall not relieve the CONTRACTOR of responsibility for any deviation from the requirements of the Contract Documents unless the CONTRACTOR has informed the ARCHITECT in writing of such deviation at the time of submission and the ARCHITECT has given written acceptance to the specific deviation. The ARCHITECT's favorable review shall not relieve the CONTRACTOR from responsibility for errors or omissions in the shop drawings.

L. The ARCHITECT's favorable review of a separate item shall not indicate acceptance of an assembly in which the item functions.

M. No portion of work requiring shop drawings shall be commenced until the shop drawings have been returned with a favorable review by the ARCHITECT.

N. ARCHITECT’s CAD Drawings: The CONTRACTOR may request the use of the ARCHITECT’s computer-generated drawings for use in preparing shop drawings. The CONTRACTOR must assume all liability for the accuracy and completeness of the shop drawings so prepared, and must hold the ARCHITECT harmless. The

request must be in writing to the ARCHITECT, specifying the format and media requested.

1.06 PRODUCT DATA

A. Product Data includes manufacturers' standard drawings, schedules, performance charts, diagrams, brochures, catalogs, certificates of conformance, substantiating calculations, instructions, and similar relevant data as specified in individual Specification sections.

B. Submit six (6) copies loose-leaf in binders, to facilitate copying of individual sheets. Provide the CONTRACTOR's stamp on the cover sheet of each submittal.

C. Mark each copy to identify applicable products, models, options and other data. Supplement manufacturers' standard data to provide information unique to this Project.

D. Review process, corrections, final distribution, and other conditions shall be similar to that for Shop Drawings.

1.07 SAMPLES

A. The term "samples" as used herein are physical examples furnished by CONTRACTOR to illustrate materials, equipment or quality and includes natural materials, fabricated items, equipment, devices, appliances or parts thereof as called for in the Specifications, and any other samples as may be required by the ARCHITECT to determine whether the kind, quality, construction, finish, color and other characteristics of the materials, etc., proposed by the CONTRACTOR conform to the required characteristics of the various parts of the Work. All Work shall be in accordance with the approved samples.

B. Submit samples to illustrate functional and aesthetic characteristics of the material or other product with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

C. Submit samples from the full range of manufacturers' standard or custom colors, textures and patterns, as specified in individual specification sections. ARCHITECT may select from any range submitted at no additional cost to DISTRICT.

In case a considerable range of color, graining, texture, or other characteristics may be anticipated in finished products, a sufficient number of samples of the specified materials shall be furnished by the CONTRACTOR to indicate the full range of characteristics, which will be present in the finished products; and products delivered or erected without submittal and approval of full range samples shall be subject to rejection. Except for range samples and unless otherwise called for in the various sections of the specifications, samples shall be submitted in duplicate.

D. All samples shall be marked, tagged or otherwise properly identified with the name of the submitting party, the name of the project, the purpose for which the samples are submitted and the date and shall be accompanied by a letter of transmittal containing similar information, together with the specification section number for identification of each item. Each tag or sticker shall have clear space for the review stamps of CONTRACTOR and ARCHITECT.

Samples of materials, which are generally furnished in containers bearing the manufacturers descriptive labels and printed application instructions, shall, if not submitted in standard containers, be supplied with such labels and application instructions.

E. Submit a minimum of six (6) samples or as specified in individual sections of the specifications.

F. Review process, corrections, final distribution, and other conditions shall be similar to that for Shop Drawings.

G. Maintain at the Site approved samples. Samples shall be available to the ARCHITECT and shall be delivered to the ARCHITECT for delivery to the DISTRICT upon completion of the Work.

1.08 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting and finishing in quantities specified for Product Data. (This is in addition to instructions for training, operation and maintenance required as part of the Contract Close-out Procedures.)

B. Review process, corrections, copies, final distribution, and other conditions shall be similar to that for Shop Drawings

1.09 MANUFACTURER'S CERTIFICATES

A. When specified in individual specification sections, submit manufacturers' certificates to ARCHITECT for review in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product, but must be acceptable to ARCHITECT.

D. Review process, corrections, final distribution, and other conditions shall be similar to that for Shop Drawings.

1.10 COORDINATION DRAWINGS

A. The CONTRACTOR shall prepare and submit for review Coordination Drawings of all major spaces. Coordination Drawings indicate routing, locations, sizes, types and numbers of components for each class of work in concealed spaces where potential conflict may occur between structures, mechanical, electrical, fire sprinklers, communications and ceiling suspension systems. They include both plans and section drawings. (See also the General Requirements Section “PROJECT COORDINATION & MEETINGS.”)

B. Show all systems components, including plan locations of all ceiling penetrations and surface-mounted items. Provide cross sections wherever necessary to indicate proper support of ceilings and noninterference with work of other sections of the specifications. Cross sections shall indicate coordination required and proposed solutions for routing of elements where potential conflict exists.

C. Drawings shall be based on field measurements, shop drawings and product data. They shall be prepared early enough to allow time to identify and resolve conflicts without delaying the progress of the Work. Conflicts shall be brought to ARCHITECT's attention immediately, together with CONTRACTOR’s recommendations for resolution.

D. Submit the Coordination Drawings in a scale of not less than 1/8" = 1' - 0," with necessary sections and profiles at an appropriate, clearly readable enlarged scale. Submit the coordinated drawings as one reproducible and two prints.

E. The ARCHITECT will review the submittals, make appropriate notations and comments to ensure the solutions meet the intent of the Contract Documents, and then return to CONTRACTOR for implementation.

F. It shall be the responsibility of the CONTRACTOR to assure that all fabricators and installers of work involved in the Coordination Drawings be informed, consulted and advised in sufficient advance time to arrive at solutions where no extension of contract time or extra cost to the DISTRICT will be involved.

1.11 DEFERRED APPROVALS

A. Installation of deferred approval items shall not be started until detailed plans, specifications and engineering calculations have been accepted and signed by the ARCHITECT or Engineer in responsible charge of design and signed by a California registered ARCHITECT or Professional Engineer who has been delegated responsibility covering the work shown on a particular plan or specification, and the design has been approved by the City of Rancho Cucamonga and ARCHITECT. Deferred approval items for this project are the following:

1. Complete Fire Sprinkler Design.
2. Complete Fire Alarm System
3. Any additional systems identified within the contract documents.

B. Deferred approval drawings and specifications become part of the approved documents for the project when they have been approved by the City of Rancho Cucamonga and ARCHITECT.

C. Submit one (1) reproducible transparency and six (6) prints of each drawing.

D. Submit six (6) copies of calculations, product data and test reports.

E. Identify and specify all supports, fasteners, spacing, penetrations, etc. for each of the deferred approval items, including calculations for each and all fasteners.

F. Submit documents to the ARCHITECT for review prior to submitting to the City of Rancho Cucamonga. Submission shall be made within 35 days of the award of contract.

G. Documents shall bear the stamp and signature of the Structural, Mechanical, or Electrical Engineer licensed in the State of California who is responsible for the Work shown on the documents.

H. ARCHITECT will submit the documents as appropriate to the Project Structural, Mechanical and Electrical Engineers for review. Their review shall only be for conformance with the design intent shown in the Contract Documents.

J. After review by ARCHITECT, forward submittal to the City of Rancho Cucamonga for approval, with copy of the transmittal to the DISTRICT.

K. Respond to review comments made by the City of Rancho Cucamonga and revise and resubmit submittal to City of Rancho Cucamonga for final approval. Provide copies of the City of Rancho Cucamonga approved documents to the ARCHITECT, DBE Project Manager and District Representative.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 34 00

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Preparation and implementation, including reporting and documentation, of a Waste Management Plan for reusing, recycling, salvage or disposal of non-hazardous waste materials generated during demolition and/or new construction (Construction & Demolition (C&D) Waste), to foster material recovery and re-use and to minimize disposal in landfills.

B. Related Sections

1. Section 01 33 00: Submittals
2. Section 01 50 00: Construction Facilities and Temporary Controls
3. Section 01 77 00: Closeout Procedures

1.02 REFERENCES

A. California Integrated Waste Management Act of 1989 (AB 939)

B. California Code of Regulations Title 14, Section 18700 et seq.

1.03 SYSTEM DESCRIPTION

A. Collection and separation of all C&D waste materials generated on-site, reuse or recycling on-site, transportation to approved recyclers or reuse organizations, or transportation to legally designated landfills, for the purpose of recycling salvaging and/or reusing a minimum of 75% of the C&D waste generated.

1.04 SUBMITTALS

A. C&D Waste Management Plan (Exhibit 1): Within 10 calendar days after the Notice to Proceed and prior to any waste removal, submit the following to the DISTRICT for review and approval. Update quarterly. Include:

1. Materials to be recycled, reused, or salvaged, either onsite or offsite.
2. Estimates of C&D waste quantity (in tons) by type of material. (If waste is measured by volume, give factors for conversion to weight in tons.)
3. Procedures for recycling/ reuse program.
4. Permit or license and location of Project waste-disposal areas.
5. Site plan for placement of waste containers.

B. C&D Waste Management Monthly Progress Report (Exhibit 2): Summary of waste generated by Project, monthly with Application for Payment. Include:

1. Firms accepting the recovered or waste materials.
2. Type and location of accepting facilities (landfill, recovery facility, used materials yard, etc.). If materials are reused or recycled on the Project site, location should be designated as “on-site reuse / recycling”.
3. Type of materials and net weight (tons) of each.

4. Value of the materials or disposal fee paid.

5. Attach weigh bills and other documentation confirming amount and disposal location of waste materials.

C. C&D Waste Management Final Compliance Report: Final update of Waste Management Plan to provide summary of total waste generated by Project.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.01 IMPLEMENTATION

A. Implement approved Waste Management Plan including collecting, segregating, storing, transporting and documenting each type of waste material generated, recycled or reused, or disposed in landfills.

B. Designate an on-site person to be responsible for instructing workers and overseeing the sorting and recording of waste/ recyclable materials.

C. Include waste management and recycling in worker orientation and as an agenda item for regular Project meetings.

D. Recyclable and waste bin areas shall be limited to areas approved on the Waste Management Plan. Keep recycling and waste bins neat and clearly marked to avoid contamination of materials.

3.02 ATTACHMENTS

A. Exhibit 1: Waste Management Plan

B. Exhibit 2: Waste Management Monthly Progress Report.

EXHIBIT 1

WASTE MANAGEMENT PLAN
CONSTRUCTION/ MAINTENANCE/ALTERATION & DEMOLITION PROJECTS

PROJECT NAME: **911 Memorial Park**
PROJECT NO: **NONE**
NAME OF COMPANY:
CONTACT PERSON:
TELEPHONE:
PROJECT SITE LOCATION:
PROJECT TYPE: ☐ NEW CONSTRUCTION ☐ DEMOLITION
☐ MAINTENANCE/ALTERATION PROJECTS
PROJECT SIZE (SQ. FT.):
DATE & ESTIMATED PERIOD

(1) Material Type	(2) Tons Estimated Recycle	(3) Tons Estimated Reuse	(4) Tons Estimated Salvage	(5) Tons Estimated Landfill	(6) Proposed Disposal or Recycling Facility (e.g., Onsite, Name of Facility)
Total					
Diversion Rate: Columns [(2)+(3)+(4)] / [(2)+(3)+(4)+(5)]					**=**

Signature	Title	Date

Column 1 "Material Types" – Enter type of materials targeted for recycling, reuse, and/or salvage, either on- or off-site, and include a category for waste materials requiring disposal.

Columns 2 thru 4 "Estimated Generation" - Enter estimated quantities (tons) of recyclable, reusable, or salvageable waste materials anticipated to be generated and state number of salvageable items.

Column 5 "Estimated Landfill" - Enter quantities (tons) of materials to be disposed in landfill.

Column 4 "Disposal Location" - Enter end-destination of recycled, salvaged, and disposed materials.

General : (1) Attach proposed Recycling & Waste Bin Location Plan.

(2) Attach name and contact data for each recycling or disposal destination to be used.

EXHIBIT 2

WASTE MANAGEMENT PROGRESS REPORT
CONSTRUCTION/ MAINTENANCE/ALTERATION & DEMOLITION PROJECTS

PROJECT NAME: **911 Memorial Park**
PROJECT NO: **NONE**
NAME OF COMPANY:
CONTACT PERSON:
TELEPHONE:
PROJECT SITE LOCATION:
PROJECT TYPE: ☐ NEW CONSTRUCTION ☐ DEMOLITION
☐ MAINTENANCE/ALTERATION PROJECTS
PROJECT SIZE (SQ. FT.):
PERIOD to

(1) Material Type	(2) Tons Actual Recycle	(3) Tons Actual Reuse	(4) Tons Actual Salvage	(5) Tons Actual Landfill	(6) Disposal or Recycling Facility (e.g., Onsite, Name of Facility)
Total					
Diversion Rate: Columns [(2)+(3)+(4)] / [(2)+(3)+(4)+(5)]					**=**

Signature	Title	Date

Column 1 "Material Types" – Enter type of materials targeted for recycling, reuse, and/or salvage, either on- or off-site, and include a category for waste materials requiring disposal.

Columns 2 thru 4 "Estimated Generation" - Enter estimated quantities (tons) of recyclable, reusable, or salvageable waste materials anticipated to be generated and state number of salvageable items.

Column 5 "Estimated Landfill" - Enter quantities (tons) of materials disposed.

Column 4 "Disposal Location" - Enter end-destination of recycled, salvaged, and disposed materials.

General : (1) Attach proposed Recycling & Waste Bin Location Plan.

(2) Attach name and contact data for each recycling or disposal destination to be used.

END OF SECTION

SECTION 01 35 42

CALGREEN REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes general requirements and procedures for compliance with 2019 CALGreen nonresidential mandatory requirements.

B. Related Sections:
   1. Divisions 01 through 48 Sections, as applicable, for CALGreen requirements specific to the work of each of those Sections.

1.02 SUBMITTALS

A. CALGreen submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated CALGreen requirements.

B. Contractor shall develop a spreadsheet or use one furnished by the DBE Architect or building department to track submittals required by CALGreen.

C. CALGreen Submittals:
   1. Furnish documentation showing verification of CALGreen compliance as required by enforcing agency.
   2. Section 5.106.1 - Storm Water Loss Prevention Plan: Newly constructed projects and additions which disturb less than one acre of land shall prevent the pollution of stormwater runoff from the construction activities through one or more of the following measures:
      a. Local ordinance, 5.106.1.2.
      b. Best management practices (BMP) complying with Section 5.106.1.2.
   3. Section 5.106.10 - Grading and Paving: Furnish drawing showing grading and paving designed to keep surface water from entering buildings.
   4. Section 5.408.2 - Construction Waste Management Plan: Furnish a construction waste management plan complying with specified requirements.
   5. Section 5.504.4.5 - Composite Wood Products: Furnish documentation showing compliance with Section 5.504.4.5.
   6. Section 5.504.5.6 - Resilient Flooring: Furnish documentation showing resilient flooring materials meet the pollutant emission limits.

1.03 SUMMARY OF CALGREEN REQUIREMENTS

A. Division 5.1 - Planning and Design:
   1. Site Development Requirements: Comply with the applicable requirements ofSection 5.106.
      a. Section 5.106.1 - Storm Water Pollution Program: Newly constructed projects and additions which disturb less than one acre of land shall prevent the pollution of stormwater runoff from the construction activities through one or more of the following measures:
         1) Local ordinance, 5.106.1.2.
         2) Best management practices (BMP) complying with Section 5.106.1.2.
      b. Section 5.106.4 - Bicycle Parking: Comply with Section 5.106.4.1 or 5.106.4.2, as applicable, for short-term and long-term bicycle parking.
      c. Section 5.106.5.2 - Designated Parking: Comply with Section 5.106.5.2 for designated parking for low-emitting, fuel-efficient and carpool/van pool vehicles.
      d. Section 5.106.8 - Light Pollution Reduction: Comply with Section 5.106.8.1 for outdoor lighting systems.
      e. Section 5.106.10 - Grading and Paving: Construction and grading plans shall comply with Section 5.106.10.

B. Division 5.3 - Water Efficiency and Conservation:
   1. Section 5.303 - Indoor Water Use: Comply with the applicable requirements of Section 5.303 and Table 5.303.2.2 for Indoor Water Use Baseline.
   2. Section 5.304 - Outdoor Water Use: Comply with the applicable requirements of Section 5.304.

C. Division 5.4 - Material Conservation and Resource Efficiency:
   1. Section 5.407 – Water Resistance and Moisture Management: Comply with requirements specified in Section 5.407 for Weather Protection and Moisture Control.
   2. Section 5.408 – Construction Waste Reduction, Disposal and Recycling: Comply with requirements specified in Section 5.408.
      a. Recycled and/or salvage for reuse a minimum of 50-percent of the nonhazardous construction and demolition waste or meet a local construction and demolition waste management ordinance, whichever is more stringent.
      b. Where the local jurisdiction does not have a construction and demolition waste management ordinance, submit a construction waste management plan with the following:
         1) Identify the materials to be diverted from disposal by efficient usage, recycling, reuse on the Project or salvage for future use or sale.
         2) Determine if materials will be sorted on-site or mixed.
         3) Identify diversion facilities where material collected will be taken.

4) Indicate the amount of materials diverted, calculated by weight or volume, but not by both.

c. Utilize a waste management company that can provide verifiable documentation that the percentage of construction and demolition waste material diverted from the landfill complies with Section 5.408.1.2.

d. The combined weight of new construction disposal that does not exceed 2-pounds per sq. ft. of building area may be deemed to meet the 50-percent minimum requirement.

e. Documentation shall be provided to the enforcing agency which demonstrated compliance with Section 5.408.1 thru 5.408.1.3. The waste management plan shall be updated as required and shall be accessible during construction for examination by the enforcing agency.

f. 100-percent of trees, stumps, rocks and associated vegetation and soils resulting primarily from land clearing shall be reused or recycled.

3. Section 5.410 - Building Maintenance and Operation: Comply with the requirements specified in Section 5.410.

a. Provide readily accessible areas that serve the entire building and are identified for the depositing, storage and collection of non-hazardous materials for recycling, including paper, corrugated cardboard, glass, plastics and metals.

b. For new buildings of 10,000-sq. ft. or more, comply with the commissioning requirements specified in Section 5.410.2. Commissioning shall be performed by trained personnel with experience on projects of comparable size and complexity. General commissioning requirements include the following. The specific requirements of each item are specified in Section 5.410.2.1 thru 5.410.2.6.

1) Owner's or Owner Representative’s project requirements.
2) Basis of design.
3) Commissioning measures shown in the Construction Documents.
4) Commissioning plan.
5) Functional performance testing.
6) Documentation and training.
7) Commissioning report.

c. For new buildings less than 10,000-sq. ft., test and adjust systems asspecified in Sections 5.410.4.2 thru 5.410.4.5.

D. Division 5.5 - Environmental Quality:

1. Section 5.504 - Pollutant Control: Comply with the requirements specified in Section 5.504.

a. The permanent HVAC system shall only be used during construction if necessary to condition the building or areas of addition or alteration within the required temperature range for material and equipment installation. If the HVAC system is used during construction, use return air filters with a minimum MERV of 8.

b. Cover duct openings and protect mechanical equipment during construction as specified in Section 5.504.3.

c. Finish materials shall comply with the requirement specified in Sections

d. 5.504.4.1 thru 5.504.4.4, as follows:

1) Adhesives, adhesive bonding primers, adhesive primers and caulks shall meet the following requirements:

a) Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 and 5.504.2.

b) Aerosol adhesives and smaller unit sizes of adhesives, and sealant or caulking compounds shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of CCR Title 17, commencing with Section 94507.

2) Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARB Architectural Coatings Suggested Control Measure, as shown in Table 5.504.4.3 unless more stringent local limits apply.

a) Aerosol paints and coatings shall meet the PWMIR Limits for ROC in Section 94522(a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances, ion Sections 94522(c)(2) and (d)(2) of CCR, Title 17, commencing with Section 94520 and in areas under the jurisdiction of the SCAQMD additionally comply with the percent VOC by weight of product limits.

3) Carpet shall meet the testing and product requirements of one of the following, as required by Section 5.504.4.4:

a) Carpet and Rug Institute's Green Label Plus Program.
b) California Department of Public Health Standard Practice forthe testing of VOCs (Specification 01350).
c) NSF/ANSI 140 at the Gold level.
d) Scientific Certifications Systems Sustainable Choice.

4) Carpet cushion shall meet the requirements of the Carpet and Rug Institute Green Label program.

5) Carpet adhesive shall meet the requirements of Table 5.504.4.1.

6) Composite wood products, including hardwood plywood, particleboard and medium density fiberboard, used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in ARB's Air Toxics Control Measure for Composite Wood (17 CCR 93120 et seq.) by or before the dates specified in those sections, as shown in Table 5.504.4.5.

7) For 80% of floor area receiving resilient flooring, installed resilient flooring shall meet at least one of the following:
   a) Certified under the Resilient Floor Covering Institute (RFCI) FloorScore program.
   b) Compliant with the VOC emission limits and testing requirements specified in the California Department of Public Health's 2010 Standard Method for the Testing and Evaluation Chambers, Version 1.1, February 2010.

e. Provide regularly occupied areas of the building with air filtration media for outside and return air prior to occupancy that provides at least a MERV of 8as specified in Section 5.504.5.3.

f. Where outdoor areas are provided for smoking, prohibit smoking within 25-feet of building entries, outdoor air intakes and operable windows and in buildings; or as enforced by ordinances, regulations or policies of any city or county, whichever are more stringent. Post signage to inform building occupants of the prohibitions.

2. Indoor Moisture Control: Comply with the requirements specified in Section 5.505.
3. Indoor Air Quality: Comply with the requirements specified in Section 5.506.
4. Environmental Comfort: Comply with the requirements specified in Section 5.507.
5. Outdoor Air Quality: Comply with the requirements specified in Section 5.508.

E. Summary:
1. Certain CALGreen Measures needed to comply with code are dependent on material selections, documentation and means and methods of the work. Each item related to CALGreen may not be specifically identified as CALGreen requirements in this Section. Refer to CALGreen Code, CCR Title 24, Part 11 for complete descriptions of measures and submittal requirements.
2. Designate an onsite field staff person contact for all CALGreen prerequisites and credit documentation, subcontractor supervision and submittal coordination and to manage the Contractor's portions of the CALGreen submittal process.
3. Documentation for CALGreen Measures shall be submitted in the format required by the CALGreen code.
4. A copy of the CALGreen code, CCR Title 24, Part 11 shall be available on-site at all times.
5. Additional information on CALGreen can be found at http://www.bsc.ca.gov.

F. Meetings:
1. Contractor shall conduct CALGreen compliance meetings as required. Contractor personnel who shall attend CALGreen compliance meetings include, but are not limited to:
   a. Contractor's project manager.

b. Owner’s Representative.
c. Other attendees designated by Owner’s Representative.
d. Subcontractor representatives as appropriate to stage of work.

2. At a minimum, CALGreen compliance issues shall be discussed at the followingmeetings:
   a. Preconstruction meetings.
   b. Progress meetings.
   c. Subcontractor meetings.
   d. Meetings shall be scheduled as part of regularly scheduled job meetingson-site.

PART 2 – PRODUCTS – Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION

SECTION 01 35 70

CONTRACTOR SAFETY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Health and Safety Policies of the DISTRICT

B. Safety Activities and Measures.

C. Reporting Requirements and Forms

1.02 GENERAL

A. HEALTH AND SAFETY POLICIES

1. The safety guidelines included here are made available as an extension of the safety clause in the Contract General Conditions Article 10. This information is offered as assistance to the CONTRACTOR in complying with all project safety requirements, and to provide assurance to the DISTRICT that appropriate and required safety measures are being taken. However, the information contained within this Section is not intended to reflect all requirements for safe practices and conduct for which a CONTRACTOR may be responsible, including safety of persons and property, and compliance with all statutes, rules, regulations and orders applicable to the conduct of the work.

2. The DISTRICT assumes no liability for the CONTRACTOR's safety program, or the CONTRACTOR's compliance with any safety practices or policies. It is the sole responsibility of each CONTRACTOR to monitor and maintain a safe working environment for their employees, and in so doing, assure a safe working environment for all other CONTRACTORs who may come in contact with their work.

2. The policy of the DISTRICT is to promote safety at a level to assure personal safety and minimize potential property damage.

3. Employees of CONTRACTORs working on this project are required to meet or exceed all established and recognized codes and standards for safety and protection of personnel and property.

4. The possession, use, or sale of any alcoholic beverage or illegal controlled drug substance will not be permitted on or adjacent to the job site by any CONTRACTOR, CONTRACTOR employee, subcontractor employer or associate.

5. The abuse of prescribed medication will not be permitted on or adjacent to the job site by any CONTRACTOR, CONTRACTOR employee, subcontractor employee or associate.

. The CONTRACTOR, and other CONTRACTORs, share the responsibility of monitoring and enforcing, as necessary, paragraphs A.4 and A.5 above. Any known (or with due cause believed to be), violator shall be immediately reported to the CM.

6. The DISTRICT reserves the right to take corrective action, as deemed in the best interest of the project and the DISTRICT, for violation of any health or safety standard. This corrective action may include, but is not limited to removal (from the job site) of any unsafe tools or equipment; temporary work stoppage for any unhealthy or unsafe condition; and immediate removal (from the job site) of any person that is unwilling or incapable of conducting themselves in a manner that promotes a healthy and safe working atmosphere. Any person found to be repeatedly in violation of health and/or safety standards will be permanently restricted from the site.

B. RESPONSIBILITIES

1. The DISTRICT demands that all project CONTRACTORS perform in a reasonable and safe manner.

2. All CONTRACTOR and subcontractor employees/workers shall wear, at a minimum, the following at all times while on the site: 1) hard hats, 2) proper long pants (no shorts), 3) shirts with sleeves (no tank tops or cut off sleeves), 4) safety vests, and 5) work boots. Work boots shall have steel toes, if necessary, for the work being performed. Employees/workers not complying with requirements will be asked to leave the site.

3. The CONTRACTORs working on this project have the ultimate and total responsibility to conduct a sound accident control program as it pertains to their work, their subcontractors, and their employees, as well as to ensure safe working conditions for employees of other CONTRACTORs.

3. The CONTRACTOR will ensure that his employees and subcontractors cooperate with and coordinate safety matters with other CONTRACTORs to form a joint safety effort.

4. Employees who have been or will be exposed to excessive (measured against applicable standards) levels of toxic materials or harmful physical agents shall be notified by the CONTRACTOR. Notice of corrective action being taken shall be provided to the employees. Accurate records must be kept of all exposures which are required to be monitored under the State and Federal Codes.

5. In the event of a defense by the CONTRACTOR against unsafe independent employee actions, the Appeals Board requires that evidence must be presented of the following:

    a. Employee was experienced in the job being performed;

    b. Employer has a well devised safety program, which includes training employees in safety matters relating to their individual job assignments;

    c. Employer effectively enforces the safety program;

    d. Employer has and enforces a policy of sanctions against employees who violate the safety program; and

    e. Employee caused a safety infraction which he or she knew was in violation of a safety requirement.

C. SAFETY ACTIVITIES

1. CONTRACTOR will conduct or initiate:

    a. Safety program as required by current State of California requirements.

    b. Weekly "tool box" safety meetings between CONTRACTOR and CONTRACTOR's supervisors, foremen, employees and subcontractors working on the project.

    c. Weekly safety inspections of your work area and those areas of work under your responsibility or shared responsibility as well as taking any other necessary safety precautions.

D. REPORTS

1. Submit all preliminary, periodic, and special reports to the DBE Project Manager and District Representative. The CONTRACTOR is in no way relieved of the requirements for submission of reports to any agency or authority.

    a. All reports listing deficiencies, accidents or injuries shall show corrective action taken.

    b. A weekly status and summary report of each "tool box" meeting held and items discussed.

    c. A weekly status report of inspection results. The attached status forms are for your convenience only.

d. A continuing list of deficiencies found, date identified, responsible party, corrective action and date corrected.

e. Accident reports and injury forms. Submit a copy of one of the following to the Construction Manager for each case:

1) California Division of Labor Statistics and Research Form 5020 (latest rev.), or;

2) Federal OSHA Form 101, or;
3) Insurance Company form similar to 1 or 2 above.

f. A copy of CAL/OSHA Form 200 "Log and Summary of Occupational Injuries and Illness."

2. Special Reports

a. Notify the DBE Project Manager and District Representative immediately of any accident involving injury to personnel or property; and complete written reports within 24 hours of a death or injury of five (5) or more employees as a result of one accident.

b. Copies of all toxic or harmful agent reports (See paragraph B.4.)

3. Governmental Reports

a. Notification of governmental authorities is the responsibility of each affected CONTRACTOR.

E. SAFETY DEFICIENCY CORRECTION

1. All safety deficiencies will be corrected by CONTRACTORs in accordance with the following priorities.

a. Immediate correction of items with any probability of major or minor injury to people.

b. Correction immediately of any accident probability which could involve people and/or equipment.

c. Correction within one (1) day (or sooner) of potential injury or damage to property.

F. OUTSIDE SAFETY INSPECTIONS

1. Unannounced inspections by city, state or federal safety agencies or insurance companies may occur.

a. CONTRACTORs are to escort representatives of these agencies or companies directly to the DBE Project Manager and assist him as required or directed.

b. If the DBE Project Manager is not available, the CONTRACTOR's foreman or representative shall accompany the inspector on the inspection.

G. INVESTIGATING

1. All injuries are to be investigated by the CONTRACTORs and reported.

2. The DBE Project Manager and District Representative shall be notified prior to proceeding with an investigation.

H. SAFETY STANDARDS AND CODES

1. All CONTRACTORs are to provide their job supervision with applicable safety code publications and ensure they are familiar with the contents.

2. Occupation Safety and Health Administration Standards (latest applicable edition) on the designated applicable safety standards.

3. In states with OSHA approved plans, state codes will take precedence unless federal standards are more stringent, in which case federal standards shall apply.

4. All code and standard conflicts will be resolved by applying the most restrictive code and/or standard.

5. Suggested references for CONTRACTORs are:

a. Safety & Health Regulation for Construction, U.S. Department of Labor, OSHA, Volume 37, No. 243.

b. Construction Safety Orders, State Standard, CAL/OSHA, State of California, latest edition.

c. GSA Manual - GSA -PBSP 5900.3.

d. U.S. Army Engineering Manual - BM 385-1.

e. Accident Prevention, Associated General CONTRACTORs.

f. A Short Guide to the California Occupational Safety and Health Act. -National Federation of Independent Business, 150 West 20th Avenue, San Mateo, California 94403.

I. REQUIRED NOTICES TO BE VISIBLY DISPLAYED

1. Workers' Compensation Insurance Notice

2. OSHA poster: Safety and Health Protection on the job.

3. State of California Department of Human Resources: Notice to Employees Unemployment Insurance - Disability Insurance.

4. “Hard Hat Area” Signs.

5. List of ambulances, doctors and hospitals with telephone numbers which can be called during an emergency.

6. Name and title of the safety representative from each CONTRACTOR's organization.

7. Any other safety signs, slogans, etc. that will improve the general awareness of a joint safety program.

J. PERMITS

1. Permits from the Division of Industrial Safety are required before CONTRACTORs may undertake the following kinds of work:

   a. Construction of trenches or excavations which are five (5) feet or more deep, into which a person is required to descend;

   b. Construction of any building, structure, falsework or scaffolding more than three stories high.

   c. Demolition of any building, structure, falsework or scaffolding more than three stories high.

2. The Division of Industrial Safety may investigate or confer with the CONTRACTOR, as employer, before the start of work. If a pre-job safety conference between the Division of Industrial Safety personnel and the employer is a requirement specified by the Division of Industrial Safety at the time the permit is issued, employees or their representatives are to be included at the conference.

3. Permits must be posted at or near each place of employment requiring a permit. If posting at the actual job site is not possible, the permit must be available for inspection at all times at the site, or, in the case of a mobile unit, at the employer's head office in the area.

4. Additional permits may be required from the Division of Industrial Safety or other applicable governmental agencies. It is the responsibility of each CONTRACTOR to determine, procure and pay for his own permits.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION (Form Attached)

SAFETY STATUS FORMS

THIS REPORT IS TO SERVE AS A MINIMUM STANDARD GUIDELINE AND DOES NOT INCLUDE JOB OR TRADE SPECIFIC ITEMS OR CONDITIONS. SAID ITEMS OR CONDITIONS SHOULD BE ADDED BY CONTRACTOR ON THE LAST PAGE ENTITLED "COMMENTS AND REMARKS".

#:	*QUESTION / CHECK LIST COMMENT:*	*YES*	*NO*	*N/A*
A.	**FIRE PROTECTION AND PREVENTION**			
1.	Are all flammable liquid containers clearly identified?			
2.	Are all flammable liquid containers UL or FM listed?			
3.	Have proper storage practices for flammables been observed?			
4.	Have the proper type & adequate number of fire extinguishers been observed at the job site?			
5.	Are extinguishers readily accessible and serviced regularly?			
6.	Are hydrants clear and accessible for Fire Department personnel?			
B.	**ELECTRICAL**			
1.	Are all switchgear, panels and devices that are energized marked and/or guarded to prevent accidental contact?			
2.	Are lockout devices available and used on all circuits and equipment that could become energized while work is being performed?			
3.	Are all temporary circuits properly guarded and grounded?			
4.	Are all extension cords in continuous lengths without splices or tape?			
5.	Are GFCI's being used? If not, is Assured Equipment Grounding Conductor Program being followed?			
6.	If temporary lighting is provided, are bulbs protected against accidental breakage?			
7.	Are there a sufficient number of temporary outlets on the job site?			
8.	Are there any visual signs of outlet overloading?			
C.	**HAZARD COMMUNICATION**			
1.	Does the Hazard Communication Program include a list of hazardous chemicals?			

#:	QUESTION / CHECK LIST COMMENT:	YES	NO	N/A
2.	Does the Hazard Communication Program include container labeling?			
3.	Does the Hazard Communication Program include “Material Safety Data Sheets” (MSDS)?			
4.	Does the Hazard Communication Program include employee training?			
5.	Does the Hazard Communication Program include personal protective equipment (PPE)?			
6.	Does the Hazard Communication Program include emergency response procedures, information & phone numbers?			
7.	Does the Hazard Communication Program include a list of hazards for non-routine tasks?			
8.	Does the Hazard Communication Program include procedures for informing other CONTRACTORs of hazardous conditions and/or procedures?			
9.	Does the Hazard Communication Program include adequate posting of signage & warning labels?			
10.	Is a copy of the Hazardous Communication Program at this job site?			
D.	**EXCAVATION / TRENCHING**			
1.	Have utility companies been notified of proposed excavation work (one-call system)?			
2.	Are overhead utility lines noted and precautions taken to avoid contact by cranes, backhoes or other heavy equipment?			
3.	Is the excavation inspected daily or more frequently when there is a change in weather or environment that could affect the soil?			
4.	If needed, are barricades, stop logs, etc. properly located?			
5.	Are excavations five (5) feet or deeper correctly sloped, benched, shored or is a trench box (shield) used?			
6.	Is a ladder or other means of exit (egress) provided in trenches or excavations four (4) feet or deeper?			
7.	When ladders are used, do they extend three (3) feet above the surface and are they secured?			

#:	QUESTION / CHECK LIST COMMENT:	YES	NO	N/A
8.	Are shoring and shielding systems inspected daily by a competent person?			
E.	**SCAFFOLDING**			
1.	Are scaffold components visibly free of any physical damage (no bent supports or cross bracing)?			
2.	Is scaffolding properly erected with all pins and braces in place and locked?			
3.	Are rolling scaffolds equipped with locking wheels?			
4.	Are wheels locked when scaffold is in use?			
5.	Is scaffold erected on a firm and substantial surface?			
6.	Is planking of a scaffold grade?			
7.	Is planking in good condition and properly installed?			
8.	Are toeboards and guardrails in place on scaffolds over ten (10) feet?			
9.	Are workers on scaffolding protected from falling objects if overhead hazards exist?			
10.	Is a ladder provided for access to scaffold work platform?			
F.	**BARRICADING**			
1.	Are floor openings planked and secured or barricaded?			
2.	Is a flag person provided to direct traffic when needed?			
3.	Are open excavation, road drop offs, manholes & uneven surfaces barricaded?			
G.	**LADDERS**			
1.	Is the proper ladder for the job being used?			
2.	Are ladders in good condition (no missing or broken rungs, etc.)?			
3.	Is there a need for and/or are there safety shoes/cleats on the bottom of ladders?			
4.	Are non-conductive ladders available for use around live wiring?			
5.	Are ladders tied-off at top or otherwise secured?			
6.	Do side rails extend 36 inches above the top of the landing?			

#:	QUESTION / CHECK LIST COMMENT:	YES	NO	N/A
7.	Are step ladders fully opened when in use?			
H.	**PERSONAL PROTECTIVE EQUIPMENT**			
1.	Is hearing protection available for personnel that may be exposed to noisy conditions?			
2.	Is respiratory protection available to personnel and is it being used when conditions require same?			
3.	Are safety harnesses, belts, lifelines and lanyards available and being used?			
4.	Are personnel using gloves when handling sharp or rough material?			
I.	**MEDICAL**			
1.	Are first-aid kits available and properly stocked?			
2.	Are all emergency phone numbers posted?			
3.	Are all employees aware of the address of the site or capable of giving proper directions to emergency personnel?			
4.	Is anyone trained in first-aid and CPR?			
J.	**TOOLS: (hand & power)**			
1.	Are tools free of any obvious physical damage?			
2.	Are tools inspected for frayed and damaged cords?			
3.	Are tools and cords properly grounded and are ground pins in good condition?			
4.	Are the handles on all tools in good condition (not bent, splintered or broken)?			
5.	Are all hoses on air or hydraulic tools in good condition?			
6.	Are all shields and guards in place on the tools and in good condition?			
7.	Has each tool and/or equipment operator received proper operating and safety instruction for each tool and/or piece of equipment which he or she is using?			
8.	Has each user of a powder actuated tool been properly certified and are their certifications current?			

#:	QUESTION / CHECK LIST COMMENT:	YES	NO	N/A
K.	**WELDING AND CUTTING**			
1.	Welding goggles/helmet, gloves and clothing being used by each welder			
2.	Inspection for fire hazards after welding stops			
3.	Are gas cylinders, hoses, regulators, torches, torch tips and welding carts in good working order and are same being properly secured?			
L.	**HOIST, CRANES AND DERRICKS**			
1.	Are cables and sheaves checked?			
2.	Are slings hooks, eyelets and chokes inspected?			
3.	Are load capacities posted in cab?			
4.	Are power lines at a safe distance?			
5.	Are crane inspection logs with crane?			
M.	**FLOOR, WALL OPENINGS, STAIRWAYS**			
1.	Are floor and roof openings guarded by properly constructed guardrails or a properly reinforced and secured cover?			
2.	Are open-sided floors and platforms six (6) feet or more above the ground guarded with a properly constructed railing?			
3.	Are stairs with four or more risers equipped with standard hand rail construction?			
4.	Are runways four feet or more above the ground properly guarded?			

CONTRACTOR SAFETY - “COMMENTS & REMARKS”

SECTION 01 45 00

QUALITY CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Quality assurance and control of installation
B. Reference Standards
C. Field Samples
D. Mock-up
E. Project Inspector
F. Coordination
G. Verified Reports
H. Manufacturers' field services and reports
I. Testing and Inspection

1.02 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions and workmanship to produce work of specified quality.

B. Comply fully with manufacturers' instructions including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes or specified requirements indicate higher standards or more precise workmanship.

E. Perform work by persons qualified to produce workmanship of specified quality.

F. Where experience minimums for workmen, applicators, companies or manufacturers are required in individual sections, written certification and documentation substantiating such minimums shall be submitted and approved by the Architect, when requested.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.03 REFERENCE STANDARDS

A. Conform to reference standard by date of issue current on date of Contract Documents.

B. Obtain copies of standards when required by Contract Documents.

C. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.

D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.04 FIELD SAMPLES

A. Install field samples at the site as required by individual specifications Sections for review by Architect.

B. Accepted samples represent a quality level for the Work.

C. Where field sample is specified in individual Sections to be removed, clear area after field sample has been accepted by Architect and is no longer required for reference.

1.05 MOCK-UP

A. Tests will be performed under provisions identified in this section.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals and finishes.

C. Where mock-up is specified in individual Sections to be removed, clear area after mock-up has been accepted by Architect and is no longer required for reference.

1.06 PROJECT INSPECTOR

A. An Inspector, herein referred to as the "Project Inspector" or " Inspector of Record", will be employed by the Design Build Entity and approved by the District and the Office of California Building Standards Commission, Building Inspection Division in accordance with 2019 California Building Standards Code in Title 24, Section 17958.7, California Code of Regulations. His duties are described with RCFPD Building and Safety Service Department.

B. The work of construction in all stages of progress shall be subject to the personal continuous observation of the Project Inspector of Record (PIOR). He shall have free access to any or all part of the work at any time. The Contractor shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting the progress and manner of the work and the character of the materials. Inspection of the work shall not relieve the Contractor from any obligation to fulfill the requirements of this Contract.

C. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents are the responsibility of the Contractor.

D. Contractor will pay the costs of additional inspections and tests required due to any of the following:

1. Contractor's failure to complete the entire Work within the contract time stated in the Agreement between Owner and Contractor, including properly authorized time extensions.

2. Claims between separate contractors.

3. Covering of Work before required inspections and tests are performed.

4. Tests and inspections of Contractor's correction of defective Work.

5. Inspecting and testing agency overtime costs due to acceleration of the Work for Contractor's convenience.

6. Tests and inspections required because of a change in materials provided or a change in source of supply.

7. Tests and inspections required solely for the convenience of the Contractor in scheduling and performing the Work.

8. Inefficient inspection and testing caused by the Contractor's inefficient and sporadic manufacturing, purchasing or installation processes.

E. Inspection Requests: Contractor shall request inspection of completed portions of the Work through the DBE Project Manager at least 2 working days in advance of the inspection to be performed. Contractor shall submit said request for inspection in writing using a form acceptable to the DBE Project Manager. The Contractor is responsible for reviewing all of the Contract Documents for inspection requirements.

F. Inspections which are to occur more than 50 miles from the project site (i.e., factory inspections) require a minimum advance notice to the DBE Project Managerof 14 calendar days. All such inspections requiring the Inspector of Record to travel shall be reimbursed by the Contractor.

G. Contractor shall provide, on a weekly basis, an anticipated Inspection Requirements Schedule at each weekly Construction Coordination meeting. The Contractor shall be solely responsible for any delays due to improper or untimely inspection requests.

H. There shall be a final inspection and approval of all buildings, structures, and equipment when completed and ready for occupancy and use.

1.07 COORDINATION

A. Contractor to coordinate the work to assure efficient and orderly installation of each part of the work. Coordinate construction operations included under

different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.

B. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.

C. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.

D. Make adequate provisions to accommodate items scheduled for later installation.

1.08 VERIFIED REPORTS

A. Contractor shall comply with Title 24, California Code of Regulations and RCFPD Building and Safety Service Department and issue verified reports through the Architect as required.

1.09 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and as applicable and to initiate instructions when necessary.

B. Manufacturers Representatives shall report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

C. Submit report of observation to Architect for review.

1.10 TESTING AND INSPECTION

A. The District shall have the right to reject materials and workmanship which are defective, or to require their correction. Rejected workmanship shall be satisfactorily corrected and rejected materials shall be removed from the premises without charge to the District. If the Contractor does not correct such rejected work within a reasonable time, fixed by written notice, the District may correct same and charge the expense to the Contractor.

B. Should it be considered necessary or advisable by the District at any time before final acceptance of the entire work to make an examination of the work already completed by removing or tearing out the same, the Contractor shall on request promptly furnish all necessary facilities, labor and materials. If such work is found to be defective in any respect due to the fault of the Contractor or his subcontractor, he shall defray all expenses of such examinations and of satisfactory reconstruction. If, however, such work is found to meet the

requirements of the Contract, the additional cost of labor and material necessarily involved in the examination and replacement shall be allowed the Contractor.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 45 50

TESTING AND INSPECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

This Section includes CONTRACTOR's (Herein known as the Design Build Entity) responsibilities with regard to mandatory testing and inspection services:

A. Testing and inspection services to meet requirements of the California Code of Regulations (CCR), Title 24, California Building Code (CBC), and with all other laws, ordinances, rules, regulations or orders of public authorities having jurisdiction.

B. Tests of materials required by the Contractor's certified testing agency as set forth in the California Building Standards Administrative Code and Rancho Cucamonga Fire District's Standards and Guidance Ordinance FD54.

C. Inspection by certified inspectors, employed by the Design Build Entity (Inspector of Record) and Building Inspectors (Project Inspector, PI) employed by the City of Rancho Cucamonga in accordance with the requirements of California Building Standards Administrative Code, assigned to the Work with duties specifically defined in Rancho Cucamonga Fire District's Standards and Guidance Ordinance FD54.

1.02 TESTING AGENCY

A. The Design Build Entity will select, and District Representatives approve, an independent 3rd party testing agency and laboratory approved by California certified authorized authority agency having jurisdiction to conduct tests, sampling, and testing of materials.

B. Selection of material to be tested shall be by the agency or the PROJECT INSPECTOR.

C. Any material shipped from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from INSPECTOR OF RECORD that such testing and inspection is not required shall not be incorporated into the Work.

D. CONTRACTOR to directly reimburse testing agency the costs for all required tests and inspections, and additional costs for retesting will be the CONTRACTOR's responsibility as noted in related portions of the Contract Documents.

E. The independent testing agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work. The testing agency shall not perform any duties of CONTRACTOR. The agency does not have authority to stop the Work.

1.03 TEST REPORTING

A. Test reports shall include all tests performed, regardless of whether such tests indicate the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported. Records of special sampling operations as required shall also be reported. Reports shall indicate the material or materials were sampled and tested in accordance with requirements of CBC, Title 24, Parts 1 and 2. Test reports shall indicate specified design strength. They shall also definitely state whether or not material or materials tested comply with the specified requirements. When requested by DISTRICT or Architect, provide interpretation of test results.

B. After each inspection and test, testing agency will promptly submit one (1) copy of laboratory report to the following distribution list:

1. District
2. Design Build Entity Project Manager
3. Project Inspector
4. D-BE Architect
5. D-BE Structural Engineer
6. D-BE Mechanical and Electrical Engineers (Related Tests and Inspections)
7. Contractor (Design Build Entity)

C. Each test report will include:

1. Date issued
2. Project title, Architect's number
3. Name of agency's inspector
4. Date and time of sampling or inspection
5. Identification of product and Specifications Section
6. Location in the Project
7. Type of inspection or test
8. Date of test and ambient conditions at time of test
9. Results of tests
10. Statement of Conformance with Contract Documents
11. Signature by Registered Professional Engineer licensed in California
12. Statement that tests were conducted in accordance with Parts 1 and 2, Title 24, California Code of Regulations

C. Immediately upon testing agency determination of a test failure, the agency will report the results of the test to the D-BE ARCHITECT, D-BE PROJECT MANAGER, and CONTRACTOR (Design Build Entity). On the same day, the agency will send written test results to those on the distribution list.

1.04 TEST AND INSPECTION VERIFICATION REPORT

A. Testing agency shall provide a verified report in triplicate, with copies to the DISTRICT, D-BE PROJECT MANAGER, and CONTRACTOR covering each test which is required to be performed by that agency during progress of the Work.

Such report shall be furnished each time construction on the Work is suspended, covering tests up to that time, and also prior to Final Completion of the Work, covering all tests.

1.05 INSPECTION BY DISTRICT

A. DISTRICT and its representatives shall at all times have access, for purpose of inspection, to all parts of the Work and to shops wherein the Work is in preparation, and CONTRACTOR shall at all times maintain proper facilities and provide safe access for such inspection.

B. DISTRICT shall have the right to reject materials and/or workmanship deemed defective Work, and to require correction. Defective workmanship shall be corrected in a satisfactory manner and defective materials shall be removed from the premises and legally disposed of, all without charge to DISTRICT. If CONTRACTOR does not correct such defective Work within a reasonable time, fixed by written notice and in accordance with the terms and conditions of the Contract Documents, DISTRICT may correct such defective Work and proceed to recover costs in accordance with related Articles of the Contract Documents.

1.06 PROJECT INSPECTOR

A. PROJECT INSPECTOR (PI) also known as the Building Inspector, is employed by the City of Rancho Cucamonga in accordance with requirements of Title 24 of the California Code of Regulations with their duties specifically defined therein including Rancho Cucamonga Fire Protection District's Standards and Guidance, RCFPD Ordinance FD54.

B. Inspection of Work shall not relieve CONTRACTOR from any obligation to fulfill all of the terms and conditions of the Contract Documents.

C. CONTRACTOR shall be responsible for scheduling times of inspection, tests, sample taking, and similar activities of the Work.

1.07 CONTRACTOR RESPONSIBILITIES

A. Provide INSPECTOR OF RECORD and testing agency as a part of their project team. Deliver to testing agency, at designated location, adequate samples of materials proposed to be used which require testing.

B. Cooperate with testing agency personnel, DISTRICT’s Representative, DBE INSPECTOR OF RECORD, PROJECT INSPECTOR, D-BE PROJECT MANAGER and the DBE ARCHITECT, to provide access to the Work including weekends and after work hours and to manufacturer's facilities.

C. Provide incidental labor, materials and facilities to provide, at all times, safe access to Work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.

D. Notify D-BE PROJECT MANAGER, INSPECTOR OF RECORD, PROJECT INSPECTOR and testing agency 24 hours in advance of required inspections or sampling, and 48 hours in advance of special testing or inspections. Notify

DISTRICT in advance of the manufacturer or fabrication of materials in time to plan and schedule required testing at the source of supply. Extra expenses resulting from a failure to notify the agency shall be borne by the CONTRACTOR. Whenever extra expenses are indicated to be borne by the CONTRACTOR, they will be charged to the CONTRACTOR by Change Order.

1. CONTRACTOR to create an account on City of Rancho Cucamonga's Accelerate portal to request required City Building Department inspections. CONTRACTOR to give full account access to D-BE PROJECT MANAGER and District Representatives.

    a. Building Department Inspection requests shall be scheduled based on the PROJECT INSPECTOR's availability, Monday thru Thursday 7:00 am to 5:00 pm. Times are subject to change.

    b. CONTRACTOR to copy D-BE PROJECT MANAGER and DISTRICT REPRESENTATIVES in all communications with INSPECTOR OF RECORD and PROJECT INSPECTOR.

2. CONTRACTOR to utilize an Inspection Request Form to be provided by the D-BE PROJECT MANAGER and approved by the D-BE's testing agency, for all activities requiring third party testing and inspection.

    a. CONTRACTOR to copy D-BE PROJECT MANAGER in all communications with CONTRACTOR's testing agency.

E. The DISTRICT, INSPECTOR OF RECORD, PROJECT INSPECTOR, D-BE PROJECT MANAGER or the D-BE ARCHITECT shall have the right to reject materials and workmanship which are defective or to require their correction. Rejected workmanship shall be satisfactorily corrected and rejected materials shall be removed from the premises without cost to the DISTRICT. Extra expenses for retesting and re-inspection shall be borne by the CONTRACTOR as noted below. If the CONTRACTOR fails to correct such rejected work within a reasonable time, fixed by written notice, the DISTRICT will correct same and charge the expense to the CONTRACTOR by Change Order.

1. Additional Testing or Inspection: If the inspector, the D-BE ARCHITECT, the DISTRICT, or public authority having jurisdiction determines that portions of the work require additional testing, inspection, or approval not included under paragraph 1.01.A, the inspector will, upon written authorization from the DISTRICT, make arrangements for such additional testing, inspection, or approval. The DISTRICT shall bear such costs except as provided in paragraph 1.06.E.2.

2. Costs of Retesting: If such procedures for testing, inspection or approval under paragraphs 1.01.A reveal failure of the portions of the work to comply with requirements established by the contract documents, the CONTRACTOR shall bear all costs arising from such failure, including those of re-testing, re-inspection, or re-approval, including, but not limited to, compensation for the ARCHITECT's services and expenses. Any such

costs shall be paid by the DISTRICT, invoiced to the CONTRACTOR and deducted from the next progress payment.

3. Costs for Premature Test: In the event the CONTRACTOR requests any test or inspection for the project and is not completely ready for the inspection, the CONTRACTOR shall be invoiced by the DISTRICT for all costs and expenses resulting from that testing or inspection, including, but not limited to, the ARCHITECT's fees and expenses and the amount of the invoice of shall be deducted from the next progress payment.

4. Tests or Inspections Not to Delay Work: Tests or inspections conducted pursuant to the contract documents shall be made promptly to avoid unreasonable delay in the work.

F. Should it be considered necessary or advisable by the DISTRICT at any time before date of substantial completion of the entire work to make an examination of work already completed by removing or tearing out the same, the CONTRACTOR shall on request promptly furnish all necessary facilities, labor and materials. If such work is found to be defective in any respect due to fault of the CONTRACTOR or his subcontractor, all extra expenses shall be borne by the CONTRACTOR. If, however, such work is found to meet the requirements of the Contract, the additional cost of labor and material necessarily involved in the examination and replacement costs shall be allowed the CONTRACTOR by Change Order.

G. When changes of construction progress schedule are necessary during construction, coordinate such changes with the testing agency as required.

H. When the testing agency is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, extra charges for testing attributable to the delay shall be borne by the CONTRACTOR.

I. CONTRACTOR shall provide an insulated curing box with the capacity for twenty (20) concrete cylinders and will relocate said box and cylinders as rapidly as required in order to provide for progress of the Work.

J. CONTRACTOR is responsible for compliance to all applicable local, state, and federal regulations regarding codes, regulations, ordinances, restrictions, and requirements, regardless of the provisions of this Section.

K. Inspecting and testing performed exclusively for the CONTRACTOR's convenience shall be the sole responsibility and expense of the CONTRACTOR.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.01 TESTS AND INSPECTIONS

A. The following tests and inspections do not limit inspection of the Work but are required by DISTRICT, other agencies, or are required in related Sections of the Contract Documents. The list may not be all inclusive.

B. Excavations, Foundations and Retaining Walls - CBC, Chapter 18A and 33A

1.	Inspection:		
	a.	Earth Fill Compaction	1801A.2

C. Concrete - CBC, Chapter 19A:

1.	Materials:		
	a.	Test of Materials	1903A.1
	b.	Portland Cement Tests	1903A.2
	c.	Concrete Aggregate	1903A.3
	d.	Shotcrete Aggregate	1903A.3; 1924A.3
	e.	Reinforcing Bars	1903A.5.1; 1903A.5.2; 1903A.5.3; 1903A.5.4;
	f.	Prestressing Steel & Anchorage	1903A.5.5;
	g.	Structural Steel, Steel Pipe or tubing	1903A.5.6
	h.	Admixtures	1903A.6
	d.	Batch Plant Inspection	1929A.4
	e.	Waiver of Batch Plant Inspection & Tests	1929A.5, 1929A.6
2.	Quality:		
	a.	Proportions of Concrete	1905A.1; 1905A.2; 1905A.3; 1905A.4; 1905A.5; 1905A.6,
	b.	Mixing and Placing	1905A.1.1; 1905A.1.2; 1905A.1.3
	c.	Concrete Testing	1905A.6;
	d.	Composite Construction Cores	1929A.8
3.	Inspection:		
	a.	Project Site Inspection	1905A.7.1
	b.	Batch Plant Inspection:	1929A.4, 1929A.5; 1929A.6
	c.	Reinforcing Bar Welding Inspection	1929A.12, 1903A.10

D. Lightweight Metal - CBC, Chapter 20A:

1.	Materials:		
	a.	Alloys	2001A.2
	b.	Identification	2001A.4

2. Inspection:
   a. Welding — 2004A.8

E. Masonry - CBC, Chapter 21A:

1. Materials:
   a. Masonry Units — 2102A.2,.4,.5,.6
   b. Portland Cement, Lime — 2102A.2.2, .3; 2103A.2
   c. Mortar & Grout Aggregates — 2102A.2.1; 2103A.4.3
   d. Reinforcing Bars — 2102A.2.10; 1903A5, 2102A.2.10

2. Quality:
   a. Portland Cement Tests — 1903A.2, 1929(A.1)
   b. Mortar & Grout Tests — 2105A.3.4.2
   c. Masonry Prism Tests — 2105A.3.2, 2105A3.5
   d. Masonry Core Tests — 2105A 3.1
   e. Reinforcing Bars — 2102A.2.10

3. Inspection:
   a. Reinforced Masonry — 2105A
   b. Reinforcing Bar Welding Inspection — 1903A.10, 1929A.12

F. Steel - CBC, Chapters 17A & 22A:

1. Materials:
   a. Structural Steel, Cold Formed Steel — 2202A.1, 2231A.1
   b. Material Identification — 2203.A4

2. Inspection and Tests:
   a. Test of Structural Steel — 2231.A
   b. Tests of High Strength Bolts, — 2231.A.2 Nuts & Washers
   c. Tests of End Welded Studs — 2231.A.3
   d. Shop Fabrication Inspection — 2231.A.4
   e. Welding Inspection — 2231.A.5
   f. Non-destructive Weld Testing — 1703A
   g. High Strength Bolt Inspection — 2231A.6
   h. Steel Joist Load Tests — 2231A.7
   i. Spray applied fire resistance materials — 1701

G. Wood - CBC, Chapter 23A:

1. Materials:
   a. Lumber and Plywood Grading — 2303A.1, 2304A

3.02 EARTHWORK

A. The Design Build Entity's testing agency, under the direction of the Geotechnical Engineer of Record, will provide continuous inspection of fill and will field test fill

and earth backfill as placed and compacted, and inspect excavations and subgrade before concrete is placed and provide periodic inspection of open excavations, embankments, and other cuts or vertical surfaces of earth. Geotechnical Engineer will sign all reports of observation and testing.

B. Unsatisfactory materials shall be removed from the site. Materials installed improperly shall be removed, replaced, moisture adjusted, re-compacted and otherwise re-worked to achieve a satisfactory installation.

C. Imported fill materials from offsite or onsite shall be inspected and tested at the source before importing and placing, and a report issue attesting to the satisfactory nature of the material.

D. The DESIGN BUILD ENTITY'S testing agency will perform all sampling and testing of materials and testing of work in place as required by Geotechnical Engineer of Record, Project Inspector, or otherwise required. Testing will be performed in accordance with ASTM or California-required test methods.

3.03 CONCRETE

A. The DESIGN BUILD ENTITY'S testing agency will conduct one-time sampling of aggregate and preparation and testing of concrete mix design for each strength and/or aggregate size specified. Testing costs for additional mix designs shall be borne by the CONTRACTOR.

B. Continuous plant inspection and other concrete installation tests will be conducted by the DESIGN BUILD ENTITY'S testing agency. However, costs for retesting of materials that do not meet specification requirements shall be borne by the CONTRACTOR.

3.04 ROOFING

A. The INSPECTOR OF RECORD, Project Inspector, Architect, and Roofing Membrane Manufacturer's Technical Representative will conduct inspection and testing of the fully adhered single-ply TPO roofing membrane with flashings and other system components to comprise a complete roofing system in accordance with manufacturer's instructions, including:

1. Attend pre-roofing conference at least two weeks prior to beginning this work.

2. The surface of the substrate shall be inspected prior to installation of the TPO roof membrane. The substrate shall be clean, dry, free from debris and smooth, with no surface roughness or contamination.

3. Membrane Manufacturer's Representative shall make regular, in-progress, inspections while this work is in progress to observe roofing application and ensure conformance with specifications.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security, and protection.

B. Temporary utilities required include but are not limited to:

1. Water service and distribution.

2. Temporary electric power and light.

3. Phone and high-speed internet services.

4. Storm and sanitary sewer.

C. Temporary construction and support facilities required include but are not limited to:

1. Temporary heat.

2. Field offices and storage sheds.

3. Sanitary facilities, including drinking water.

4. Temporary enclosures.

5. Temporary Project identification sign.

6. Waste disposal services.

D. Security and protection facilities required include but are not limited to:

1. Temporary fire protection. Coordination of Fire Watch.

2. Barricades, warning signs.

3. Environmental protection and mitigation.

4. Temporary security fencing when required.

1.2 SUBMITTALS

A. Temporary Utilities: Submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.

1.3 RELATED WORK

A. All equipment furnished by contractors shall comply with all requirements of pertinent safety regulations. The ladders, planks, hoists, and similar items normally furnished by the individual trades in execution of their own portions of the work are not part of this section.

B. Permanent installation and hook-up of the various lines are described in the other pertinent sections.

1.4 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:

1. Building Code requirements.

2. Health and safety regulations.

3. Utility company regulations.

4. Police, Fire Department and Rescue Squad rules.

5. Environmental protection regulations.

B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities."

1. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", prepared jointly by AGC and ASC, for industry recommendations.

2. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).

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

1.5 PROJECT CONDITIONS

A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

1.6 TEMPORARY WATER AND DUST CONTROL

A. Fugitive Dust Control Plan: Prior to the issuance of Grading and/or Building Construction Permits, The Contractor shall prepare and submit to the City of Rancho Cucamonga Building & Safety Services Department a fugitive dust control plan, which shall require watering of exposed ground surfaces and disturbed areas a minimum of every three hours on the construction site and a minimum of three times per day during the entirety of the construction duration. This watering requirement shall be in addition to the existing requirements for fugitive dust control under South Coast Air Management District Rule 403. The Building & Safety Services Department shall verify that this measure is implemented during normal construction site inspections.

B. The Contractor shall provide construction water throughout the duration of the project in sufficient quantities to continually maintain dust control and construction operations per the Fugitive Dust Control Plan. Prevent dust and dirt from accumulating on walks, roadways, parking areas and from washing into sewer and storm drain lines. Sterilize temporary water piping prior to use.

C. The Contractor shall provide and pay for all dust control for contract work. Bid Package Contractor shall implement the SCAQMD Air Quality Management Plan including application and notification, fees and perform all related work in this section.

D. The Contractor shall provide temporary (metered) construction water service at locations throughout site with an appropriately sized service connection at each location. Locations to be determined by the DBE Project Manager. This Bid Package Contractor shall include all costs associated with maintaining temporary water service (including paying for all temporary water usage for the full duration of the project construction). This service is to be maintained for the duration of the project. Acquiring meters and any deposits required will be this Bid Package Contractor’s responsibility.

E. The Contractor shall install required temporary connections to existing water. Locate temporary pipelines so that they do not interfere with traffic or drainage. Design and construct such pipelines so that they do not leak or cause damage or nuisance. Upon completion of work, remove all temporary piping.

F. The Contractor shall initiate and pursue the application process for obtaining permits and licenses (including all required DISTRICT signatures) necessary for the temporary water service, electricity, gas, oil, sewer, and telephone used including all utility permits, fees, and water usage. No reimbursement will be allowed for fees associated with City or County business licenses, disposal, trucking, material, labor, or equipment required to provide this temporary service.

G. The Contractor shall initiate and pursue the application process for obtaining permits, licenses, and fees (including all required DISTRICT signatures) related to their bid package scope of work in accordance with General Conditions, Article 3.7, All temporary utilities including but not limited to temporary water service,

electricity, gas, oil, sewer, internet, and telephone used on work shall be furnished and paid for by Bid Package Contractor. Bid Package Contractor shall furnish and install necessary temporary distribution systems, including meters, if necessary, from point to point on site where utilities are necessary to carry on the work. Upon completion of work, Bid Package Contractor shall removal all temporary distribution systems. No reimbursement will be allowed for fees associated with City or County business licenses, disposal, trucking, material, labor, or equipment required to provide this temporary service.

1.7 TEMPORARY CONTROLS

A. Provide and maintain methods, equipment, and temporary construction, as necessary to provide controls over environmental conditions at the construction site and related areas under Contractor's control; remove physical evidence of temporary facilities at completion of work.

B. Noise Control: Prior to the issuance of any permits for grading, a construction-related noise mitigation plan shall be submitted by The Contractor to the Planning and Engineering Department for review and approval. The plan shall depict the location of the construction equipment and how the noise from this equipment would be mitigated during construction. **Proof of compliance is achieved by providing this plan to the Planning and Engineering Departments.** Prior to issuance of any permits for grading and/or construction, the construction contractor shall provide a map of the haul truck routes to the Planning and Engineering Department for review and approval. The planned haul truck routes shall avoid residential areas to the maximum extent feasible. Haul truck deliveries shall not take place between the hours of 8:00 p.m. and 6:30 a.m. on weekdays, including Saturday, or at any time on Sunday or a national holiday. Additionally, if heavy trucks used for hauling would exceed 100 daily trips (counting both to and from the construction site), then the project applicant shall prepare a noise mitigation plan denoting any construction traffic haul routes and include appropriate noise mitigation measures. To the extent feasible, the plan shall denote haul routes that do not pass sensitive land uses or residential dwellings. Construction and grading noise levels shall not exceed the standards specified in Development Code Section 17.66.050, as measured at the property line. The project applicant shall hire a consultant to perform weekly noise level monitoring as specified in Development Code Section 17.66.050. Monitoring at other times may be required by the City's Building Official. Said consultant shall report their findings to the Building Official within 24 hours; however, if noise levels exceed the above standards, then the consultant shall immediately notify the Building Official. If noise levels exceed the above standards, then construction activities shall be reduced in intensity to a level of compliance with above noise standards or halted. Avoid excessive noise that would affect detrimentally adjacent activities and adjoining property. Confine operations to permissible hours of day, to eliminate neighborhood noise pollution.

C. Dust Control: Provide positive methods and apply dust control materials and methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into the atmosphere.

D. Water Control: Provide methods to control surface water to prevent damage to the Project, the site, or adjoining properties.

1. Control fill, grading and ditching to direct surface drainage away from excavations, pits, tunnels, and other construction areas, and to direct drainage to proper runoff.

2. Provide, operate, and maintain hydraulic equipment of adequate capacity to control surface water.

3. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the site or to adjoining areas.

E. Excavate and dispose of any contaminated earth off-site and replace with suitable compacted fill and topsoil.

1. Take special measures to prevent harmful substances from entering public waters and atmosphere.

2. Prevent disposal of wastes, effluent, chemicals, or other such substances in sanitary or storm sewers.

1.8 TEMPORARY SANITARY FACILITIES

A. The Contractor shall provide and maintain temporary chemical type toilet and wash facilities throughout the duration of the project in sufficient quantities as required for the total workforce on the project site. The Contractor will add additional facilities as required based on fluctuations in workforce. The Contractor shall provide temporary facilities at the lay-down area and at the building site. All temporary toilets shall be properly serviced twice weekly and shall meet all applicable governmental codes at all times.

B. The Contractor shall provide temporary drinking water supply to the DBE Project Manager's and Project Inspector field office. Bid Package Contractor shall make connections, pay charges and fees associated with service.

C. The Contractor shall provide two (2) secured/locked port-o-lets for the exclusive use of Project Inspector, and Owner Representatives. These port-o-lets are to be located next to the field office. Bid Package Contractor shall make connections, pay charges and fees associated with service for the duration of the project. All temporary toilets shall be properly serviced twice weekly and shall meet all applicable governmental codes at all times.

1.9 FENCES AND BARRICADES

A. The Contractor shall furnish, install, continually maintain, relocate as required, and removal in portions when directed by the Design Build Entity’s Project Manager, temporary chain link safety and security perimeter fencing surrounding the entire construction sites encompassing the full length of the north, south,

east, and west site boundaries. Fencing shall conform to the following specifications:

1. 8-foot-high chain link fence with 95% or greater new wind screen/mesh with locked entrance and access gates to enclose the entire project site at or near the property line.

2. Cable top, bottom, and center of fence.

3. Mesh shall be attached with hog rings.

4. Includes man and vehicle gates where required.

5. Gateposts shall be of size to accommodate the size of opening and its intended purpose as directed by the DBE Project Manager.

6. All gateposts shall be cored in existing concrete or asphalt surfaces or set in concrete footings where installed at dirt locations.

7. Every other fence post shall be set in a concrete footing. Concrete post footings shall be removed at the end of the project when the temporary fencing is removed.

8. At completion of project repair concrete or A.C. substrate, fill holes to match existing materials flush with adjacent surface.

9. Fencing shall be set back beyond Sitework improvements.

10. Provide relocation and switching of panels and/or gates during construction as directed by the Design Build Entity's Project Manager.

11. Provide continuous maintenance and repair of the temporary fencing and gates throughout construction.

12. Fence and gates shall be covered in new green privacy fabric. Fence & gates must be continually maintained to prohibit public from gaining access to the site and also deter persons of all ages from entering the site after hours. If fence, gates, mesh screen are damaged or vandalized in anyway, the Contractor must repair or replace applicable sections within 24 hours or less to provide a secure, graffiti and vandalism free perimeter.

13. The Contractor shall submit shop drawings showing proposed site logistics including locations of proposed fencing and gates for DBE Project Manager's review and approval.

14. Provide and maintain protection for plant life and trees designated to remain. Tree and landscape protection shall at a minimum include 8' chain link fence erected at the tree's drip line or as required by the Architect. The Contractor shall provide temporary irrigation for trees and landscape as required by Architect including but not limited per contract drawings and specifications.

1.10 TEMPORARY TELEPHONE/ DATA SERVICE

A. Contractor shall furnish, install, and pay for phone and high-speed internet services to the DBE Project Manager's temporary field office with branch cabling to each trailer office and conference room as soon as DBE Project Manager's temporary field office has been set. Service shall continue uninterrupted for the duration of the project and shall be removed by Contractor upon completion of the project only when directed by the DBE Project Manager. Phone service shall include monthly usage including local and long-distance calling. High speed internet shall be business class service with a minimum of 5 static IP addresses provided. Services shall be by Charter Spectrum or equivalent upon DBE Project Manager approval.

B. The aforementioned telephone and internet services are for the exclusive use of the DBE Project Manager's staff. Bid Package Contractor shall also pay for all monthly usage of said aforementioned services including the costs of set-up and take-down said systems.

C. The Contractor's Foremen and/or Superintendent must carry an operable cell phone with them will on the site at all time for purposes of communication with the DBE Project Manager's staff and their home offices. The DBE Project Manager's site Superintendent shall be given the cell phone number of the Bid Package Contractor's supervisory field staff including updates whenever said cell phone number changes.

1.11 CONSTRUCTION EQUIPMENT

A. Bid Package Contractor shall erect, equip, and maintain construction equipment in strict accordance with applicable statues, laws, ordinances, and regulations of authority having jurisdiction.

B. Bid Package Contractor shall orient all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest the project site. The contractor shall locate equipment staging in areas that will create the greatest distance between construction-related noise sources and noise-sensitive receptors nearest the project site throughout the duration of project construction.

C. Bid Package Contractor shall provide, maintain, and move upon completion of the Work all temporary rigging, scaffolding, hoisting equipment, rubbish chutes, ramps, stairs, runways, platforms, ladders, railings, and other temporary construction as required for all work hereunder.

1.12 STORAGE

A. Operations of the Bid Package Contractor, including storage of materials, shall be confined to areas approved by Site Logistics Plan, and approved by DBE Project Manager. Bid Package Contractor shall be liable for damage caused by him/her during such use of property of the District or other parties. Bid Package Contractor shall hold the District and DBE Project Manager along with their

respective officers, employees and agents, and the Architect and his employees, free and harmless from liability of any nature or kind arising from any use, trespass, or damage occasioned by his operations on premises of third persons.

B. Storage facilities shall provide protection of products from excessive cold, heat, moisture, humidity, or physical abuse as specified in the respective sections for the products stored.

1.13 TEMPORARY JOB OFFICE

A. The Contractor shall provide, pay for, and maintain in good condition throughout the duration of the project an on-site, adequate field office for use by DBE Project Manager, the District Inspector, and the Architect during the time construction is in progress. The temporary field office shall be conveniently located and shall be watertight and waterproof, clean, insulated, electrically heated, air conditioned with two high security type lockable exterior doors with stairs and ramps and railing as required provided with high security grills on windows to give adequate light and ventilation, have electrical service outlets. Temporary field office shall be divided into rooms and conference room. Said field offices shall be for the DBE Project Manager's and District Inspector use only. Flooring shall be in new condition. Layout and configuration of temporary field office shall be at DBE Project Manager's discretion and approval.

B. The Contractor shall repair any vandalism to temporary field offices by the business day the damage or vandalism is reported so that field offices are secure, graffiti and vandalism free.

C. The Contractor shall provide a weekly cleaning service of the trailers including offices.

D. The Contractor shall pay for dedicated security system for the DBE Project Manager's field office. Service will include installation, monthly monitoring, and removal. Service will be established in a manner where the DBE Project Manager will have sole access. Provide maintenance to keep system working 24 hours/days a week. Invoices for security system will be billed and paid for by Bid Package Contractor.

E. The Contractor shall provide exterior mounted security flood lights controlled by photocell to all four sides of all temporary field offices.

F. Should Bid Package Contractor(s) require office space, office shall be located per the approved Site Logistics Plans.

1.14 TEMPORARY ELECTRICAL

A. The Contractor shall furnish, install, maintain, relocate as required, and eventually remove in portions when directed by the DBE Project Manager a complete and operable code approved temporary power system (including

paying for all temporary power usage throughout the construction contract) as follows:

1. One 200-amp single phase service.

2. A 50-amp subpanel mounted on the post will not be more than 50 feet away from each building. Each Building shall have its own subpanel.

3. Each subpanel shall be equipped with two 110-volt receptacles, one 220 volt receptacle, and one 50-amp twists lock pigtail.

4. Any temporary power requirements beyond these provided will be the responsibility of the contractor requiring same.

5. All welding will be done with self-contained gas-powered units.

6. Provide a temporary meter and pay all service fees/charges for the duration of the project.

7. The primary and secondary temporary power poles must be of size and height to accommodate wire span and clearance for construction equipment.

8. Shop drawings shall be submitted to the DBE Project Manager for approval prior to installation. Temporary power poles shall be located in planters when possible and not in turf areas.

B. The Contractor shall furnish, install, maintain, and eventually remove when directed by the DBE Project Manager power service for the DBE Project Manager's temporary field offices including paying for all temporary power usage throughout the project duration.

C. The Contractor shall survey in temporary power to avoid needless relocation.

D. In accordance with General Conditions, the Contractor shall initiate and pursue the application process for obtaining permits and licenses (including all required DISTRICT signatures) necessary for the temporary power services, including utility fees and power usage related to this bid package contractor. No reimbursement will be allowed for fees associated with City or County business licenses, disposal, trucking, material, labor, or equipment required to provide this temporary service.

1.15 TEMPORARY LIGHTING

A. The Contractor shall be responsible to provide and maintain all temporary lighting and access lighting as required to safely access and perform their work.

B. The Contractor shall furnish, install, and pay for individually operated motion detector/photocell operated temporary site security lights (minimum of 10 - 16' tall poles with security lights on top) for nighttime security. Poles shall be located per

the Site Logistics Plan and approved by the DBE Project Manager. The Contractor shall pay all costs for set-up, takedown, operation, and maintenance throughout the duration of the project.

C. The Contractor Provide Power and Lighting: Furnish, install, and maintain temporary wiring, poles, meter board, service entrance switch, lamps, and equipment necessary to provide temporary lighting and power for the construction site.

1. Temporary power is available from location as directed by the Power Company.

2. Any temporary transmission lines required shall be installed by Contractor.

3. Provide power sources within eighty feet of any working position to allow the use of one-hundred-foot extension cords.

1.16 TEMPORARY HEAT AND VENTILATION

A. Temporary heat will be supplied and maintained by the Contractor.

B. The Contractor shall not use permanent equipment for temporary heating or venting purposes unless specifically noted otherwise in the contract documents.

C. The Contractor shall ventilate enclosed areas to assist cure of materials, dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases as the above may be generated by them.

D. Provide temporary heat and ventilation as required to maintain adequate environmental conditions to facilitate the progress of the work, to meet specified minimum conditions for the installation of materials, and to protect materials and finishes from damage due to temperature and humidity.

E. The Contractor shall pay costs of installation, maintenance, operation and removal, and fuel consumed.

1.17 TEMPORARY SITE SECURITY

A. The Contractor shall employ and is responsible to maintain sufficient security and safety measures to effectively prevent vandalism, vagrancy, theft, arson, and all other such negative impacts to the Work both stored and installed.

B. Any impacts to the progress of the Work, due to loss from inadequate security, will be the responsibility of the Contractor.

1.18 TEMPORARY BARRIERS

A. The Contractor shall provide, install, and maintain substantial temporary enclosures of partially completed areas of construction. Provide locking

entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Provide additional keys for any locks used to secure the buildings to the DBE Project Manager.

B. Where materials, tools and equipment are stored within the Work area, The Contractor shall provide secure lock up to protect against vandalism, theft, and similar violations of security. District accepts no financial responsibility for loss, damage, vandalism, or theft.

C. The Contractor shall provide barricades and covered walkways required by governing authorities to preserve public rights-of-way and for public access due to their work.

D. The Contractor shall provide and maintain protection for soft and hardscape areas adjacent to their work, replace damaged materials as directed by the Architect.

E. The Contractor shall protect non-owned vehicular traffic, stored materials, site, and structures from damage.

F. Bid Package Contractor No.01 shall construct and maintain planking, barricades, lights, lighting, access lighting and warning signs as indicated as required by Local authorities and State safety ordinances and as necessary for the protection of the public.

1.19 PROJECT IDENTIFICATION AND SIGNS

A. The Contractor shall provide sign per plans and specifications.

B. Project Identification and Temporary Signs: Prepare project identification and other signs of the size indicated; install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative treated wood or steel. Do not permit installation of unauthorized signs.

C. Provide temporary on-site informational signs.

1. As required by codes, laws, and regulatory agencies.

2. To identify key elements of the construction facilities.

3. To direct traffic.

D. Project Identification Sign: Size, design and information lettered as specified and as shown on drawings. Locate sign as indicated or directed by the DBE Project Manager, Architect and District.

E. The Contractor shall provide two (2) project site sign on two 4x4 posts with footings identifying address for all deliveries and visitors as required by the DBE Project Manager. Sign material to be weatherproof, durable, and vandal

resistant. Contractor to design layout, for review, local ordinance and compliance and approval prior to fabrication and installation at construction site.

F. The Contractor shall provide two (2) each 4’x8’ SCAQMD sign and two (2) 4'x8' SWPPP sign on each two 4x4 posts with footings as required by the DBE Project Manager. Sign material to be weatherproof, durable, and vandal resistant. Contractor to design layout for review, ordinance compliance and approval prior to fabrication and installation at construction site.

G. The Contractor shall provide applicable safety signage as required and/or as they see fit.

H. Posting of Contractor signage is subject to DBE Project Manager and District approval.

1.20 POLLUTION CONTROL

A. AIR QUALITY: Prior to the issuance of construction permits, this Bid Package Contractor shall prepare and submit to the City of Rancho Cucamonga Building & Safety Services Department a fugitive dust control plan, which shall require watering of exposed ground surfaces and disturbed areas a minimum of every three hours on the construction site and a minimum of three times per day during the entirety of the construction duration. This watering requirement shall be in addition to the existing requirements for fugitive dust control under South Coast Air Management District Rule 403. The Building & Safety Services Department shall verify that this measure is implemented during normal construction site inspections. **This is required prior to issuance of Grading and/or Building Construction Permits. Proof of compliance is achieved by submitting to Building & Safety Services Department a fugitive dust control plan.**

B. The Contractor shall provide a dust control sign per plans and specs.

C. The Contractor shall provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

D. The Contractor shall provide equipment and personnel; perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids.

E. Do not burn refuse, debris, or other materials on the site.

F. Comply with all State and local ordinances and regulatory requirements controlling environmental pollution during the course of construction and disposal operations.

1.21 EROSION AND SEDIMENT CONTROL

A. The Contractor shall plan and execute construction by methods that will control surface drainage from cuts and fills and from borrow and waste disposal areas, and to prevent erosion and sedimentation.

B. The Contractor shall minimize amount of bare soil exposed at one time.

C. The Contractor shall provide temporary measures such as berms, dikes and drains to prevent water flow over adjacent properties or City rights-of-way.

D. The Contractor shall construct fill and waste areas by selective placement to avoid erosive surface silts or clays. Avoid any eroded materials flowing off the property.

E. The Contractor shall periodically inspect earthwork to detect evidence of erosion and sedimentation; and promptly apply corrective measures.

1.22 NOISE CONTROL AND MITIGATION

A. Avoid excessive noise that would affect detrimentally adjacent activities and adjoining property.

B. Confine operations to permissible hours of day, to eliminate neighborhood noise pollution.

C. Construction- Related Noise Mitigation Plan: Prior to the issuance of any permits for grading, Bid Package No. 01 Contractor shall submit a construction-related noise mitigation plan to the Planning and Engineering Department for review and approval. The plan shall depict the location of the construction equipment and how the noise from this equipment would be mitigated during construction. Bid Package No. 01 shall pay all mitigation plan associated fees.

D. During all project site excavation and grading, the construction contractor(s) shall equip all construction equipment, fixed or mobile, with properly operating and maintained mufflers consistent with the manufacturers' standards.

E. Site Plan: Bid Package No. 01 Contractor shall orient all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest the project site. Locate equipment staging in areas that will create the greatest distance between construction-related noise sources and noise-sensitive receptors nearest the project site throughout the duration of project construction. These are required prior to issuance of Grading and/or Building Construction Permits. Proof of compliance is achieved by submitting a Site Plan to the Planning Department showing the location of the subject construction equipment. Bid Package No. 01 shall pay all site plan associated fees.

F. Map: Prior to issuance of any permits for grading and/or construction, the Bid Package No. 01 Contractor shall provide a map of the haul truck routes to the Planning and Engineering Department for review and approval. The planned haul

truck routes shall avoid residential areas to the maximum extent feasible. This is required prior to issuance of Grading and/or Building Construction Permits. Proof of compliance is achieved by providing a map to the Engineering and Planning Departments showing the haul truck routes. Bid Package No. 01 shall pay all site plan associated fees.

G. Haul truck deliveries shall not take place between the hours of 8:00 p.m. and 6:30 a.m. on weekdays, including Saturday, or at any time on Sunday or a national holiday. Additionally, if heavy trucks used for hauling would exceed 100 daily trips (counting both to and from the construction site), then the Bid Package No. 01 Contractor shall prepare a noise mitigation plan denoting any construction traffic haul routes and include appropriate noise mitigation measures. To the extent feasible, the plan shall denote haul routes that do not pass sensitive land uses or residential dwellings. This mitigation is a general note and if Bid Package No. 01 Contractor conducts haul activities during the times specified and heavy truck haul trips do not exceed 100 daily trips, then no further action is required. If Bid Package No. 01 conducts haul activities outside the times specified and/or haul trips exceed 100 daily trips, then traffic haul routes are to be included in noise mitigation plan and all associated fees shall be paid by Bid Package No. 01.

H. Construction and grading noise levels shall not exceed the standards specified in Development Code Section 17.66.050, as measured at the property line. District shall hire a consultant to perform weekly noise level monitoring as specified in Development Code Section 17.66.050. Monitoring at other times may be required by the City's Building Official. Said consultant shall report their findings to the Building Official within 24 hours; however, if noise levels exceed the above standards, then the consultant shall immediately notify the Building Official. If noise levels exceed the above standards, then Bid Package No. 01's construction activities shall be reduced in intensity to a level of compliance with above noise standards or halted.

1.23 BIOLOGICAL ENVIRONMENT MITIGATION

A. Prior to the commencement of any proposed actions (e.g., site clearing, demolition, grading) during the breeding/nesting season (September 1 through February 15), a qualified monitoring biologist contracted by the Rancho Cucamonga Fire Protection District/City of Rancho Cucamonga shall conduct a preconstruction survey(s) to identify any active nests in and adjacent to the project site no more than three days prior to initiation of the action. If the biologist does not find any active nests that would be potentially impacted, the proposed action may proceed. However, if the biologist finds an active nest within or directly adjacent to the action area (within 100 feet) and determines that the nest may be impacted, the biologist shall delineate an appropriate buffer zone around the nest using temporary plastic fencing or other suitable materials, such as barricade tape and traffic cones. The buffer zone shall be determined by the biologist in consultation with applicable resource agencies and in consideration of species sensitivity and existing nest site conditions, and in coordination with Bid Package No. 01 Contractor. Bid Package No. 01 shall work closely with monitoring biologist.

B. The qualified biologist shall serve as a construction monitor during those periods when construction activities occur near active nest areas to ensure that no inadvertent impacts on these nests occur. Only specified activities (if any) approved by the qualified biologist in coordination with Bid Package No. 01 Contractor shall take place within the buffer zone until the nest is vacated. Activities that may be prohibited within the buffer zone by the biologist may include but not be limited to grading and tree clearing. Once the nest is no longer active and upon final determination by the biologist, the proposed action may proceed within the buffer zone.

C. The monitoring biologist shall prepare a survey report/memorandum summarizing his/her findings and recommendations of the preconstruction survey. Any active nests observed during the survey shall be mapped on a current aerial photograph, including documentation of GPS coordinates, and included in the survey report/memorandum. The completed survey report/memorandum shall be submitted to the City of Rancho Cucamonga Planning Department prior to the commencement of construction-related activities that have the potential to disturb any active nests during the nesting season. Bid Package No. 01 Contractor to become familiar with report and follow recommendations.

1.24 TRIBAL CULTURAL RESOURCE MITIGATION

A. During the project's construction phases that involve ground-disturbing activities, Bid Package No. 01 shall work closely with the District's professional tribal monitor/consultant. Upon discovery of archaeological resources (if any), construction activities in the immediate vicinity of the find shall cease until the find can be assessed. If human remains or funerary objects are encountered, work in the immediate vicinity (within a 100-foot buffer of the find) shall cease. Bid Package No. 01 to review and follow CEQA Mitigation Measure TCR-1 and TCR-2 for additional information.

1.25 EXTERIOR ENCLOSURES

A. The Contractor shall provide temporary weather-tight closure of exterior openings to accommodate acceptable working conditions and protection for materials, to allow for temporary heating and maintenance or required ambient temperatures identified in individual Specification Sections, and to prevent entry of unauthorized persons. Provide temporary access doors with self-closing hardware and locks if necessary. Provide additional keys for any locks used to secure the buildings to the DBE Project Manager.

1.26 ACCESS ROADS AND PARKING AREAS

A. Prior to starting work, the Contractor, District and the Architect or his representative shall make a thorough survey of the site and approaches thereto. The Contractor will maintain temporary access roads required to perform the work and locate construction offices at locations approved by the Architect/Engineer and the District. The Contractor shall verify all grade

elevations indicated on the Drawings at the site and immediately notify the Architect/Engineer if any deviations are found. The Contractor shall assume all responsibility if any work proceeds without such notification.

B. Maintain specific vehicular access as required for the orderly progress of the work. Fill, compact and grade areas as necessary to provide suitable support during all weather conditions for anticipated loads including municipal fire apparatus. Provide adequate surface drainage and do not interrupt natural flow of existing drainage.

C. Provide designated parking areas. On-site parking will only be used for District, Architect, and DBE Project Manager. Construction personnel shall park off-site; thus, provide off-site parking. Provide an area for material & tool drop off.

D. Restore temporary vehicular access and parking areas to original or to specified conditions at completion of work.

E. Provide and maintain access to fire hydrants, free of obstructions.

F. Bid Package No. 01 Contractor shall not use the Fire Station's apparatus response driveway for access or parking once constructed.

G. The Contractor to provide a level area for installation of temporary office trailers.

H. The Contractor to provide a level area graded to drain and covered with crushed rock at temporary parking area and cobles or track-out pad as required to surface streets as required per SWPPP.

1.27 PROGRESS CLEANING

A. The Contractor shall maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Debris shall be cleared and disposed of each day so that no debris accumulates. Debris may be stockpiled at a designated area if approved by the DBE Project Manager. The Contractor generating debris shall provide temporary protection and maintenance of said protection as required.

C. The Contractor shall remove waste materials, debris, and rubbish from site daily and legally dispose off-site.

D. The Contractor shall remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to the space being enclosed.

E. Bid Package Contractor s No.01 hall broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate dust. Clean substrate: remove dirt, oil, grease, construction markings, and foreign matter that could adversely affect surface finish appearance or performance.

F. If The Contractor fail to maintain a clean work area as determined by the DBE Project Manager, DBE Project Manager will at his discretion, hire additional labor to perform cleaning and back charge the Bid Package Contractor accordingly.

G. Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.

1.28 DUMPSTER SERVICE

A. The Contractor shall provide dumpsters as required for the disposal of debris generated by their work.

B. The Contractor shall provide a 3 cubic yard trash bin and weekly service for the duration of the project for the sole use of the DBE Project Manager.

1.29 FIRST AID

A. Maintain such first aid supplies as may be required for minor accidents. Make arrangements with local emergency center and nearest hospital to receive cases requiring medical attention, including emergencies. Such information shall be conspicuously displayed at the construction office.

1.30 WATCHMAN SERVICES

A. The Contractor shall provide such watchman services as he may deem necessary to properly safeguard materials, tools, appliances, and work during all hours that operations under the Contract are not actively proceeding. The District will not assume any responsibility for the loss of or damage to materials, tools, appliances, or work arising from acts of theft, vandalism, malicious mischief, or other causes.

1.31 FIRE PROTECTION

A. Provide fire extinguisher on the premises during the course of construction of the type and sizes recommended by the NBFU to control fires resulting from the particular work being performed. Instruct employees in their use. Place extinguisher in the immediate vicinity of the work being performed, ready to be used.

B. During the use of hazardous equipment such as acetylene torches, welding equipment, bitumen kettles, salamanders and similar devices, no work shall be commenced, or equipment used unless fire extinguisher of an approved type and capacity are placed in the working area and available for use by the workmen using such hazardous equipment.

C. Provide fire extinguisher conforming to the requirements, as minimums, of NFPA 10 and 241.

1.32 CONSTRUCTION AIDS

A. Provide construction aids and equipment required by personnel and to facilitate the execution of the work, scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes and other such facilities and equipment.

B. Provide all necessary facilities and means of access to all parts of the structure so that Governmental Agency Inspectors, District Inspector, Special Inspectors and the Architect and Structural Engineer may inspect any portion of the structure.

1. Means of access includes, but is not limited to, ladders, and/or scaffolds.

1.33 CONTRACTOR CONDUCT AND DRESS CODE

A. Contractor's and subcontractor's personnel shall observe and abide by District requirement concerning appropriate conduct, loud noise (unrelated to construction activities) and dress requirements for a safe and un-disturbing workplace. Conduct work activities in a professional manner at all times.

B. Dress Code requirements: contractor's personnel shall wear traditional work attire or uniforms without logos, graphics or wording detrimental to work environment; unless logos, graphics or wording are for business identification purposes.

C. Contractors and subcontractors shall wear orange safety vests along with other required safety attire including hard hats and safety glasses.

D. Hard hat Identification stickers issued by the DBE Project Manager shall be worn at all times, displayed in full view and not concealed.

E. No radios permitted on the job site.

F. District reserves the right to remove any person(s) not observing conduct and dress requirements specified herein.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials; if acceptable to the DBE Project Manager, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

B. Water: Provide potable water approved by local health authorities.

2.2 TEMPORARY FACILITIES

A. The Contractor shall provide all temporary office furniture, equipment, computers, printers, copier, software, services, accessories, supplies, and facilities for the duration of the project. Provide delivery of same to the jobsite trailers. Items become the property of the District at the completion of the project and Contractor shall provide delivery to a location identified by the District upon completion of the project or when directed by the DBE Project Manager.

B. The Contractor shall provide all software, licenses, and computer services.

C. Where indicated, The Contractor shall provide the exact manufacturer and model specified. No substitutions will be accepted.

D. All furniture, equipment, computers, phone system equipment, software, etc. shall be new condition and shall include all accessories for a complete and operable system.

2.3 TEMPORARY OFFICE SUPPLIES

A. The Bid Package 1 Contractor shall establish and pay for a Staples.com account for the DBE Project Manager's office supplies. DBE Project Manager shall have sole access to the account and shall select username and password. Contractor shall provide $1,500 for initial office mobilization supplies and $500 per month thereafter for the duration of the project. Any monies leftover for any month shall be rolled over to the next. Any monies leftover at the completion of the project will be credited to the District via a deductive change order.

B. Contract shall establish account immediately after contract award to facilitate mobilization.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Locate and install where directed by the DBE Project Manager and maintain in a safe and sanitary condition at all times until completion of the contract.

D. Temporary facilities shall be located so as to minimize impacts to the progress of the contract work. The Contractor understand that work may be impacted by temporary facilities and work may need to be completed out of sequence so as to

accommodate temporary facilities. The Contractor shall perform this work out of sequence at no additional cost to the District.

3.2 OPERATION, TERMINATION AND REMOVAL

A. Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.

B. The Contractor shall remove those Temporary Facilities provided under their scope of work including site signs, temporary utilities, fencing, trailers, storage containers, temporary roads, temporary parking areas. Contractors shall then complete their contract scope of work at no additional cost to the District.

1. Materials and facilities that constitute temporary facilities are property of the Bid Package Contractor. The District reserves the right to take possession of Project identification signs.

3.3 MATERIALS

A. All items listed under this section are to be supplied by The Contractor. All items purchased for the District's or DBE Project Manager's use during the course of the project become property of the District upon completion of the project and will be turned over to the District. The Contractor will pay for all costs associated with moving and delivering these items to the project and to a location identified by District at the completion of the project. All items listed under this section shall be new. No used items will be accepted. Provide exact models, products, and quantities as specified. No substitutions will be approved.

a. Technology Related Items:

Quantity:	Item and Description:
One (1)	Firebox T55-W.
Six (6)	Monitors–Benq Model ID GL2760H, LCD display 27", provide all cables for connection to computer/laptop.
Two (2)	Printers- HP LaserJet Pro M402n Monochrome Printer (C5F93A#BGJ)
Four (4)	Docking Stations- Plugable UD-3900 USB 3.0 Universal Docking Station
One (1)	Apple TV 4K, 64GB
One (1)	PC - Dell OptiPlex 3060 Micro Form Factor (MFF) Business Desktop Intel Six Core Processor i5-8500T 16G RAM 2TB HDD Windows 10 Professional
One (1)	TV Mount- Cheetah Mounts APTMM2B
One (1)	TV- Vizio 65” Class (64.5” Diag.) 4K Ultra Smart HDTV M65-C1
Two (2)	iPad Pro 12.9”, 256GB, Wi-Fi, Space Gray
Four (4)	Sets of Wireless Keyboard and Mouse- Logitech Wireless Combo MK520
One (1)	Primavera Software License for selected scheduling program for CM's use.

b. Phone Related Items:

Four (4)	VoIP Phones- NEC DT700 ITL-32D-1 (BK)
One (1)	Teleconference speaker phone for conference room: Polycom Sound Station 2, 220-16201-001 cordless conference phone or equal.
One (1)	Bid Package No. 01 Contractor shall provide and install phone and 1000 Mbps high speed internet services by Charter Spectrum or equivalent upon CM approval.

c. Printer Related Items:

One (1)	Copier/Scanner/Printer/Fax, Ricoh MP C2503, color, staple function, scan function, copy function, collating tray, 11x17 copies.
One (1)	Copier Maintenance - full maintenance with 20,000 copies per month including color. Maintenance shall include all labor, parts, and supplies, excluding only paper.
Two (2)	Battery Backup- APC BE350G Back-UPS 350VA
Six (6)	Ethernet 10ft- Mediabridge Cat5e Ethernet Patch Cable (10 feet) RJ45 Computer Networking Cord (31-399-10B)
Six (6)	Ethernet 25ft- Mediabridge Cat5e Ethernet Patch Cable (25 feet) RJ45 Computer Networking Cord (31-399-25B)
Two (2)	Ethernet 50ft- Mediabridge Cat5e Ethernet Patch Cable (50 feet) RJ45 Computer Networking Cord (31-399-50B)

d. Miscellaneous Construction Items:

Twelve (12)	White full brim hard hats
Twelve (12)	Class 2 deluxe safety vests (2 medium, 6 large and 4 X-large)
Twelve (12)	Safety glasses (Ice Wraparounds- Silver Mirror from Uline)
Fifty (50)	Ear plugs
Two (2)	Fire Extinguishers
One (1)	First Aid Kit

e. General Conditions:

Two (2)	Temporary Project Site Sign at two locations designated by CM
Two (2)	SWPPP Temporary Site Sign at two locations designated by CM
Two (2)	SCAQMD Temporary Site Sign at two locations designated by CM
One (1)	Project Trailer Sign at location designated by CM

f. Furniture and Equipment:

Three (3)	Metal-L Shape with multiple drawers and file storage;
One (1)	Electric height adjustable desk min. 30” x 60” with dual monitor arms;
One (1)	Metal 30” x 60” with multiple drawers and file storage;
Four (4)	Realspace Eaton Mid-Back Bonded Leather Chair, Black, 39 3/8” – 43 ¼”, steel & plywood frame, black leather & polyvinyl chloride, Office Depot Item #303477;
One (1)	Conference Room desk large enough to accommodate 15 people:
Two (2)	6'x30" Folding Tables;
Two (2)	4' Folding Tables;
Twenty (20)	Folding Chairs (Metal with back and seat cushion);
One (1)	5'H x 36"W Bookcase;

One (1)	41 ¾”H x 36” W Steel Storage Cabinet, Office Depot Item #166451;
One (1)	File Cabinets Metal 4 drawer letter;
One (1)	Bulletin Board 4'x6'
Three (3)	White Board 4'x6'
One (1)	Medium duty, high capacity, jam resistant 18 sheet shredder.
One (1)	Microwave, minimum 1.1 CF
One (1)	Toaster Oven
One (1)	Keurig Coffee Maker
One (1)	Refrigerator, minimum 4.6 CF

g. Services:

One (1)	Trailer (CM Office) - 12'x60' Trailer to include two (2) offices, conference room. Contractor to provide possible layout for CM's approval. Final layout of office trailer will at the CM's discretion and approval.
One (1)	Cleaning Service - Regular weekly service of CM's field office.
One (1)	Security System - Trailer security to be contracted by Bid Package No. 1 Contractor. Service to include initial installation and removal and monthly monitoring.
One (1)	Mobilization of the trailer (CM Office).
One (1)	Relocation of the trailer (CM Office).
One (1)	De-Mobilization of the trailer (CM Office).
One (1)	Water Cooler & Service – Water Cooler to have hot and cold function. Service shall consist of five (5) 5-gallon bottles and three (3) water bottle (16.9 oz) packs delivered once a month.
One (1)	Trash Container - 3-yard container with weekly service for CM's use, not for contractor debris.
Two (2)	Port-o-lets being provided for CM, Project Inspector, and Owner Representatives shall be at a minimum a model that meets United Site Services’ Deluxe Restroom with disposable seat covers. The female and male port-o-let(s) are to be secured/ locked at all times. All temporary toilets shall be properly serviced twice weekly.
One (1)	Hand wash station for CM, Project Inspector, and Owner Representatives.
	Port-o-let including hand wash stations are provided as required based on labor force on site. The female port-o-let(s) are to be secured/ locked at all times. Provide facilities at both lay-down area and work site.
	Temporary Fencing - Provide 8' temp fence with new mesh screen as required.
	Temporary Electrical Power – Provide temporary construction power and service for site and construction field office including removal.
	Lighting – Provide temporary construction task lighting as required as well as security lighting at field office.

END OF SECTION

SECTION 01 58 50

PROJECT SIGNS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project identification sign

B. AQMD identification sign

C. SWPPP identification sign.

1.02 RELATED REQUIREMENTS

A. Section 01 50 00 - Temporary Facilities and Controls.

1.03 QUALITY ASSURANCE

A. Design sign and structure to withstand 50 miles/hr (80 km/hr) wind velocity.

B. Sign Painter: Experienced as a professional sign painter for minimum three years.

C. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawing: Show content, layout, lettering, color, foundation, structure.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

A. Structure and Framing: New, wood, structurally adequate, minimum 4" x 4" posts.

B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4-inch (19 mm) thick, standard large sizes to minimize joints.

C. Rough Hardware: Galvanized.

D. Paint and Primers: Exterior quality, two coats; sign background of color as selected.

E. Lettering: Exterior quality paint, colors as selected.

2.02 PROJECT IDENTIFICATION SIGN

A. One painted sign, 32 sq ft (2.98 sq m) area, bottom 6 feet (2 m) above ground.

B. Content:
1. Project number, title, logo and name of District as indicated on Contract Documents.
2. Names and titles of Fire Board members.
3. Name of Design Build Entity.

C. Graphic Design, Colors, Style of Lettering: Designated by Architect.

D. Lettering: Standard Alphabet Series C, as specified in FHWA Standard Highway Signs (SHS).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install project identification sign within 30 days after date fixed by Notice to Proceed.

B. Erect at designated location.

C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.

D. Install sign surface plumb and level, with butt joints. Anchor securely.

E. Paint exposed surfaces of sign, supports, and framing.

3.02 MAINTENANCE

A. Maintain signs and supports clean, repair deterioration and damage.

3.03 REMOVAL

A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes administrative and procedural requirements governing products for incorporation into the Work.

1.02 RELATED SECTIONS

C. Section 01 33 00: Submittal Procedures

E. Section 01 45 50: Testing and Inspection

F. Section 01 25 00: Substitution Procedures

G. Section 01 78 60: Warranties, Guarantee, & Bonds

1.03 DEFINITIONS

A. Definitions used in this Section are not intended to change the meaning of other terms used in the Contract Documents, such as “specialties,” “systems,” “structure,” “finishes,” “accessories,” and other similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.

1. “Products” are items purchased for incorporation into the Work, whether purchased for the Work or taken from previously purchased stock. The term “product” includes the terms “material” and “equipment” and terms of similar intent.

a. “Named Products,” are items identified by the manufacturer’s product name, including make, model number or other designation, shown or listed in the manufacturer’s published product literature, current as of the date of the Contract.

b. “Foreign Products,” as distinguished from “domestic products,” are items substantially manufactured (50 percent or more of value) outside the United States and its possessions.

2. “Materials” are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.

3. “Equipment” describes products with operational parts, whether motorized or manually operated, that may require service connections, such as wiring or piping. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work.

1.04 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.

B. Compatibility of Options: When the CONTRACTOR is given the option of selecting between two or more products for use in the Work, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products that will be exposed in view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.

2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:

a. Name of product and manufacturer

b. Model and serial number

c. Capacity

d. Speed

e. Ratings

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

1. Schedule delivery to minimize long-term storage at the Project site and to prevent overcrowding of Work spaces.

2. Coordinate delivery with installation time to assure minimum holding time for all items, but especially those that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

3. Deliver products to the Project site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Provide equipment and personnel to handle and store products by methods to prevent soiling, disfigurement or damage.

5. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

6. Store products at the Project site in a manner that will facilitate inspection and measurement of quantity or counting of units. Periodically inspect to ensure products are undamaged and are maintained under specified conditions.

7. Store heavy materials away from structures in a manner that will not endanger the structure's supporting construction.

8. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

9. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

10. When approved by the District, provide off-site storage and protection in a bonded warehouse approved by District when site does not permit on-site storage or protection at no cost to the District.

11. Store products subject to damage by the elements above ground, under cover in a weather-tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

12. For exterior storage of fabricated products, place on sloped supports, above ground and protect as necessary to prevent deterioration or damage product.

1.06 MATERIAL SELECTION

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

1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.

2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other Projects.

B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:

1. Proprietary Specification Requirements: Where Specifications name only a single material or manufacturer, provide the product indicated. No substitutions will be permitted.

2. Semi-proprietary Specification Requirements: Where Specifications name two or more products or manufacturers, provide one of the products indicated throughout the Project. No substitutions will be permitted.

a. Where Specifications specify products or manufacturers by name, accompanied by the term “or equal,” comply with General Conditions article on Substitutions to obtain approval for use of an unnamed product.

3. Descriptive Specification Requirements: Where Specifications describe a product or assembly and list exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that has the characteristics and otherwise complies with the Contract Documents.

4. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated.

   a. Manufacturer’s recommendations may be contained in published material literature or by the manufacturer’s certification of performance.

5. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes, or regulations specified.

6. Visual Matching: Where Specifications require matching an established Sample, decision of the ARCHITECT will be final on whether a proposed product matches satisfactorily.

7. Visual Selection: Where specified product requirements include the phrase “… as selected from manufacturer’s standard or premium colors, patterns, textures…” or a similar phrase, select a product and manufacturer that complies with other specified requirements. The ARCHITECT will select the color, pattern, and texture from the product line selected.

1.07 INSTALLATION OF PRODUCTS

A. Comply with manufacturer’s instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located, and aligned with other Work.

B. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration until Substantial Completion.

1.08 OWNER-FURNISHED, OWNER-INSTALLED WORK (OFOI)

A. Indicate in construction progress schedule owner-furnished owner-installed items and schedule time for installation.

B. Items indicated on Drawings as OFOI will be furnished by Owner and installed by Owner. Work indicated as OFOI will be performed under separate contract employees by Owner at its discretion. Where work of this Contract adjoins or conflicts with OFOI, work, Contractor shall cooperate with Owner and its

employees in manner that will provide for reasonable and accurate completion of this Contract and work under separate contact.

C. Coordinate with OFOI work affecting this contract. Including verification and interfacing of this contract with OFOI work.

1.09 OWNER-FURNISHED, CONTRACTOR-INSTALLED WORK (OFCI)

A. Indicate in construction, progress schedule owner-furnished contractor-installed items and schedule time for installation.

B. Contractor shall verify exact sizes and services required for each item of equipment indicated on Drawings or in Project Manual as OFCI and shall obtain from Owner rough-in drawings, diagrams, setting templates and other necessary information to ensure proper mating of assemblies.

C. Contractor shall receive at project site each item of equipment from Owner and from that time on shall assume full responsibility for items and equipment until Substantial Completion.

D. Contractor shall give Owner 15 days prior notice of requirements for delivery to site of all OFCI equipment.

E. Contractor shall be responsible for receiving OFCI items and equipment and shall uncrate, inspect and notify Owner in writing within 7 days of receiving said items or equipment of acceptance or rejection of items or equipment. Owner, after receiving notice, will take appropriate action to have items or equipment made acceptable for Contractor's use. Rejected items shall be carefully stored and protected from damage by Contractor until Owner takes appropriate action.

F. Contractor shall be responsible for final placing, installation, connection, start-up, checking, testing and demonstrated satisfactory operation. Owner will provide names of manufacturer's representatives, who shall assist the Contractor in checking, testing and demonstrating equipment.

PART 2 – PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 62 00

STORAGE AND PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Upon delivery to the site, provide adequate storage area in protecting products scheduled for use in the work and finish improvements until completion and acceptance.

B. Related Requirements: The General Provisions of the Contract Documents.

C. Related Work: Additional procedures also may be prescribed in other sections of these specifications.

1.02 QUALITY ASSURANCE

A. Include within the Contractor's quality assurance such procedures required to assure full protection of the work, materials and finish improvements.

1.03 MANUFACTURERS' RECOMMENDATIONS

A. Except as otherwise specified, determine and comply with the manufacturers' recommendations on product handling, storage and protection.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Equipment Access: To avoid conflict, the DBE Project Manager shall establish and provide area for Contractor-provided secure storage for handling of stored products away from ongoing activities of the work.

B. Provide secure protection of work and materials against damage. Manufactured products shall be stored per manufacturer's recommendations on product handling, storage, and protection.

C. Deliver products to the job site in their manufacturer's original container, with labels intact and legible.

1. Maintain packaged materials with seals unbroken and labels intact until time of use.
2. Promptly remove damaged materials and unsuitable items from the job site, and promptly replace with material meeting the specified requirements.

D. The Architect may reject as non-complying such material and products that do not bear identification satisfactory to the Architect as to manufacturer, grade, quality and other pertinent.

1.05 PROTECTION

A. Protect existing finish improvements through which equipment and material are handled.

B. Provide protection for horizontal finish surfaces in traffic areas prior to allowing equipment to be moved over surfaces.

C. Maintain finished improvement surfaces clean, unmarred, and suitably protected until acceptance by the Owner.

1.06 REPAIRS AND REPLACEMENTS

A. In event of damage, promptly make replacements and repairs to the approval of the Architect and at no additional cost to the Owner.

B. Additional time required to secure replacements and to make repairs will not be considered by the Architect to justify an extension in the Contract Time of Completion.

END OF SECTION

SECTION 01 70 00

EXECUTION REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Field engineering and surveying.

B. Requirements and limitations for cutting and patching of Work.

C. Cleaning throughout construction period.

D. Adjusting.

E. Closeout procedures.

F. Spare parts and operation and maintenance data.

G. Instruction to Owner personnel.

H. Warranty and Guarantee.

I. Project Record Documents.

1.02 FIELD ENGINEERING QUALITY CONTROL

A. Employ Land Surveyor registered in the State of California and acceptable to Architect.

B. Submit name, address and telephone number of Surveyor before starting survey work.

C. Maintain complete and accurate log of control and survey Work as it progresses.

D. On completion of foundation walls, floor slabs and major site improvements, prepare a certified survey illustrating dimensions, locations, angles and elevations of construction.

E. Refer to Section 01 71 20 Field Engineering for survey and layout markings requirements.

1.03 CUTTING AND PATCHING

A. Refer to Section 01 73 90 Cutting and Patching for cutting and patching requirements.

1.04 QUALITY ASSURANCE- CLEANING

A. Refer to Section 01 71 00 Cleaning for cleaning requirements.

1.05 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

1.06 CLOSEOUT PROCEDURES

A. Refer to Section 01 77 00 Closeout Procedures for closeout requirements.

1.07 SPARE PARTS AND OPERATION AND MAINTENANCE DATA

A. Refer to Section 01 77 00 Closeout Procedures for spare parts and operation and maintenance data requirements.

1.08 INSTRUCTION TO OWNER'S PERSONNEL

A. Refer to Section 01 77 00 Closeout Procedures for training requirements.

1.09 WARRANTIES

A. Refer to Section 01 78 60 Warranties, Guarantees, and Bonds for warranty requirements.

1.010 1.10 PROJECT RECORD DOCUMENTS

A. Refer to Section 01 78 90 Project Record Documents for record document requirements.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 71 00

CLEANING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Cleaning throughout the construction period, and final project cleaning prior to the acceptance tour.

B. Related Work Described Elsewhere: In addition to standards specified herein, comply with requirements for cleaning up as described in other sections of these Specifications.

1.02 QUALITY ASSURANCE

A. Inspection: Conduct daily inspection, and more often if necessary to verify that requirements of cleanliness are being met.

B. Codes and Standards: In addition to the requirements specified herein, comply with pertinent requirements of authorities having jurisdiction.

C. For final cleaning, use only professional cleaning company experienced in commercial cleaning.

D. Contractor's Responsibility: The CONTRACTOR at all times shall keep the site and surrounding area free from accumulation of waste material or rubbish caused by operations under the contract. The site shall be maintained in a neat and orderly condition. All crates, cartons, paper and other flammable waste materials shall be removed from work areas and properly disposed of at the end of each day. The CONTRACTOR shall remove from and about the site the waste materials, rubbish, tools, construction equipment, machinery and materials no longer required for the work.

E. Failure to Cleanup: If the CONTRACTOR fails to clean up as provided in the contract documents, the DISTRICT may do so, and the cost thereof shall be invoiced to the CONTRACTOR and deducted from the next progress payment. Each subcontractor shall have the responsibility for the cleanup of its own work. If the subcontractor fails to clean up, the CONTRACTOR may do so and back-charge the subcontractor.

F. DISTRICT reserves right to withhold certification of payment requests for failure on part of CONTRACTOR to regularly clean Project in conformance with Requirements of this Section.

G. Construction Buildings: When directed by the DISTRICT, CONTRACTOR and subcontractor shall dismantle temporary structures, if any, and remove from the site all construction and installation equipment, fences, scaffolding, surplus materials, rubbish and supplies belonging to CONTRACTOR or subcontractor. If the

CONTRACTOR does not remove the tools, equipment, machinery and materials within fifteen (15) calendar days after completion of its work, then they shall be deemed abandoned and the DISTRICT can dispose of them for its own benefit in whatever way it deems appropriate.

PART 2 – PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

A. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

2.02 COMPATIBILITY

A. Use cleaning materials and equipment, which are compatible with the surfaces being cleaned, as recommended by the manufacturer of the material to be cleaned.

PART 3 – EXECUTION

3.01 PROGRESS CLEANING

A. General:

1. Retain stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.

2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this Work. Debris shall be removed from the site and disposed of in a lawful manner. Disposal receipts or dump tickets shall be furnished to the DBE Project Manager upon request.

3. At least once a week, and more often if necessary, remove scrap, debris, and waste material from the job site.

4. Provide adequate storage for items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology.

B. Site:

1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris and waste material. Remove items to the place designated for their storage. Combustible waste shall be removed from the site. Flammable waste shall be kept in sealed metal containers until removed from the site.

2. Weekly, and more often if necessary, inspect, arrangements of materials stored on the site; restack, tidy, or otherwise service arrangements to meet the requirements specified above.

3. Maintain the site in a neat and orderly condition.

C. Structures:

1. Weekly, and more often if necessary, inspect the structures and pick up scrap, debris, and waste material. Remove items to the place designated for their storage.

2. Weekly, and more often if necessary, sweep interior spaces clean.

a. “Clean”, for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and a handheld broom, i.e., ‘broom-clean”.

3. As required preparatory to installation of succeeding materials, clean the structures of pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the required cleanliness.

4. Clean substrate; remove dirt, oil, grease, construction markings, and foreign matter that could adversely affect surface finish appearance or performance.

5. Following the installation of finish floor materials, clean the finish floor daily, and more often if necessary, and while work is being performed in the space in which finish materials have been installed.

a. “Clean”, for the purpose of this subparagraph, shall be interpreted as meaning free from foreign material which, in the opinion of the DBE Project Manager, may be injurious to the finish floor material, i.e., “vacuum clean”.

3.02 FINAL CLEANING

A. Definition: Except as otherwise specifically provided, “clean”, for the purpose of the Article, shall be interpreted as meaning the level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials, i.e., “scrub and polish clean”.

B. General: Complete following cleaning operations before requesting inspection for certification of Substantial Completion.

1. Prior to completion of Work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste, conduct final progress cleaning as described above.
2. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    a. Unless otherwise specifically directed by Architect or Construction Manager, water and broom clean paved areas on site and public paved areas directly adjacent to site. Remove resultant debris.
3. Rake grounds that are neither planted nor paved to smooth, even-textured surface.
4. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

C. Structures:

1. Exterior: In areas affected by the work under this contract, visually inspect exterior surfaces and remove traces of soil, waste material, smudges, and other foreign matter. Remove traces of splashed material from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure. In the event of stubborn stains not removable with water, the DBE Project Manager may require light sandblasting or other cleaning at no additional cost to the District.

2. Interior: In areas affected by the work under this contact, visually inspect interior surfaces and remove traces of soil waste material, smudges, and other foreign matter. Remove traces of splashed materials from adjacent surfaces. Remove paint drippings, spots, stains, and dirt from finished surfaces. Use only the cleaning materials and equipment instructed by the manufacturer of the surface material.

3. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

4. Polished Surfaces: On surfaces requiring the routine application of buffed polish, apply the polish recommended by the manufacturer of the material being polished. Glossy surfaces shall be cleaned and shined as intended by the manufacturer.

5. Carpet. Use only dry-chemical method of cleaning. Steam cleaning or water based cleaning shall not be used on carpet. Use only dry-chemical materials and methods fully approved by carpet manufacturer, as instructed in manufacturer’s published literature.

6. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily

repaired or restored or that already show evidence of repair or restoration.

a. Do not paint over “UL” and similar labels, including mechanical and electrical nameplates.

D. Mechanical and Electrical Systems:

1. Prior to completion of Work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste, conduct final progress cleaning as described above.
2. Replace parts subject to unusual operating conditions.
3. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
4. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
5. Clean ducts, blowers, and coils if units were operated without filters during construction.
6. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

E. Timing: Schedule final cleaning as accepted by the DBE Project Manager to enable the District to accept a completely clean project.

3.03 CLEANING DURING THE DISTRICT’S OCCUPANCY

A. Should the District occupy the work or any portion thereof prior to its completion by the Contractor and acceptance by the District, the DBE Project Manager in accordance with the General Conditions of the Contract shall determine responsibilities for interim and final cleaning of the occupied spaces.

END OF SECTION

SECTION 01 71 20

FIELD ENGINEERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Quality Control Procedures
B. Field Engineering & Staking Furnished and Paid for by CONTRACTOR
C. Survey Reference Points
D. Staking Requests and Procedures
E. Survey Requirements
F. Layout Markings

1.02 QUALITY CONTROL PROCEDURES

A. To maintain continuity, clarity, and simplicity of layout and surveying work throughout the course of the project, ALL surveying, staking and field engineering listed in paragraph 1.03 below will be provided by one surveyor by this CONTRACTOR as indicated in the Summary of Work.

B. Any supplemental surveying required not identified in paragraph 1.03 below will be the responsibility of this CONTRACTOR.

C. It is this CONTRACTORs responsibility to understand, double check and verify the placement of any stakes provided within this section prior to beginning work and notify the DBE PROJECT MANAGER of any discrepancies, questions and/or problems before proceeding with the work.

D. All surveying required in paragraph 1.03 below, and the associated costs, will be the financial responsibility of this CONTRACTOR.

1.03 MINIMUM FIELD ENGINEERING & STAKING FURNISHED

A. The CONTRACTOR will be given an AutoCAD drawing file for the project for their use in determining earthwork quantities for construction of the project.

B. The CONTRACTOR shall be responsible for retaining a registered Civil Engineer authorized to practice Land Surveying or a Licensed Land Surveyor, both registered in the State of California to provide all survey services required for the successful completion of the project.

C. The Surveyor retained for the project by the CONTRACTOR shall also provide an As Built Grading Plan and Certification of Final Grading certifying as constructed grading has been constructed within +/-0.1 feet of design elevations in AutoCAD drawing format, denoting post construction filed surveyed horizontal and vertical data taken at minimum 25 foot intervals, including all tops and bottoms of slopes and vertical cuts on the project, and providing Rough Grading

Inspection Certifications wet signed and sealed along with the required supporting documents as noted on the project plans and as required by the City.

D. Pad certification for elevation of all pads within the project shall be submitted by the CONTRACTOR to the Engineering Services Department for approval prior Pad certification for elevation of all pads within the project shall be submitted by the CONTRACTOR to the Engineering Services Department for approval prior to any concrete pouring. Pad certification shall be by approved black-line as-built grading and drainage plan and by letter format with supporting documentation in accordance with the attached Rough Grading Inspection Certificate showing the design and as-built pad elevations as shown on the approved grading and drainage plan and sealed by a Civil Engineer or Land Surveyor registered in the State of California retained by the CONTRACTOR.

E. Certificates of final lot grading are to be submitted by the CONTRACTOR to the Engineering Services Department prior to final building inspection. Certificates of final lot grading are to be submitted by the CONTRACTOR to the Engineering Services Department prior to final building inspection.

F. Final Approval includes the construction of all improvements shown on the approved plan, including drainage facilities, drainage patterns, walls, curbs. Final Approval includes the construction of all improvements shown on the approved plan, including drainage facilities, drainage patterns, walls, curbs. asphalt pavement, buildings, etc. All items shall be constructed to the line and grade shown on the approved plans with appropriate staking provided by a Registered Civil Engineer authorized to practice land surveying or a Licensed Land Surveyor retained by the Contractor.

G. An as-graded grading plan and certification of compliance in accordance with the attached Civil Engineer's Certification of Final Grading shall be submitted An as-graded grading plan and certification of compliance in accordance with the attached Civil Engineer's Certification of Final Grading shall be submitted by a Registered Civil Engineer authorized to practice land surveying or a Licensed Land Surveyor retained by the CONTRACTOR to the Engineering Services Department prior to release of grading bond and prior to final grading inspection.

H. At the Completion of Rough Grading, the grading CONTRACTOR shall submit to the Permit Technicians (Building and Safety Front Counter) an original and a copy of the Pad Certifications to be prepared by and properly wet signed and sealed by the Civil Engineer retained by the CONTRACTOR and Soils Engineer of Record

I. As-Built/Site Verification and Record Drawings:

1. Surveyor will provide grade checking and certification for grading work, including elevations on completed building pads.
2. Surveyor will check the layout of work by instrumentation, including underground utilities prior to trench closure. Schedule the surveyor prior to trench closures.

3. Preparation of Record Drawings indicating all work is in compliance with the drawings and specifications, and including locations by coordinate of all utilities with top of pipe elevations at major grade and alignment changes, rim-of-grate or top-of-curb and flow line elevations of all drainage structures and manholes.
4. Final Submittal: Submit one (1) set of final marked-up Record Prints, two (2) sets of Record-revised As-Built (AutoDesk software) CAD Drawing files on electronic media (one set locked, and one set unlocked and completely manipulate-able), and two (2) copies printed from the Record-revised As-Built CAD Drawings. Print each drawing whether or not changes and additional information were recorded to create complete sets. In addition, submit Record-revised As-Built Drawings in PDF format. Each drawing shall be titled to exactly match the drawing number and title on printed Record-revised As-Built Drawings.

J. Other Points

1. Provide other points as necessary to complete the work required by the Contract Documents.

1.04 SURVEY REFERENCE POINTS

A. Prime CONTRACTOR shall locate and protect survey control & reference points.

B. Control datum for survey is that established by the surveyor.

C. Prime CONTRACTOR shall protect survey control points prior to starting site work; and preserve permanent reference points during construction.

D. Promptly report to the CM's job site superintendent the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

J. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice from the DBE Project Manager.

1.05 STAKING REQUESTS AND PROCEDURES

A. All staking and staking requests shall be the responsibility of the CONTRACTOR.

B. Staking requests shall be made for a minimum of 4 hours of survey time per request unless surveyor and CONTRACTOR mutually agree to shorter requested time per request.

C. Staking request shall consider continuity of survey work (for example):

1. Survey staking of a complete area of site.

2. Survey staking of total sewer/storm drain line or large segment of continuous work.

E. After the stakes are set, it shall be the prime CONTRACTOR's sole responsibility to protect the stakes from any damage. Any re-staking will be paid for by the CONTRACTOR.

F. Should a discrepancy occur and the Surveyor's stakes are missing, then the Surveyor's field notes shall be relied on as to how the object was staked. A set of field notes will be provided to the DBE PROJECT MANAGER (DBE PM) and the CONTRACTOR after the staking is complete. The field notes and the marking stakes shall be used together, and any differences shall be immediately brought to the attention of the DBE PM.

G. The Prime CONTRACTOR responsible for the building foundations shall measure between the Surveyor's staking for building layout and immediately notify the DBE PM of any discrepancies found.

1.06 SURVEY REQUIREMENTS

A. Provide field engineering services. Use recognized engineering survey practices.

B. Establish a minimum of two permanent 3-inch diameter brass plate benchmarks on site, referenced to established control points. Record locations, with horizontal and vertical data on Project Record Documents. Establish additional temporary bench marks at all floor levels.

C. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means, make use of laser instrumentation. Contractor shall arrange and pay for Field Engineering and Staking.

a. Site improvements including pavements; stakes for grading, fill placement; utility locations, slopes, invert elevations and batter boards.
b. Grid or axis for structures.
c. Building foundation, column locations, ground floor elevations.
d. Floor elevations of existing structures that relate to project.
e. Partition layouts on rough floor as a guide to all trades.

D. Periodically verify layouts by same means.

1.07 LAYOUT MARKINGS

A. Layout markings shall not be made with xylene-based inks, paint, or dyes, or with other solvent-based products that may bleed through finishes.

PART 2 PRODUCTS (Not applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 73 90

CUTTING AND PATCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements and limitations for cutting and patching of work.

1.02 SCOPE

A. Where the work requires that a particular existing building element, such as a partition, wall, paving, window or similar element of existing building construction, be removed, it is the intention of this specification that such work be a part of the demolition section and not a part of cutting and patching. Refer to individual category scope of work sheets to determine the limits of demolition work for each CONTRACTOR.

B. New work required to replace such removals is considered as a part of the separate sections of the specifications covering similar new construction.

C. Where incidental cutting and patching is required for the installation of a specific item or piece of equipment (including piping, ductwork, conduit, etc.), all such cutting and patching is considered to be specified as a part of the section requiring the cutting and patching, but shall also comply with the requirements of this Section.

D. CONTRACTOR shall verify and check all areas to be cut and patched and shall coordinate the work of the various trades involved.

E. Where doubt exists as to size, location, or method of cutting concrete or any other structural element, including metal stud framing, Contractor shall contact Architect before proceeding.

F. Where doubt exists, Contractor shall distinguish between “cutting” and “demolition”.

G. Unless specifically designated otherwise, existing work cut, altered or revised to accommodate new work shall be patched to duplicate undisturbed adjacent finishes, colors, textures and profiles. New work in existing portions shall also be finished to match adjacent existing work unless noted otherwise.

H. The CONTRACTOR shall be responsible for cutting, fitting or patching required to complete the work or to make its parts fit together properly. Refer to individual scope of work sheets for more detailed information.

I. Consent. The CONTRACTOR shall not damage or endanger a portion of the work or fully or partially completed construction of the DISTRICT or separate contractors by cutting, patching, or otherwise altering such construction, or by

excavation. The CONTRACTOR shall not cut or otherwise alter such construction by the DISTRICT or a separate CONTRACTOR except with written consent of the DISTRICT and of such separate CONTRACTOR; such consent shall not be unreasonably withheld. The CONTRACTOR shall not unreasonably withhold from the DISTRICT or a separate CONTRACTOR the CONTRACTOR's consent to cutting or otherwise altering the work. All cutting shall be done promptly. And all repairs shall be made as necessary.

J. Structural Members. New or existing structural members and elements, including reinforcing bars and seismic bracing, shall not be cut, bored, or drilled except by written authority of the ARCHITECT. Work done contrary to such authority is at the CONTRACTOR's risk, subject to replacement at its own expense and without reimbursement under the contract. Agency approvals shall be obtained by the ARCHITECT, not by the CONTRACTOR.

K. Subsequent Removal. Permission to patch any areas or items of the work shall not constitute a waiver of the DISTRICT's or the ARCHITECT's right to require complete removal and replacement of the areas of items of the work if, in the opinion of the ARCHITECT or the DISTRICT, the patching does not satisfactorily restore quality and appearance of the work or does not otherwise conform to the contract documents.

1.03 SUBMITTALS

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. Include in request:

1. Identification of Project
2. Location and description of affected work
3. Necessity for cutting or alteration
4. Alternatives to cutting and patching
5. Description of proposed work and products to be used
6. Effect on work of District or separate CONTRACTOR
7. Written permission of affected separate CONTRACTOR
8. Date and time work will be executed

C. Obtain approval of ARCHITECT before proceeding with any cutting and patching.

PART 2 PRODUCTS

2.01 MATERIALS

A. Primary Products: Those required for original installation, unless specifically approved otherwise.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. Confirm status and current warranties and guarantees.

B. After uncovering existing work, inspect conditions affecting performance of work.

1. Prior to cutting, boring or drilling through new or existing structural members or elements including reinforcing bars not specifically detailed, CONTRACTOR shall prepare detailed drawings for review by the ARCHITECT and the City of Rancho Cucamonga. Approval by Agencies is required prior to commencement of Work. Agency approvals shall be obtained by the ARCHITECT, not CONTRACTOR.

C. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Provide temporary support to ensure structural integrity of the work. Provide devices and methods to protect other portions of Project from damage.

B. Provide protection from elements for areas which may be exposed by uncovering work.

C. Maintain excavations free of water.

D. Where the Work requires sandblasting of existing surfaces in order to receive new materials secured by cementitious, adhesive or chemical bond, completely remove existing finishes, stains, oil, grease, bitumen, mastic and adhesives or other substances deleterious to the new bonding and/or fastening of new Work. Utilize wet sand blasting for interior surfaces and for exterior surfaces where necessary to prevent objectionable production of dust.

3.03 PERFORMANCE

A. Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay. Carefully remove existing Work to be salvaged and/or reinstalled. Protect and store for

reuse in the Work. Verify compatibility and suitability of existing substrates before starting the Work.

B. The word “cutting” as used in the Contract Documents includes, but is not limited to, cutting, drilling, chopping, and other similar operations and the word “patching” includes, but is not limited to, patching, rebuilding, reinforcing, repairing, refurbishing, restoring, replacing, or other similar operations.

C. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining Work. Where possible, review proposed procedures with the original installer; comply with the original installer’s recommendations.

1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

3. Cut through concrete and masonry using a cutting machine, such as a carborundum saw or a diamond-core drill. Saw cut reinforcing bars and paint ends with bituminous paint except where bonded into new concrete or masonry.

4. Comply with requirements of applicable Division 2 Sections where cutting and patching requires excavating, backfill, and/or re-compaction.

5. Woodwork: Cut and or remove to a panel or joint line.

6. Sheet Metal: Remove back to joint, lap, or connection. Secure loose or unfastened ends or edges and seal watertight.

7. Glass: Remove cracked, broken, or damaged glass and clean rebates and stops of setting materials.

8. Plaster: Cut back to sound plaster on straight lines, and back bevel edges of remaining plaster. Trim existing lath and prepare for new lath.

9. Gypsum Wallboard: Cut back on straight lines to undamaged surfaces with at least two opposite cut edges centered on supports.

10. Acoustical ceilings: Remove hanger wires and related appurtenances where ceilings are not scheduled to be installed.

11. Tile: Cut back to sound tile and backing on joint lines.

12. Flooring: Completely remove flooring and clean backing of prior adhesive. Carefully remove wood flooring for patching and repairing of existing wood flooring scheduled to remain.

D. Patching: Patch with durable seams that are as invisible as possible. Comply with required tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation. Verify conditions of existing substrates prior to executing Work.

2. Restore exposed finishes of patched areas and extend finish restoration into retaining adjoining construction in a manner that will eliminate all evidence of patching and refinishing.

3. Concrete: Maintain cut edges in a moist condition for twenty four (24) hours prior to the placement of new concrete. In lieu of this an epoxy adhesive may be provided. Finish placed concrete to match existing unless noted otherwise. Concrete shall have a compressive strength of 3,000 psi where installed to repair and/or match existing improvements, unless noted otherwise.

4. Metal Fabrications: Items to remain exposed shall have their edges cut and ground smooth and rounded.

5. Sheet Metal: Replace removed or damaged sheet metal items as required for new Work.

6. Glass: Install matching glass and re-seal exterior window assemblies.

7. Gypsum Wallboard: Fasten cut edges of wallboard. Install patches with at least two opposite edges centered on supports and secure at 6” centers. Tape and finish joints and fastener heads. Patching shall be non-apparent when painted or finished.

8. Acoustical Ceilings: Comply with the requirements for new Work specified in related sections of the Contract Documents.

9. Resilient Flooring: Completely remove flooring and prepare substrate for new material.

10. Paint: Prepare areas to be painted as specified for painting specific surfaces in the painting and coatings Sections of the Specifications.

E. Fit work air tight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

F. At penetrations of fire-rated walls, partitions, ceiling or floor construction, completely seal voids with fire-rated devices or material in accordance with Section 07 84 00, to full thickness of the penetrated element.

G. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

H. Extend patching to point where patching is not evident unless directed otherwise by Architect.

3.05 SLEEVES AND HANGERS

A. Provide conduit, outlets, piping sleeves, boxes, inserts or other materials or equipment necessary to be built into work. Promptly furnish same and set such sleeves or other materials as construction program required.

B. In the event delays occur in delivery of sleeves or other materials, arrange to have boxes or other forms set at locations where piping or other material is to pass through or into slabs or other work.

C. Upon subsequent installation of sleeves or other material, install fill materials to completely seal voids with fire-rated devices or moisture-resistant material, to full thickness of the penetrated element. Necessary expenditures incurred for boxing out or filling shall be without extra cost to the OWNER.

END OF SECTION

SECTION 01 75 00

CONTRACTOR'S CERTIFICATE
REGARDING ASBESTOS MATERIAL

This form is to be submitted at the time final billing is provided.

"I certify that all the materials and supplies installed under this _____

_____ contract are free of asbestos-containing materials".
(Name of Contract)

_____
Date

_____
Official Name of Contractor

_____
By

_____
Title

_____
Signature

END OF DOCUMENT

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This Section includes administrative and procedural requirements for Contract Closeout, including but not limited to, the following:

1. Completion Procedures
2. Project Record Documents
3. Operation and Maintenance Manuals
4. Orientation and Instruction of DISTRICT'S Personnel
5. Orientation and Instruction of DISTRICT'S Personnel for Commissioned Equipment
6. Warranties And Guarantees
7. Spare Parts And Materials
8. Final Cleaning

B. Additional closeout requirements for specific Work activities are included in the appropriate Sections in Divisions 01 through 48.

1.02 RELATED SECTIONS

A. Submittal Procedures
B. Construction Progress Schedule
C. Temporary Facilities and Controls
D. Warranties, Guarantees, and Bonds
E. Project Record Documents

1.03 COMPLETION PROCEDURES

A. Substantial Completion and Partial Occupancy:

1. CONTRACTOR shall develop an internal completion list identifying all items to be completed or corrected. Once prepared the CONTRACTOR will proceed to make the required corrections prior to requesting that the IOR review the work with them.

2. Submit a request through the DBE PROJECT MANAGER for the Project Inspector and/or ARCHITECT to walk the completed work. Request must

include a copy of the CONTRACTOR's list completely signed off by the CONTRACTOR's Superintendent.

3. In conjunction with the Owner, prepare a subsequent list of items to be completed or corrected. List may be developed by areas, when approved by the ARCHITECT.

4. Within a reasonable time after receipt of the list, the ARCHITECT will inspect to determine status of completion.

5. Should the ARCHITECT determine that Work is not substantially complete:

   a. The ARCHITECT will promptly notify the CONTRACTOR in writing, giving the reasons for his determination.

   b. CONTRACTOR, within 7 days of notification, shall remedy the deficiencies and notify the ARCHITECT when Work is ready for reinspection.

   c. The ARCHITECT will reinspect the Work. ARCHITECT will provide for one re-inspection visit of work. Costs for any additional visits will be charged to the CONTRACTOR.

6. When the ARCHITECT concurs that work is substantially complete:

   a. The ARCHITECT will prepare a "Certificate of Substantial Completion" on AIA Form G704, accompanied by the CONTRACTOR's list of items to be completed or corrected as verified by the ARCHITECT.

   b. The ARCHITECT will submit the Certificate to the DISTRICT and to the CONTRACTOR for their written acceptance of the responsibilities assigned to them in the Certificate.

B. Final Completion:

1. Verify the Work is complete.

2. Prepare and submit a notice that Work is ready for final inspection and acceptance.

3. Certify that:

   a. Work has been inspected by all governing agencies and is in compliance with all governing regulations.

   b. Work has been inspected for compliance with the Contract Documents.

c. Work has been completed in accordance with the Contract Documents.

d. Equipment and systems have been tested as required and are operational.

e. Work is completed and ready for final inspection.

4. The ARCHITECT will make an inspection to verify status of completion.

5. Should the ARCHITECT determine the Work is incomplete or defective:

a. The ARCHITECT will promptly notify the CONTRACTOR in writing, listing incomplete or defective work.

b. CONTRACTOR shall remedy the deficiencies within 7 calendar days of notification and notify the ARCHITECT when ready for re-inspection.

6. When the ARCHITECT determines the Work is acceptable under the Contract Documents, he will request the CONTRACTOR to make closeout submittals.

7. Prior to submittal of CONTRACTOR's application for final payment, and as a further condition to its approval by the ARCHITECT, each subcontractor shall deliver closeout submittals to the CONTRACTOR, who shall assemble these manuals for all divisions of the work, review them for completeness and submit them to the DISTRICT. Manuals must be arranged in proper order, indexed, endorsed, and placed in three-ring binders.

C. Submit all closeout documents, including but are not limited to:

1. Project Record Documents to include a Table of Content Cover Sheet.

2. Operation and Maintenance Manuals (for all items requiring special knowledge for operation or for maintenance, listed in pertinent Sections of these Specifications), and for other items when so approved by the ARCHITECT.

3. Warranties and Guarantees.

4. Keys and Keying Schedule.

5. Spare parts, maintenance materials, extra stock to be turned over to the DISTRICT with a transmittal.

6. Evidence of payment and release of liens, when requested by DISTRICT and/or DBE PROJECT MANAGER.

7. List of subcontractors, service organizations and principal vendors, including names, addresses and telephone numbers, where they may be contacted for emergency service at all times, including nights, weekends and holidays.

D. Final Payment:

1. Submit a Final Payment Request, showing all adjustments to the Contract Sum.

1.04 VERIFIED REPORTS

A. Construction progress of the Work shall be reported as requested per the authority having jurisdiction, the City of Rancho Cucamonga, the ARCHITECT, and DBE PROJECT MANAGER.

1.05 OPERATION AND MAINTENANCE MANUALS

A. Prior to Substantial Completion, submit three (3) hard copy sets and three (3) electronic sets of Operation and Maintenance (O&M) Manuals to the CONSTRUCTION MANAGER for ARCHITECT's review and for DISTRICT's records if acceptable.

B. Organize O&M Manuals into sets of manageable size. Provide heavy-duty quality, 2"-3" three-ring, 8-1/2 x 11 inch, binders with hardback, cleanable, plastic covers, with pocket folders for folded sheet information.

C. Label cover and spine of each binder with typed or printed title OPERATON AND MAINTENANCE (O&M) MANUALS, with title of Project. Number separate volumes in order.

D. Table of Contents: Typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the Specification Section in which specified and the name of the product or work item.

E. Separate each O&M data with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. Use paper of durable, long-lasting quality. List Subcontractor, supplier, and manufacturer, with name, address and telephone number of responsible principal.

F. O&M Manual data to include but not limited to:

1. Project record documents
2. Manufacturer's operating and maintenance instructions, including any seasonal adjustments
3. Copies of warranties and guarantees
4. Keys and Keying schedule
5. Spare parts, maintenance and extra materials list and transmittals

6. Emergency instructions
7. Recommended “turn-around” cycles
8. Inspection procedures
9. Fixture lamping schedule
10. Shop Drawings and Product Data
11. Wiring diagrams

1.06 ORIENTATION AND INSTRUCTION OF DISTRICT’S PERSONNEL:

A. Instruct the DISTRICT’s personnel in proper operation and maintenance of all systems, equipment and similar items, which were provided as part of the work. Provide maintenance and inspection schedules that conform to manufacturer's recommendations. Provide instruction by manufacturers’ representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:

1. Maintenance manuals
2. Record documents
3. Spare parts and materials
4. Tools
5. Lubricants
6. Fuels
7. Identification systems
8. Control sequences
9. Hazards
10. Cleaning
11. Warranties and bonds
12. Maintenance agreements and similar continuing commitments

B. CONTRACTOR shall provide a schedule to the DISTRICT for approval for each of the instruction periods required.

1. Organize the instruction sessions into group sizes and schedule the elapsed time for instruction in a manner to provide complete coverage of the subject matter. Video tape each session and provide DISTRICT with two (2) copies.

C. Instruction sessions will be held in a DISTRICT designated area on the project site and at DISTRICT's convenience. Amount of time required for each session shall be as specified in individual sections, but in no case less than the time needed to fully convey the information needed by DISTRICT personnel for operating and maintaining the products.

D. Instructors shall be qualified by the product manufacturer in the subject matter presented at each session.

1. Submit names of instructors and qualifications to the Architect and DISTRICT for approval, 30 days prior to each scheduled session.

2. Substitution of instructors will not be permitted without prior approval of Architect or DISTRICT.

E. As part of instruction for operating equipment, demonstrate the following procedures:

1. Start-up
2. Shutdown
3. Emergency operations
4. Noise and vibration adjustments
5. Safety procedures
6. Seasonal adjustments
7. Economy and efficiency adjustments
8. Effective energy utilization measures

F. Schedule and provide seasonal or periodic training sessions when specified in technical sections of the Specifications.

1.07 ORIENTATION AND INSTRUCTION OF DISTRICT'S PERSONNEL FOR COMMISSIONED EQUIPMENT:

A. The CONTRACTOR is responsible for training coordination and scheduling and ultimately for ensuring that training is completed.

B. The Commissioning Provider (CP) shall be responsible for overseeing and approving the content and adequacy of the training of FACILITIES personnel for commissioned equipment.

1. The CP shall interview FACILITIES personnel to determine the special needs and areas where training will be most valuable. The OWNER'S REPRESENTATIVE and CP shall decide how rigorous the training should be for each piece of commissioned equipment. The CP shall communicate the results to the CONTRACTOR and subcontractors who have training responsibilities.
2. In addition to these general requirements, specific training requirements are specified in Sections 01 91 17 and 01 91 18.
3. Each contractor responsible for training will submit a written training plan to the CP for review and approval prior to training. The CP will provide a template form for this purpose.
4. The CP develops an overall training scope for commissioned equipment and coordinates and schedules with the CONTRACTOR. The CP develops criteria for determining that the training was satisfactorily

completed, including attending some of the training. The CP recommends approval of the training to the ENGINEER using a standard form.

C. The controls contractor shall provide operating manuals, training to maintenance and operation personnel.

1.08 WARRANTIES AND GUARANTEES

A. Refer to Section 01 78 60 Warranties, Guarantees, and Bonds for additional information and responsibilities.

B. Submit prior to final Application for Payment.

1.09 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.

B. Deliver to project site location as directed by DISTRICT with a transmittal.

1.10 FINAL CLEANING

A. Final cleaning is provided by CONTRACTOR as is assigned by the Summary of Work and as defined in Section 01 71 00 Cleaning.

PART 2 PRODUCTS (Not applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 78 60

WARRANTIES, GUARANTEES, AND BONDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation and submittal of warranties and bonds

B. Time and schedule of submittals

1.02 RELATED SECTIONS

A. Contract Closeout Procedures

B. Product Requirements

C. Materials and Equipment

D. Technical Specifications Sections: Warranties required for specific products or Work

1.03 WARRANTY REQUIREMENTS

A. Warranties or bonds shall provide for replacement or reconstruction of failed or defective Work to an acceptable condition complying with the requirements of the Contract Documents. Work shall be restored at no cost to the District regardless of whether the District has benefited from use of the Work for a portion of its anticipated useful service life.

B. Provide warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item or work.

C. When a designated portion of the Work is partially used and/or occupied by the DISTRICT, submit properly executed warranties within ten (10) days of the Partial Use or Occupancy of the designated portion of the Work.

D. Verify that documents are in proper form and contain full information.

E. DISTRICT Recourse: Expressed warranties made to DISTRICT are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which DISTRICT can enforce such other duties, obligations, rights, or remedies.

1.04 FORM OF SUBMITTALS

A. Prepare three (3) hard copy sets and three (3) electronic sets of warranty binders, heavy-duty quality, 2”-3” three-ring, 8-1/2 x 11 inch, binders with hardback, cleanable, plastic covers, with pocket folders for folded sheet information.

B. Label cover and spine of each binder with typed or printed title WARRANTIES AND BONDS, with title of Project. Number separate volumes in order.

C. Table of Contents: Typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the Specification Section in which specified and the name of the product or work item.

D. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. Use paper of durable, long-lasting quality. List Subcontractor, supplier, and manufacturer, with name, address and telephone number of responsible principal.

1.05 TIME AND SCHEDULE OF SUBMITTALS

A. Except for specifically authorized exceptions, the date for beginning the period of warranty shall be the Date of Notice of Completion.

B. For equipment or component parts of equipment put into service during construction with District's permission, submit documents within ten (10) days after acceptance.

C. Make other submittals within ten (10) days after Date of Notice of Completion prior to final Application for Payment.

D. For items of Work when acceptance is delayed beyond Date of Notice of Completion, submit within ten (10) days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

GUARANTEE

To: **RANCHO CUCAMONGA FIRE PROTECTION DISTRICT**

Project: **911 Memorial Park**

Scope of Work: _____

We hereby guarantee all the Work described above was performed, installed or constructed, both labor and materials, on the above Project and guarantee that such work has been done in accordance with the Project Drawings, Specifications, and other Contract Documents, and that the Work as installed/constructed fulfills the requirements included in the Contract Documents.

The undersigned agrees to repair or replace, at no cost to the District, any or all of such work, that may prove to be defective in workmanship or material together with any other adjacent work which may be displaced in connection with such replacement within the Guarantee Period, ordinary wear and tear and unusual abuse or neglect excepted.

The Guarantee Period shall commence on the date of completion as specified in the Notice of Completion approved by the Fire Board of RANCHO CUCAMONGA FIRE PROTECTION DISTRICT and shall continue for the longer of: (a) a period of one (1) year; (b) a period in excess of one (1) year, as specified or required in any Section of the Contract Documents; (c) the duration of a manufacturer's guarantee extending beyond one (1) year.

In the event of the undersigned's failure to comply with the above mentioned conditions within a reasonable period of time, as determined by the District, but not later than ten (10) working days after being notified in writing by the District of defects requiring correction pursuant to this guarantee, the undersigned authorizes the District to proceed to have said defects repaired/corrected and made good at the expense of the undersigned, who will pay all costs and charges therefore upon demand.

Contractor Name: _____

Signature of Authorized: _____ Date of Signature: _____

Printed Name: _____

Title: _____

State License No. _____

Local Representative to be contacted for maintenance, repair and/or replacement service:

Name: _____

Phone No: _____

Email: _____

Address: _____

SECTION 01 78 90

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This Section includes administrative and procedural requirements for preparing, maintaining, and submitting Project Record Documents.

1.02 RELATED SECTIONS

A. Submittal Procedures

B. Closeout Procedures

C. Field Engineering

1.03 PROJECT RECORD DOCUMENTS

A. General: Record documents shall be kept on site at the DBE PROJECT MANAGER's office. CONTRACTOR shall prepare and maintain record documents throughout the course of construction, as specified herein.

B. Access to record documents will be provided during normal working hours.

C. Do not use project record documents for construction purposes. Protect record documents from deterioration and loss.

D. Record in concise and neat manner, concurrent with construction progress, and at least on a weekly basis, all actual revisions to the work:

1. Changes made on the Drawings, including Clarification Drawings.
2. Changes made to the Specifications.
3. Changes made by Addenda.
4. Changes made by Construction Change Directives.
5. Change Orders or other authorized Modifications to the Contract.
6. Revisions made to shop drawings, product data and samples.
7. Substitutions during construction.

E. Record Drawings shall be a clean, undamaged set of black-line white prints of Drawings and Shop Drawings. Mark the set with red erasable pencil to show the actual installation where the installation varies substantially from the Work as originally shown. Indicate which Drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Drawings. Provide detailed and accurate

field dimensions for concealed elements that would be difficult to measure and record at a later date.

1. Mark new information, including details, that is important to DISTRICT but was not shown on Drawings or Shop Drawings.

2. Show measured depths of foundations in relation to finish first floor datum.

3. Show measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Identify drains and sewers by invert elevation.

4. Verify Surveyor's Record Drawings with CONTRACTOR's utilities locations and depths markups.

5. Show measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work. Identify ducts, dampers, valves, access doors and control equipment wiring.

6. Show field changes and the final location of all mechanical equipment, utility lines, ducts, outlets, structural members, walls, partitions and other significant features, and annotated specifications showing clearly all changes, revisions and substitutions during construction.

7. Field changes of dimension and detail.

8. Refer to Scope Summaries for electronic as-built requirements.

9. Note related Change Order or Construction Directive numbers on each affected sheet.

10. Organize Record Drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.

F. Record Specifications: Maintain a complete copy of the Specifications, including Addenda, Change Orders and Construction Directives issued during construction. Legibly mark at each Section description of actual products installed if different from that specified, including:

1. Manufacturer's name, trade name, product model and number and supplier.

2. Authorized product substitutions or alternates utilized.

3. Changes made by Addenda and Modifications.

G. Record Product Data: Maintain a copy of each Product Data submittal. Note related Change Orders and Construction Directives and mark-up of record drawings and Specifications.

1. Mark these documents to illustrate significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the Project site and from the manufacturer's installation instructions and recommendations.

2. Provide detailed and accurate information regarding concealed products and portions of Work that cannot otherwise be readily discerned later by direct observation.

H. Record Samples: Immediately prior to Substantial Completion, CONTRACTOR shall meet with ARCHITECT and DISTRICT at the Project site to determine which Samples are to be transmitted to DISTRICT for record purposes. Comply with DISTRICT instructions regarding delivery to DISTRICT storage area.

I. Miscellaneous Records: Refer to other Specification sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Immediately prior to the date of Final Completion, complete and compile miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to ARCHITECT for DISTRICT records.

J. On completion of the CONTRACTOR's portion of the work and prior to application for final payment, the CONTRACTOR will provide one complete set of record drawings and annotated specifications to the DISTRICT. Certifying them to be a complete and accurate reflection of the actual construction conditions of the work.

PART 2 PRODUCTS (Not applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 79 00

FIRE SAFETY

2019 CALIFORNIA FIRE CODE

CHAPTER 33 FIRE SAFETY DURING CONSTRUCTION AND DEMOLITION

SECTION 3301 GENERAL

3301.1 Scope. This chapter shall apply to structures in the course of construction, alteration or demolition, including those in underground locations. Compliance with NFPA 241 is required for items not specifically addressed herein.

3301.2 Purpose. This chapter prescribes minimum safeguards for construction, alteration and demolition operations to provide reasonable safety to life and property from fire during such operations.

SECTION 3302 DEFINITIONS

3302.1 Terms defined in Chapter 2. Words and terms used in this chapter and defined in Chapter 2 shall have the meanings ascribed to them as defined therein.

SECTION 3303 TEMPORARY HEATING EQUIPMENT

3303.1 Listed. Temporary heating devices shall be listed and labeled in accordance with the *California Mechanical Code*. Installation, maintenance and use of temporary heating devices shall be in accordance with the terms of the listing.

3303.2 Oil-fired heaters. Oil-fired heaters shall comply with Section 603.

3303.3 LP-gas heaters. Fuel supplies for liquefied-petroleum gas-fired heaters shall comply with Chapter 61 and the *California Mechanical Code*.

3303.4 Refueling. Refueling operations for liquid-fueled equipment or appliances shall be conducted in accordance with Section 5705. The equipment or appliance shall be allowed to cool prior to refueling.

3303.5 Installation. Clearance to combustibles from temporary heating devices shall be maintained in accordance with the labeled equipment. When in operation, temporary heating devices shall be fixed in place and protected from damage, dislodgement or overturning in accordance with the manufacturer’s instructions.

3303.6 Supervision. The use of temporary heating devices shall be supervised and maintained only by competent personnel.

SECTION 3304 PRECAUTIONS AGAINST FIRE

3304.1 Smoking. Smoking shall be prohibited except in approved areas. Signs shall be posted in accordance with Section 310. In approved areas where smoking is permitted, approved ashtrays shall be provided in accordance with Section 310.

3304.2 Combustible debris, rubbish and waste. Combustible debris, rubbish and waste material shall comply with the requirements of Sections 3304.2.1 through 3304.2.4.

3304.2.1 Combustible waste material accumulation. Combustible debris, rubbish and waste material shall not be accumulated within buildings.

3304.2.2 Combustible waste material removal. Combustible debris, rubbish and waste material shall be removed from buildings at the end of each shift of work.

3304.2.3 Rubbish containers. Where rubbish containers with a capacity exceeding 5.33 cubic feet (40 gallons) (0.15 m3) are used for temporary storage of combustible debris, rubbish and waste material, they shall have tightfitting or self-closing lids. Such rubbish containers shall be constructed entirely of materials that comply with either of the following:

1. Noncombustible materials.

2. Materials that meet a peak rate of heat release not exceeding 300 kW/m2 when tested in accordance with ASTM E1354 at an incident heat flux of 50 kW/m2 in the horizontal orientation.

3304.2.4 Spontaneous ignition. Materials susceptible to spontaneous ignition, such as oily rags, shall be stored in a listed disposal container.

3304.3 Burning of combustible debris, rubbish and waste. Combustible debris, rubbish and waste material shall not be disposed of by burning on the site unless approved.

3304.4 Open burning. Open burning shall comply with Section 307.

3304.5 Fire watch. Where required by the fire code official for building demolition, or building construction during working hours that is hazardous in nature, qualified personnel shall be provided to serve as an on-site fire watch. Fire watch personnel shall be provided with not less than one approved means for notification of the fire department and their sole duty shall be to perform constant patrols and watch for the occurrence of fire.

3304.6 Cutting and welding. Operations involving the use of cutting and welding shall be done in accordance with Chapter 35.

3304.7 Electrical. Temporary wiring for electrical power and lighting installations used in connection with the construction, alteration or demolition of buildings, structures, equipment or similar activities shall comply with the California Electrical Code

SECTION 3305 FLAMMABLE AND COMBUSTIBLE LIQUIDS

3303.1 Storage of flammable and combustible liquids. Storage of flammable and combustible liquids shall be in accordance with Section 5704.

3303.2 Class I and Class II liquids. The storage, use and handling of flammable and combustible liquids at construction sites shall be in accordance with Section 5706.2. Ventilation shall be provided for operations involving the application of materials containing flammable solvents.

3303.3 Housekeeping. Flammable and combustible liquid storage areas shall be maintained clear of combustible vegetation and waste materials. Such storage areas shall not be used for the storage of combustible materials.

3303.4 Precautions against fire. Sources of ignition and smoking shall be prohibited in flammable and combustible liquid storage areas. Signs shall be posted in accordance with Section 310.

3303.5 Handling at point of final use. Class I and II liquids shall be kept in approved safety containers.

3303.6 Leakage and spills. Leaking vessels shall be immediately repaired or taken out of service and spills shall be cleaned up and disposed of properly.

SECTION 3306 FLAMMABLE GASES

3306.1 Storage and handling. The storage, use and handling of flammable gases shall comply with Chapter 58.

3306.2 Cleaning with flammable gas. Flammable gases shall not be used to clean or remove debris from piping open to the atmosphere.

3306.2.1 Rubbish Pipe cleaning and purging. The cleaning and purging of flammable gas piping systems, including cleaning new or existing piping systems, purging piping systems into service and purging piping systems out of service, shall comply with NFPA 56.

Exceptions:

1. Compressed gas piping systems other than fuel gas piping systems were in accordance with Chapter 53.
2. Piping systems regulated by the *California Mechanical Code*.
3. Liquefied petroleum gas systems in accordance with Chapter 61.

SECTION 3307 EXPLOSIVE MATERIALS

3307.1 Storage and handling. Explosive materials shall be stored, used and handled in accordance with Chapter 56.

3307.2 Supervision. Blasting operations shall be conducted in accordance with Chapter 56.

3307.3 Demolition using explosives. Approved fire hoses for use by demolition personnel shall be maintained at the demolition site whenever explosives are used for demolition. Such fire hoses shall be connected to an approved water supply and shall be capable of being brought to bear on post-detonation fires anywhere on the site of the demolition operation.

SECTION 3308 TEMPORARY HEATING EQUIPMENT

3308.1 Program superintendent. The owner shall designate a person to be the fire prevention program superintendent who shall be responsible for the fire prevention program and ensure that it is carried out through completion of the project. The fire prevention program superintendent shall have the authority to enforce the provisions of this chapter and other provisions as necessary to secure the intent of this chapter. Where guard service is provided, the superintendent shall be responsible for the guard service

3308.2 Prefire plans. The fire prevention program superintendent shall develop and maintain an approved prefire plan in cooperation with the fire chief. The fire chief and the fire code official shall be notified of changes affecting the utilization of information contained in such prefire plans.

3308.3 Training. Training of responsible personnel in the use of fire protection equipment shall be the responsibility of the fire prevention program superintendent

3308.4 Fire protection devices. The fire prevention program superintendent shall determine that all fire protection equipment is maintained and serviced in accordance with this code. The quantity and type of fire protection equipment shall be approved.

3308.5 Hot work operations. The fire prevention program superintendent shall be responsible for supervising the permit system for hot work operations in accordance with Chapter 35.

3308.6 Impairment of fire protection systems. Impairments to any fire protection system shall be in accordance with Section 901.

3308.7 Temporary covering of fire protection devices. Coverings placed on or over fire protection devices to protect them from damage during construction processes shall be immediately removed upon the completion of the construction processes in the room or area in which the devices are installed.

SECTION 3309 FIRE REPORTING

3309.1 Emergency telephone. Readily accessible emergency telephone facilities shall be provided in an approved location at the construction site. The street address of the construction site and the emergency telephone number of the fire department shall be posted adjacent to the telephone.

SECTION 3310 ACCESS FOR FIRE FIGHTING

3310.1 Required access. Approved vehicle access for fire fighting shall be provided to all construction or demolition sites. Vehicle access shall be provided to within 100 feet (30 480 mm) of temporary or permanent fire department connections. Vehicle access shall be provided by either temporary or permanent roads, capable of supporting vehicle loading under all weather conditions. Vehicle access shall be maintained until permanent fire apparatus access roads are available.

3310.2 Key boxes. Key boxes shall be provided as required by Chapter 5.

SECTION 3311 MEANS OF EGRESS

3311.1 Stairways required. Where a building has been constructed to a building height of 50 feet (15 240 mm) or four stories, or where an existing building exceeding 50 feet (15 240 mm) in building height is altered, not less than one temporary lighted stairway shall be provided unless one or more of the permanent stairways are erected as the construction progresses.

3311.2 Maintenance. Required means of egress shall be maintained during construction and demolition, remodeling or alterations and additions to any building.

Exception: Approved temporary means of egress systems and facilities.

SECTION 3312 WATER SUPPLY FOR FIRE PROTECTION

3312.1 When required. An approved water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible material arrives on the site.

SECTION 3313 STANDPIPES

3313.1 Where required. In buildings required to have standpipes by Section 905.3.1, not less than one standpipe shall be provided for use during construction. Such standpipes shall be installed prior to construction exceeding 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access. Such standpipe shall be provided with fire department hose connections at accessible locations adjacent to usable stairways. Such standpipes shall be extended as construction

progresses to within one floor of the highest point of construction having secured decking or flooring.

3313.2 Buildings being demolished. Where a building is being demolished and a standpipe is existing within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be demolished more than one floor below the floor being demolished.

3313.3 Detailed requirements. Standpipes shall be installed in accordance with the provisions of Section 905.

Exception: Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes comply with the requirements of Section 905 as to capacity, outlets and materials.

SECTION 3314 AUTOMATIC SPRINKLER SYSTEM

3314.1 Completion before occupancy. In buildings where an automatic sprinkler system is required by this code or the California Building Code, it shall be unlawful to occupy any portion of a building or structure until the automatic sprinkler system installation has been tested and approved, except as provided in Section 105.3.4.

3314.2 Operation of valves. Operation of sprinkler control valves shall be allowed only by properly authorized personnel and shall be accompanied by notification of duly designated parties. Where the sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked at the end of each work period to ascertain that protection is in service.

SECTION 3315 PORTABLE FIRE EXTINGUISHERS

3315.1 Where required. Structures under construction, alteration or demolition shall be provided with not less than one approved portable fire extinguisher in accordance with Section 906 and sized for not less than ordinary hazard as follows:

1. At each stairway on all floor levels where combustible materials have accumulated.
2. In every storage and construction shed.
3. Additional portable fire extinguishers shall be provided where special hazards exist including, but not limited to, the storage and use of flammable and combustible liquids.

SECTION 3316 MOTORIZED CONSTRUCTION EQUIPMENT

3316.1 Conditions of use. Internal-combustion-powered construction equipment shall be used in accordance with all of the following conditions:

1. Equipment shall be located so that exhausts do not discharge against combustible material.
2. Exhausts shall be piped to the outside of the building.
3. Equipment shall not be refueled while in operation.
4. Fuel for equipment shall be stored in an approved area outside of the building.

SECTION 3317 SAFEGUARDING ROOFING OPERATIONS

3317.1 General. Roofing operations utilizing heat-producing systems or other ignition sources shall be conducted in accordance with Sections 3317.2 and 3317.3 and Chapter 35.

3317.2 Asphalt and tar kettles. Asphalt and tar kettles shall be operated in accordance with Section 303.

3317.3 Fire extinguishers for roofing operations. Fire extinguishers shall comply with Section 906. There shall be not less than one multipurpose portable fire extinguisher with a minimum 3-A 40-B:C rating on the roof being covered or repaired.

END OF SECTION

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Accessories and form coating.

D. Installation of inserts, bolts, anchors and other items furnished by other trades for installation in formed concrete. Coordination of work of all trades affecting concrete formwork.

E. Form stripping.

F. Work installed but furnished in other Sections includes but is not necessarily limited to:
   1. Items supplied by other trades where the items must be placed when forms are erected.

1.2 RELATED REQUIREMENTS

A. Section 032000 - Concrete Reinforcing.

B. Section 033000 - Cast-in-Place Concrete.

C. Section 31 3219 - Lightweight, Geo-Synthetic Fill

1.3 REFERENCE STANDARDS

A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials 2010 (Reapproved 2015).

B. ACI 301 - Specifications for Concrete Construction 2020.

C. ACI 318 - Building Code Requirements for Structural Concrete 2019 (Reapproved 2022).

D. ACI 347R - Guide to Formwork for Concrete 2014 (Reapproved 2021).

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Manufacturer's data: Submit manufacturer's product data and installation instructions for proprietary materials including form coatings, manufactured form systems, ties and accessories.

Submit written certification by the form coating manufacturer that the form coating will have no adverse effect as specified below.

C. Shop drawings:
   1. Submit shop drawings, signed and sealed by a California-registered civil or structural engineer, for fabrication and erection of formwork and shoring. Show the general construction of forms including jointing, special formed joints or reveals, temporary openings, location and pattern of form tie placement, and form panel layout, and other items which affect the exposed concrete visually. Include details of inserts and anchorages. Indicate sequence of removal of forms and shoring.
   2. The Contractor shall be solely responsible for the structural adequacy of the forms, ties, shoring and bracing. Any requirements given herein are minimum for appearance purposes only, not to be considered as structural design.

1.5 QUALITY ASSURANCE

A. Standards: The applicable provisions of ACI 347R, Guide to Formwork for Concrete, and ACI 301, Chapter 4, Specification for Structural Concrete for Buildings, govern the work of this Section.

B. Definitions:
   1. Exposed concrete: Exposed-to-view concrete which will receive finish materials such as paint, applied directly to its surface, or left unfinished. Not included is exposed concrete in Mechanical and Utility Rooms and exposed exterior architectural concrete.
   2. Concealed concrete: Covered by structure or with finish material other than that applied directly to its surface as specified above. Included is exposed concrete in mechanical and utility rooms.

C. Tolerances for exposed concrete:
   1. General: Following is a list of the maximum permissible deviations from established lines, grades and dimensions for exposed concrete.
      a. Honeycombs, bubbles and similar defects are considered a part of the finish and are to be distinguished from tolerances described herein.
      b. Variations in the level of elevated concrete such as floors and beams shall be measured before removal of supporting shores. The Contractor is responsible for deflection.
   2. Variation from plumb:
      a. In the lines and surfaces of columns, piers, walls and arises:
         1) In 10 ft.: 1/4". In any story or 20 ft. maximum: 3/8". In 40 ft. or more: 3/4".
      b. For exposed corner columns, control-joint grooves and other conspicuous lines: In any bay or 20 ft.: Maximum 1/4". In any 40 ft. or more: 1/2".
   3. Variation from the level or from the grades shown:
      a. In floors, ceiling, beam soffits, joints and in arises:
         1) In any 10 ft.: 1/4". In any bay or 20 ft. maximum: 3/8". In 40 ft. or more: 3/4".

b. For exposed lintels, joists, sills, parapets, horizontal grooves and other conspicuous lines:
1) In any bay or 20 ft. maximum: 1/4". In 40 ft. or more: 1/2".

4. Variation of linear building lines from established position in plan and related position of columns, walls and partitions:
a. In any bay or 20 ft. maximum: 1/2". In 40 ft. or more: 1".
5. Variation in size and location of sleeves, floor openings and wall openings: 1/4".
6. Variation in cross-sectional dimensions of columns, beams, joists and in the thickness of slabs and walls:
a. Minus 1/4".
b. Plus 1/2".
7. Variation in steps: Do not exceed the requirements of the Building Code.

D. Tolerances for concealed concrete: Concealed concrete shall meet the following requirements.
1. Sufficiently accurate to accommodate the details of abutting work.
2. Measurably accurate so that the maximum deviation is not over 3/8" in 8 ft.
3. Measurably accurate so that the total maximum deviation is not over 1" in 40 ft. or more.

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Protect plastic foam products from damage and exposure to sunlight.

PART 2 PRODUCTS

2.1 **FORM - MATERIALS**

A. Forms for exposed finish concrete (flat surfaces):
1. Unless otherwise indicated, construct formwork with plywood, metal, metal-framed plywood-faced or other panel type materials acceptable to the Architect providing continuous, straight, as-cast surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system where shown. Provide form material with sufficient thickness to withstand pressure of placed concrete without bow or deflection beyond allowable tolerances. Use full size panels when forming exterior face of exterior walls exposed to view
2. Use plywood complying with US Product Standards PS-1, "B-B High Density Overlaid Concrete Form", Class 1, edge-sealed, with each piece bearing the legible trademark of an approved inspection agency.
3. Required form features:
a. True shape and edges.
b. Sharp, undamaged corners and edges.
c. Uniformly smooth, clean surfaces without checks or knots.
d. Free of damage, holes, bumps, warps and bends.
e. Hard, waterproof surface.

f. Single-unit forms without lapped joints for columns, beams and joists.

4. Do not use the following forms:
   a. Segmented units for joists.
   b. Boards.
   c. Plywood without high density overlay contact surface.
   d. Earth forms.

B. Cylindrical columns and supports: One of the following.
   1. Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant type adhesive.
      a. Line interior surface with polyethylene sheeting having minute perforations to permit uniform moisture penetration and wax-impregnate exterior for weather and moisture protection.
      b. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.
   2. Form round-section members of not less than 12 gage galvanized steel sheets. Butt sections together, with bolted or keyed and welded joints. Finish interior joints of forms smooth so there is no visible seam on finished concrete surfaces.

C. Forms for concealed finish: Form concrete surfaces which will be concealed in the finished structure with plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and 1 side for tight fit.
   1. Forms that cannot be removed after concrete has been poured:
      a. High density polystyrene blocks, (HDFM-1), Styrofoam PD Board, with minimum compressive strength of 60 lbs/sq.inch, by The Dow Chemical Co., or equal. Thickness shall be as required.
      b. Constructed of steel; no wood or fiberboard forms permitted at these locations.

D. Form ties:
   1. For all concrete that will remain exposed to view: Provide factory-fabricated, adjustable-length, removable or snap-off metal ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal. Provide plastic cone ties where indicated on Drawings or approved by the Architect.
   2. Unless otherwise shown, provide ties so that portion remaining within concrete after removal of exterior parts is at least 1-1/2" from the outer concrete surface. Provide form ties, which will leave a hole not larger than 1" diameter in the concrete surface.
   3. Form ties fabricated on the job site, or wire ties, wood spreaders, or embedded types in which embedded portion is less than 1-1/2" from exterior face of concrete, are not acceptable.

E. Form coating: Commercial formulation that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds, nor affect subsequent finishes to be applied to concrete surfaces.

F. Inserts:

1. Metal inserts for anchorage of materials or equipment to concrete construction not supplied by other trades and as required for the work.
2. Adjustable wedge inserts of malleable cast iron, complete with bolts, nuts and washers; minimum 3/4" bolt size unless otherwise indicated.
3. Threaded inserts of malleable cast iron, furnished complete with full-depth bolts; minimum 3/4" bolt size, unless otherwise indicated.
4. Stainless steel sheet metal reglets formed of the same material and gage as the flashing metal to be built into the reglets. Fill reglet or cover slot to prevent intrusion of concrete or debris.

G. Chamfer strips: 3/4" x 3/4" virgin vinyl with 1/2" radius and 1/2" nailing leg at corner.

H. Prefabricated construction joint keyways: Key-Loc by Form-A-Key Products Division, or Keyed Kold Joint by the Burke Company, or equal, complete with all accessories.

I. Where concrete shown in drawing to be over stryofoam, provide styrofoam per section 313219.

2.2 DESIGN OF FORMWORK

A. Design, erect, support, brace and maintain formwork so that it will safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength for that purpose.

B. Design forms and falsework to include assumed values of live load, dead load, weight of moving equipment operated on formwork, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.

C. Design formwork to be readily removable without impact, shock or damage to concrete surfaces and adjacent materials.

D. For concrete surfaces which will remain exposed in the Work, seal joints with sealant or tape to prevent cement paste leakage. At other locations provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints to prevent leakage and fins.

E. Design formwork to take into account the placing rate, temperature, vibrating and retarding admixtures so all portions of the assembly withstand the concrete pressures without deformation beyond 1/360 of spans.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Examine substrates and adjoining construction, and conditions under which formwork will be installed.

C. Do not proceed with installation until unsatisfactory conditions detrimental to the proper and timely completion of this work have been corrected.

3.2 FORM CONSTRUCTION

A. General:
1. Construct forms complying with ACI 347, to the sizes, shapes, lines and dimensions shown, and as required 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. Use selected materials to obtain required finishes.
2. Provide camber in formwork as required for anticipated deflections due to weight and pressures during concrete placement and construction loads for long span members without intermediate supports.
3. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the 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 assure ease of removal.
4. Provide temporary openings where interior of formwork is inaccessible for clean-out, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms in as inconspicuous location as possible, consistent with project requirements.
5. Form intersecting planes to provide true, clean-out corners, with edge grain of plywood not exposed as form for concrete.
6. Before concrete placement, check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.
7. During concrete placement, check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.
8. The Contractor shall engage a licensed surveyor to verify that formwork is within specified allowable tolerances. Surveyor shall report in writing to the Construction Manager, with copy to the Contractor, certifying formwork as acceptable or indicating deviations from allowable tolerances.

B. Provisions for other trades: Provide openings in concrete formwork to accommodate work of other trades. Accurately place and securely support items to be built into forms.

C. Cleaning and tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is to be placed. Re-tighten forms immediately after concrete placement as required to eliminate mortar leaks.

3.3 FORMS FOR EXPOSED CONCRETE

A. General:
   1. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes.
   2. Do not use metal cover plates for patching holes or defects in forms.
   3. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
   4. Use extra studs, whalers and bracing to prevent bowing of forms between studs.
   5. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
   6. Form molding shapes, recesses and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.

B. Corner treatment:
   1. Form exposed corners of beams and columns with chamfers to produce smooth, solid, unbroken lines, except where otherwise indicated.
   2. Form chamfers with 3/4" x 3/4" strips, unless otherwise indicated, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Extend terminal edges to require limit and miter chamfer at changes in direction.
   3. Concealed corners may be formed either square or chamfered.

C. Joint locations:
   1. Utilize largest available form panels for minimum joint spacing of 8 ft. x 4 ft.
   2. Arrange joints in a symmetrical pattern so center of the surface involved is either a joint or the center of a form unit. Use form units of matching size where possible.
   3. Arrange forms with continuous support at every joint to keep from offsetting during the placing operation.
   4. Exposed joints not shown shall be made and located to least impair the strength of the structure.
   5. Where a joint will occur, thoroughly clean the surface of the concrete and remove laitance. In addition, wet vertical joints thoroughly and slush with neat cement grout immediately before placement of new concrete. A delay until the concrete is no longer plastic in columns or walls (minimum of 2 hours) must occur before concrete is placed in the beams or slabs to be supported.
   6. At horizontal construction joints, provide 1-1/2" continuous blocking at top of first casting. Remove blocking and re-brace forming member tightly against first casting to form a leak-proof joint for second placement.
   7. There shall be no horizontal construction joints in concrete beams.
      a. Construction joints shall be made in the center of spans with vertical bulkheads.
      b. When a beam intersects a girder at this point, the joints in the girders shall be offset a distance equal to twice the width of the beam.
      c. The location of construction joints is subject to the Engineer's review in each case.
      d. Provide additional reinforcing at construction joints as directed by the Engineer.
   8. Locate construction joints in suspended floors at locations indicated on Drawings.

9. Refer to Section 033000 for additional provisions on this subject.

3.4 PREPARATION OF FORM SURFACES

A. Clean form surfaces of embedded materials, of accumulated mortar or grout from previous concreting, and of other foreign material before concrete is placed in them.

B. Unless otherwise specified or approved, treat form surfaces as follows:
   1. Before placement of either the reinforcing steel or the concrete, cover the form surfaces with specified coating material. Steel forms shall be free of rust.
   2. Coat high density overlay plywood with mill oil of 100 or higher viscosity, in accordance with APA recommendations.
   3. Do not allow excess form coating material to stand in puddles in the forms nor to come in contact with hardened concrete against which fresh concrete is to be placed.

3.5 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of the items to be attached thereto.

B. Edge forms and screeds strips for slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.

3.6 REMOVAL OF FORMS

A. General: Comply with California Building Code, Section 1906.2 Removal of Forms, shores and Reshoring.

B. Formwork not supporting 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 for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided that curing and protection operations are maintained.

C. Formwork supporting weight of concrete, such as beam soffits, joists, slabs and other structural elements may not be removed in less than 14 days, and not until concrete has attained design minimum 28-day compressive strength. Determine potential compressive strength of in-place concrete after tests of field-cured specimens, representative of the concrete location or members, have been made by the Contractor's Testing Agency.

D. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

3.7 RE-USE OF FORMS

A. Clean and repair surfaces of forms to be re-used. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces 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 all joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except when acceptable to the Architect.

END OF SECTION

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SECTION 032000 - CONCRETE REINFORCING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.2 RELATED REQUIREMENTS

A. Section 031000 - Concrete Forming and Accessories.

B. Section 033000 - Cast-in-Place Concrete.

C. Section 042900 - Engineered Unit Masonry: Reinforcement for engineered masonry.

1.3 REFERENCE STANDARDS

A. ACI 301 - Specifications for Concrete Construction 2020.

B. ACI 318 - Building Code Requirements for Structural Concrete 2019 (Reapproved 2022).

C. ACI SP-66 - ACI Detailing Manual 2004.

D. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.

E. ASTM A497/A497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete; 2007.

F. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2004a.

G. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement; 2005a.

H. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement 2016.

I. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; American Welding Society; 2005.

J. CRSI (DA4) - Manual of Standard Practice 2018, with Errata (2019).

K. CRSI (P1) - Placing Reinforcing Bars, 10th Edition 2019.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. A. Product Data: Manufacturer's product data, specifications, and installation instructions for proprietary materials and accessories.

C. Shop Drawings: For fabrication, bending, and placement of reinforcing.
   1. Comply with ACI 315.
   2. Show bar schedules, stirrup spacing, diagrams of bent bars, arrangements and assemblies, as required for fabrication and placement.

D. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

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

1.5 QUALITY ASSURANCE

A. Concrete reinforcement shall comply with ACI 318 Section 3.5

B. Welders' Certificates: Submit certifications for welders employed on the project, verifying AWS qualification within the previous 12 months.
   1. Welding procedures, welding operators and welders shall be qualified in accordance with AWS D1.4. Welders whose work fails to pass inspection shall be requalified before proceeding further welding.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver reinforcement to Project site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on shop drawings.

B. Store materials to prevent damage and accumulation of dirt or excessive rust.

C. Comply with the combined recommendations of AWS and the electrode manufacturer for storage of electrodes. Do not use electrodes that have been wetted.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Bars: ASTM A615, deformed, Grade 60.

B. All Longitudinal Bars in Concrete Moment Frame Beams and Columns: ASTM A706, low alloy steel.

C. Bars to be Welded: ASTM A706, low alloy steel.

D. Welded Wire Fabric: ASTM A185, Fy = 65 ksi.

E. Welding Electrodes: AWS A5.1 E80XX Series, low hydrogen, or as indicated.

F. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place.
   1. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.
   2. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
   3. For exposed to view concrete surfaces, where legs of supports are in contact with forms, provide supports with either plastic protected or stainless steel protected legs, at Contractor's option.
   4. Over waterproof membranes, use precast concrete block bar supports to prevent penetration of the membrane.

2.2 FABRICATION

A. General:
   1. Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with ACI 318 Section 7.5.2. and Chapter 7 of CRSI Manual of Standard Practice for fabrication of reinforcing steel. All reinforcing shall be free of rust, grease, mill scale or any other material that would affect its bond to concrete.
   2. In case of fabricating errors, do not re-bend or straighten reinforcing in a manner that will weaken the material.
   3. Unacceptable Materials: Reinforcement with one of the following defects will not be permitted in the work:
      a. Bar lengths, depths and bends exceeding CRSI fabrication tolerances.
      b. Bends or kinks not indicated.
      c. Bars with reduced cross section due to excessive rusting.
   4. Do not fabricate reinforcing bars until reinforcing bar Shop Drawings have been reviewed by Architect.

2.3 SOURCE QUALITY CONTROL

A. The Owner's Testing Laboratory will:
   1. Collect mill test reports for reinforcement

PART 3 EXECUTION

3.1 PLACEMENT

A. Comply with referenced codes and standards.
   1. Clean reinforcement to remove loose rust and mill scale, earth, and other materials which reduce or destroy bond with concrete.

2. Comply with Chapter 8 of CRSI Manual of Standard Practice, CRSI "Placing Reinforcing Bars". 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.
3. Place reinforcement to obtain minimum coverages for concrete protection.
4. Ensure bar spacing meets requirements of ACI 318 Section 7.6
5. Arrange, space, and securely tie bars and bar supports together with 16 gauge wire to hold reinforcement in position during concrete placement operations. Provide metal spreaders and spacers as needed to hold horizontal steel in position.
6. Set wire ties so that twisted ends are away from exposed concrete surfaces.

B. Install welded wire fabric in as long lengths as possible.
1. Lap adjoining pieces at least one full mesh and lace splices with 16 gauge wire.
2. Do not make end laps midway between supporting beams, or directly over beams of continuous structures.
3. Offset end laps in adjacent widths.

C. Provide sufficient numbers of supports of strength to carry reinforcing.
1. Do not place reinforcing bars more than 2-inches beyond the last leg of continuous bar supports.
2. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

D. Splices: Splice bars by lapping ends and tightly wire tying. Minimum lap of spliced bars shall be as indicated.

E. Weld splices in bars larger than No. 11, where No. 11 bars are spliced to larger size bars, and where shown.
1. Use full penetration butt welds by electric arc method.
2. Use welders who have passed AWS standard qualification tests within previous year.
3. Weld splices to develop 125 percent of specified yield strength of bars, or of smaller bar in transition splices.
4. Clean bars of oil, grease, dirt and other foreign substances and flame dry before welding.
5. Preheat bars before welding.
6. Stagger splices in adjacent bars.
7. Prepare ends of bars in compliance with AWS D1.4.

F. End splices in vertical reinforcing for No. 11 bars and larger may be made using a mechanical friction device which provides positive alignment during placement. Comply with manufacturer's directions for bar preparation and installation of clamping devices.

G. Welding:
1. Comply with requirements of AWS D1.4 for field welding.
2. Prior to field welding, determine weldability of reinforcing bars by laboratory chemical analysis of steel.
3. Only steel conforming to chemical requirements specified in AWS D12.1 may be welded.

H. Inspection and Test of Welds: In accordance with AWS D1.4 and ACI 318.

I. Conform to California Building Code code for concrete cover over reinforcement.

3.2 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 014000, will inspect installed reinforcement for conformance to contract documents before concrete placement.

B. Inspection and Tests of Welds: Provide special inspection of shop and field welding in accordance with CBC Section 1704A and Structural Contract Drawings.
   1. Tests will be made by testing laboratory for reinforcing bar welds, as
      a. Qualification of welders engaged in electric-arc welding of reinforcing
      b. Verification of location of reinforcing for accuracy.
      c. Inspection of reinforcing bar welds by certified welding inspectors.
      d. X-ray tests of sample welds of the largest size bar for each type of welding.
   2. When welds are judged to be deficient, provide and pay for such additional X-rays and tests as directed by the Architect. Defective welds shall be repaired, replaced and retested.

C. Placing: Provide special inspection as required by CBC 1704A.4

END OF SECTION

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SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete for composite floor construction.

B. Elevated concrete slabs.

C. Floors and slabs on grade.

D. Concrete foundations.

E. Concrete shear walls and elevator shaft walls.

F. Concrete foundations.

G. Joint devices associated with concrete work.

H. Miscellaneous concrete elements, including equipment pads, light pole bases, flagpole bases, thrust blocks, and manholes.

I. Concrete curing.

J. Installation of items to be embedded in unformed concrete; refer to Section 031000 and 055000 for items to be embedded in formed concrete. Coordinate with requirements of all Sections having items to be embedded in Concrete

1.2 RELATED REQUIREMENTS

A. Section 031000 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 032000 - Concrete Reinforcing.

C. Section 05 5000 - Metal Fabrications

D. Section 07 9005 - Joint Sealers

E. Section 079005 - Joint Sealers: Sealants for saw cut joints and isolation joints in slabs.

F. Section 31 3219 - Lightweight, Geo-Synthetic Fill

G. Related work provided by the Owner:
   1. Registered Deputy Inspector to inspect the placement of cast-in-place concrete in accordance with Building Code requirements.

1.3 REFERENCE STANDARDS

A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials 2010 (Reapproved 2015).

B. ACI 211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide 2022.

C. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete 1998 (Reapproved 2004).

D. ACI 301 - Specifications for Concrete Construction 2020.

E. ACI 302.1R - Guide to Concrete Floor and Slab Construction 2015.

F. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).

G. ACI 305R - Guide to Hot Weather Concreting 2020.

H. ACI 308R - Guide to External Curing of Concrete 2016.

I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2008.

J. ACI 360R - Guide to Design of Slabs-on-Ground; 2010

K. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2003.

L. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2021.

M. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2007.

N. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens) 2021.

O. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.

P. ASTM C150/C150M - Standard Specification for Portland Cement; 2007.

Q. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete 2020.

R. ASTM C172 - Method of Sampling Freshly Mixed Concrete; 2004.

S. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method 2016.

T. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).

U. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete; 2005.

V. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2019, with Editorial Revision (2022).

W. ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes 2023.

X. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2008a.

Y. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete 2020a.

Z. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete 2016.

AA. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover 2008a (Reapproved 2019).

BB. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers 2020.

CC. COE CRD-C 48 - Handbook for Concrete and Cement Standard Test Method for Water Permeability of Concrete 1992.

DD. COE CRD-C 572 - Handbook for Concrete and Cement Corps of Engineers Specifications for Polyvinylchloride Waterstop 1974.

EE. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.

FF. NSF 372 - Drinking Water System Components - Lead Content 2022.

1.4 REGULATORY REQUIREMENTS:

A. Comply with applicable codes and regulations of governmental agencies having jurisdiction, including applicable requirements of the Standard Specifications, applicable requirements for accessible access contained in local governing agency security ordinances, and applicable federal access laws.

B. Comply with CBC Section 1133B.7.1 requirements for slip resistance.
   1. Concrete paving shall have a minimum slip resistance coefficient of friction of 0.6 as tested in accordance with ASTM D 2047.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data for each material and manufactured products showing compliance with specified requirements and installation instructions.

C. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mix water to be withheld for later addition at Project site.
   2. Design mix submittal shall be wet stamped and signed by a professional engineer licensed in the State of California.
   3. For each material, including admixtures and water, state water-cement ratio and maximum allowable water content.
   4. For each material, state manufacturer's name, designation and source.
   5. Submit shrinkage and creep factors for each type of aggregate and each source proposed for use.
   6. Submit a schedule which identifies the locations within the structure where each mix design is proposed for use.

D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
   1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
   1. Cementitious materials and aggregates.
   2. Admixtures.
   3. Curing materials.
   4. Floor and slab treatments.
   5. Bonding agents.
   6. Adhesives.
   7. Vapor retarders.
   8. Epoxy joint filler.
   9. Joint-filler strips.
   10. Repair materials.

F. Minutes of preinstallation conference.

G. Samples for Pigment Color Selection: Submit manufacturer's complete sample chip set, including pigment number and required dosage rate for each color.

H. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.

I. Sustainable Design Submittals: If any wood or wood-based form materials, including supports, are permanently installed in the project, submit documentation required for sustainably harvested wood as specified in Section 016000 - Product Requirements.

J. Sustainable Design Submittal: If any fly ash, ground granulated blast furnace slag, silica fume, rice hull ash, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete cast in place, mix design(s) used showing the quantity of portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used; use LEED New Product Content Form.

K. Project Record Documents:
1. Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
2. Concrete Placement: Date and time of placement in each portion of schedule. Include starting and ending temperatures, humidity and wind velocities.
3. Test Cylinders: Cross-reference to placement record entries.
4. Upon completion of work for this section, deliver two copies of each record to structural engineer in form acceptable to Architect.

L. Floor Flatness measurements per paragraphs 3.05 and 3.06.

1.6 QUALITY ASSURANCE

A. Local / Regional Materials:
1. Provide cementitious and aggregate materials that are quarried and mixed regionally within a radius of 500 miles of Project Site.

B. Reference standards: Applicable provisions of the following govern the work of this Section, except as noted or specified.
1. ACI 211, Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete.
2. ACI 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
3. ACI 301, Specifications for Structural Concrete for Buildings.
4. ACI 302, Recommended Practice for Concrete Floor and Slab Construction.
5. ACI 304, Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
6. ACI 318, Building Code Requirements for Reinforced Concrete.
7. ACI 305, Recommended Practice for Hot Weather Concreting.
8. ACI 306, Recommended Practice for Cold Weather Concreting.
9. ACI 311 (ACI SP-2) ACI Manual of Concrete Inspection.

C. Source quality control:
1. Testing Agency shall test the materials for conformance with these Specifications before concrete mixes are established, and when source is changed, unless recent test results of

materials to be used on the Project are acceptable to the Architect.

2. Testing coarse aggregates:
   a. Test aggregates before and after concrete mix is established and whenever the character source of material is changed, but not less than one test for each 500 cubic yards.
   b. Perform a sieve analysis to determine conformity with limits of gradation. Perform sampling and testing according to ASTM C33, and as follows:
      1) Sampling of aggregates: ASTM D75. Take samples of aggregates at source of supply, or if source of supply has been approved, from storage bunkers at ready mixed concrete plant.
      2) Testing of aggregates shall include:
         (a) Sieve analysis: ASTM C136
         (b) Organic impurities: ASTM C40. Fine aggregate shall develop a color not darker than the referenced standard color.
         (c) Soundness: ASTM C88. Loss after 5 cycles not over 8% for coarse aggregate, nor 10% for fine aggregate.
         (d) Abrasion of concrete aggregate: ASTM C131. Weight loss not over 10 1/2% after 100 revolutions, nor 42% after 500 revolutions.
         (e) Deleterious materials: ASTM C33.
         (f) Materials passing No. 200 sieve: ASTM C117, not over 1% for gravel, 1.5% for crushed aggregate per ASTM C33.
         (g) Reactive materials: ASTM C289. Aggregates shall indicate no potential deleterious reactivity.
         (h) Definitions: ASTM C125.
3. Cement test:
   a. The cement mill laboratory will be acceptable as testing laboratory for this purpose when approved by Inspector of Record. Submit evidence to show that the cement mill laboratory is qualified to perform tests. The laboratory shall make tests for every 500 barrels or fraction thereof of cement used, in accordance with ASTM C150.
   b. Make tensile strength test at 7 days. Tag the cement for identification at the location of sampling. A representative of the Testing Agency shall certify that materials being used are taken from the lots sampled and tested for this report.

D. Sample panels: Before beginning work, cast a 3 ft. x 3 ft. sample panel of each type of flatwork finish specified at a location on the site agreed upon with the Architect.
   1. Use same concrete mix, placing, consolidating and finishing methods and workmen as for the finish work.
   2. Protect panels until their removal is authorized by the Architect. Make such modifications as necessary to achieve a panel satisfactory to the Architect and Owner.
   3. Approved panels shall serve as the standard for all remaining work. Remove panels only after completion and acceptance of the flatwork.

E. Local / Regional Materials:

1. Provide cementitious and aggregate materials that are quarried and mixed regionally within a radius of 500 miles of Project Site.

1.7 MOCK-UP

A. Construct and erect mock-up panel for architectural concrete surfaces indicated to receive special treatment or finish as result of formwork.
   1. Panel Size: Sufficient to illustrate full range of treatment.

B. Accepted mock-up panel is considered basis of quality for the finished work. Keep mock-up exposed to view for duration of concrete work.

C. Mock-up may not remain as part of the Work.

PART 2 PRODUCTS

2.1 FORMWORK

A. Comply with requirements of Section 031000.

2.2 REINFORCEMENT

A. Comply with requirements of Section 032000.

2.3 CONCRETE MATERIALS

A. Portland cement: ASTM C150, Type II. Do not change brand or type of cement without the Architect' s written approval. Cement may be supplemented with fly ash conforming to ASTM C 618.

B. Aggregates: Submit pit source and characteristics of each type aggregate prior to designing mixes.
   1. ASTM C33 for normal weight concrete.
   2. Aggregate shall be graded so that coarse aggregate nominal size is not larger than 1/5 of the narrowest dimension between form faces; nor 3/4 of the minimum clear spacing between individual reinforcing bars or bundles of bars, whichever is less, but never greater than 3/4" in any dimension for slabs 4" thick or less; 1 1/2" at all other locations.
   3. Except where specifically indicated, “Pea Gravel” concrete (concrete with a maximum aggregate size of 3/8”) shall not be permitted without written permission from the Engineer.
   4. ASTM C330 for light weight concrete.

C. Admixtures:
   1. Calcium chloride, thyocyanates and admixtures containing chloride ions are not permitted.
   2. Other than specified, admixtures complying with the following may be used with the Architect’s approval. Submit manufacturer's data for each product proposed for use.
   3. Admixtures shall comply with the following:

a. Air-entraining admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
b. Water-reducing admixture: ASTM C494, Type A.
c. High-range water-reducing admixture (super plasticizer): ASTM C494, Type F or Type G.
d. Water-reducing, non-chloride accelerator admixture: ASTM C494, Type E.
e. Water-reducing, retarding admixture: ASTM C494, Type D.
f. Water Resistant Admixture: Integrally batched water repellant admixture for redi-mix concrete to be Master Builders 'Barrier Crete', XYPEX C-2000, or approved equal, for use at stair treads and intermediate landings.

D. Structural adhesive: ASTM C881, 2-component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit Project requirements.
1. Thiopoxy; WR Grace.
2. Sikadur Hi-Mod; Sika Chemical Corp.
3. Patch and Bond Epoxy; The Burke Co.

E. Water: Fresh, clean, and free of oil and other materials injurious to concrete.

F. Curing compound:
1. Liquid membrane forming compound containing a fugitive dye, conforming to ASTM C309, Type I, guaranteed not to affect the bond, adhesion, or effectiveness of finishes and surface treatment specified herein to be applied to concrete.
2. Curing compound used on exposed concrete surfaces shall be non-discoloring, fast drying and shall be conclusively demonstrated not to darken or yellow with age. Curing compound for use on concrete floors to receive adhered floor finishes shall be specially formulated for such use and shall be certified by the manufacturer not to inhibit the bonding qualities of flooring adhesives.

G. Expansion joint materials:
1. Joint filler (indicated as JFT-1 on Drawings): Homex Expansion Joint by Homasote Co. or equal non bituminous product compatible with sealant specified in Section 079000. Use in combination with plastic joint cap made by Greenstreak or equal.
2. Joint sealant and back up rod: As specified in Section 079005.

H. Dry-pack and grout: One of the following.
1. Masterflow 713 by Master Builders.
2. Five Star Grout by U.S. Grout Corp.
3. Sika Grout 212, by Sika Chemical Corp.

I. Bonding agent: Weldcrete by Larsen Products Corp. or Proweld by Protex Industries Inc.

J. Curing paper: Orange Label Sisalkraft by Fortifiber Corp., or equal.

2.4 MIXES

A. Mix Design: Concrete shall be designed in accordance with 2013 California Building Code, Section 1904.2 and ACI 318 Section 5.3 and 5.4
   1. A testing agency under the direction of a California-registered Civil or Structural Engineer shall design all structural concrete mixes required for the Project to provide:
      a. Concrete of the compressive strength indicated on the Drawings.
      b. Adequate workability and proper consistency to permit concrete to be worked readily into the forms and around reinforcement without segregation and excessive bleeding.
      c. Other requirements of these Specifications.
   2. Determine proper proportions for design mixes in accordance with ACI 211 or ACI 318.
   3. Determine proper water cement ratio by preliminary test made in accordance with ASTM C192.
   4. Slump limits: Proportion and design mixes to result in the concrete slump at point of placement not exceeding the maximum recommended by ACI 301 and as accepted in the mix design.
   5. Tests shall be conducted in accordance with ASTM C39.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash: 15 percent.
   2. Combined Fly Ash and Pozzolan: 15 percent.

C. Submit reports showing results of sieve analysis, mix design and results of compression tests. Make test specimens from not less than 3 batches of each design mix. The trial batch strength for each mix shall exceed indicated f'c by 25% or a lesser amount based on standard deviations of strength test records according to ACI 318. Do not start concrete production until mixes have been reviewed and are acceptable to the Architect.

D. For each batch, weigh the fine and coarse aggregate separately, measure cement and water separately and introduce separately into the mix so that proportions can be accurately controlled and easily checked.

E. Do not change proportions established by the accepted mix design without the Architect's written approval.
   1. Cement: If concrete develops less than required minimum strength, adjust mix proportions and increase the amount of cement, as necessary.
   2. Water: Do not exceed predetermined amount of water because of slowness of discharge from mixer or any other reason, but reduce water to minimum necessary to produce concrete that will work readily into corners and angles of forms and around reinforcements, without segregation of materials and without free water collecting on the surface.
   3. Aggregates: Reasonable variations in grading will be allowed because of characteristics of available materials and the need for workability and strength.

F. Concrete mixing:
   1. Mixing and delivery shall comply with ASTM C94, these Specifications, and Building Code requirements.

2. Testing Agency shall perform check sieve analysis of the aggregates being used, check compliance with mix design and the cement being used against mix design; check that water has been removed from the drum before adding mix ingredients for the following load and shall witness the loading of mixing trucks. Testing Agency shall provide a written report of each inspection indicating compliance or non-compliance with these Specifications.
3. In addition to the requirements of ASTM C94 section 16.1 provide the following information on delivery tickets. Provide a ticket signed by an authorized representative of the batching plant with each mixer truck of concrete delivered to the site.
    a. Type and brand of cement.
    b. Cement content per cu. yd., of concrete.
    c. Maximum size of aggregate.
    d. Total water content expressed as water/cement ratio.
4. Deliver batch tickets to the Owner's Inspector at the site when concrete is delivered.
5. Maintain equipment in proper operating condition, with drums cleaned before charging each batch. Schedule rate of delivery to prevent delay of placing the concrete after mixing, or holding dry-mixed materials too long in the mixer before the addition of water and admixtures.
6. Remove all materials, including water remaining in the ready mix truck drum, completely before ingredients for the following loads are introduced in the drum.
7. Do not use concrete which has not been placed 30 minutes after leaving the mixer, or concrete that is not placed within 60 minutes after water is introduced into the mix.
8. Mix proportions for architectural cast-in-place concrete shall provide a mixture of proper workability and strength for specific type of concrete, with water-cement ratio in accordance with requirements of ACI 303R, Chapter 6. Slump shall be as low as possible, consistent with the particular type of concrete and methods of deposit. Consistency for any placement shall be constant from batch to batch in order to provide uniformity in the end product. Experiment with dryer concrete lifts gradually toward the top to provide a more uniform appearance. Experimentation may be done on concealed basement walls and/or mock-ups using Architectural concrete mix.
    a. Make every effort to pour architectural concrete with concrete temperatures between 65 and 85 degrees F. Higher temperatures can result in faster setting rate, and visible flow lines and cold joints.

2.5 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

2.6 VAPOR RETARDERS

A. Vapor Retarder, Class A:Conform to ASTM C 755.
    1. Reinforced high density polyethylene or mylar geomembrane, minimum 15 mils thickness, having the following properties:
        a. Water Vapor Permeance: ~~0.02~~ *0.01* Perms maximum, in accordance with ASTM E ~~154~~ *1745* Section 7.

b. Underslab Vapor Retarder Classification: Class A, in accordance with ASTM E 1745.
c. Puncture Resistance: 2200 grams minimum, in accordance with ASTM D 1709 Method B.
d. Tensile Strength: 45 lbf/in minimum, in accordance with ASTM E 154 Section 9, Method ASTM D 882.

2. Products: One of the following, in accordance with ASTM E 1745:
a. Moistop Ultra 15, manufactured by Fortifiber Corporation.
b. Viper VaporCheck II 15-mil, manufactured by Insulation Solutions.
c. Vapor Block 15, manufactured by Raven Industries.
d. Griffolyn Type 105, manufactured by Reef Industries.
e. Stego Wrap 15-mil Class A Vapor Barrier manufactured by Stego Industries.
f. Perminator 15 Mil, manufactured by W.R. Meadows.
g. Florprufe 120, manufactured by Grace Construction Products.
h. Blackline 400, manufactured by Carlisle coatings & Waterproofing.

3. Accessory Products: Provide vapor retarding seam tape, vapor proofing mastic, pipe boots, and related accessory products recommended by manufacturer of vapor retarder.

B. Subslab Waterproofing (At Wood Floors onr Slabs-on-Grade): Vapor barrier under slab on grade with hydraulic moisture pressures or wet soils. Conform to ASTM C 755.
1. Reinforced high density polyethylene (HDPE), mylar geomembrane, or 1/8-inch thick pre-molded membrane having the following minimum properties:
a. Water Vapor Permeance: 0.005 Perms maximum, in accordance with ASTM E 96.
b. Water Vapor Barrier Classification: Class A, in accordance with ASTM E 1745.
c. Puncture Resistance: 2400 grams minimum, in accordance with ASTM D 1709 Method B.
d. Tensile Strength: 70 lbf/in minimum, in accordance with ASTM E 154 Section 9, Method ASTM D 882.

2. Products: One of the following, or equal:
a. Alumiseal Zero Perm Vapor Barrier manufactured by Alumiseal Corporation.
b. Griffolyn VAPORguard manufactured by Reef Industries.
c. Stego Wrap 15-Mil Class A Vapor Barrier manufactured by Stego Industries.
d. Pre-Molded Membrane vapor seal with plasmatic core manufactured by W.R. Meadows. Refer to special installation requirements in Part 3.

3. Accessory Products: Provide vapor retarding seam tape, vapor proofing mastic, pipe boots, and related accessory products recommended by manufacturer of vapor retarder.

C. Seam Tape:
1. High density reinforced polyethylene tape with pressure sensitive adhesive as recommended by manufacturer of vapor/radon barrier for product accepted for use. Minimum 4 inches in width and of a contrasting color.

2.7 BONDING AND JOINTING PRODUCTS

A. *Waterstops: At all cold joint use: Bentonite and butyl rubber, complying with NSF 61 and NSF 372.*
1. *Configuration: Rectangular or half round.*

2. *Products:*
   a. *Cetco; Volclay Waterstop-RX.*
   b. *Substitutions: See Section 016000 - Product Requirements.*
3. *Accessories*
   a. *Manufacturer's recommended sealant / adhesive.*

B. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.

C. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with minimum 1 inch diameter holes for conduit or rebars to pass through at 6 inches on center; ribbed steel stakes for setting.

2.8 CURING MATERIALS

A. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C309.. Type 1, Class B.
   1. Manufacturers:
      a. L&M Construction Chemicals, Inc., a subsidiary of Laticrete International, Inc.; Dress & Seal WB 30: www.lmcc.com/#sle.
      b. Euclid Chemical Co.; Kurez DR VOX
      c. Or approved equal.
      d. Substitutions: See Section 016000 - Product Requirements.
   2. Vapor Emission Sealer **Type FVS:** Refer to Section 033970 for remedial vapor emission and alkalinity control sealer.
   3. Sealer Finish **Type FSF**: High solids, minimum 25% non-yellowing waterbased acrylic cure/sealer conforming to ASTM C 309 and ASTM C 1315 Type 1, Grade B, low VOC compliant meeting all local air quality regulations for use at exposed concrete floors for appearance, equal to one of the following:
      a. Euclid Aqua Cure VOX Super, manufactured by Euclid Chemical Co.
      b. Dress & Seal WB30, manuactured by L&M Construction Chemicals
      c. Or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.2 PREPARATION

A. Inspect excavations, subgrades and formwork, as applicable for each placing operation, for accuracy of lines, levels, elevations and dimensions.

B. Inspect placement of reinforcement and accessories for proper position, sizes, clearances, fastenings, laps and splices.

C. Moisten, do not saturate, earth subgrade and bearing surfaces. Do not place concrete on muddy subgrade.

D. Wet wood forms thoroughly when they are not treated with form release agent. Wet other materials sufficiently to reduce suction and maintain concrete workability.

E. Embedded items including, but not limited to, conduits, anchors and rough hardware, built into concrete as indicated or required.
   1. Do not embed piping and conduits, other than electrical conduits, in structural concrete. Locate conduits so as to reduce strength of the structure the least amount, as approved by the Architect, and as indicated on the Drawings.
   2. Embed bolts, inserts and other items in the concrete. Secure accurately so that they are not displaced during concrete placing, compacting and finishing operations. Wire tie, nail or bolt embeds securely to forms.
   3. Set embedded bolts for materials and equipment attached to concrete to template, layouts and shop drawings. Verify size, length and location of electrical conduits with respect to equipment supports.
   4. Fill voids in sleeves, inserts and anchor slots temporarily with readily removable material to prevent entry of concrete in the voids.

F. Install expansion joint fillers where indicated, and as required to isolate concrete slabs-on-grade from other building elements such as walls and equipment pads. Cover filler with plastic joint cap and leave in place until ready to receive sealant, then remove and discard plastic cap.

G. Do not proceed with placement of concrete until all conditions are satisfactory.

H. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

I. Vapor Retarder: Install vapor retarder over subbase in accordance with ASTM E 1643 and ACI 302.1R Addendum as required by slab floor finish requirements.
   1. Roll subgrade smooth before placing vapor retarder.
   2. Lap joints minimum 6 inches. Tape and seal all penetrations and laps with high density polyethylene pressure sensitive tape and mastic. Turn up edges of vapor retarder 2 inches at vertical surfaces. Attach pipe boots in accordance with manufacturer's recommendations.
   3. Refer to Section 031000 for limitation of grade staking in vapor retarder area.
   4. Repair damaged areas of vapor barrier with overlapping patches of vapor barrier secured with pressure sensitive tape.

3.3 CONVEYING

A. Rapid handling: Transport concrete from the mixer to location of placing as rapidly as practical to avoid separation or loss of ingredients.

B. Transporting methods:
   1. Use cranes, carts, buggies or other approved means to deliver concrete to final locations. Do not use delivery systems (pipe, chutes, etc.) formed of aluminum for transporting concrete.
   2. If pumping of concrete is contemplated, first obtain the Architect's approval for the design mix and the placement method before placing concrete.

C. Free fall: As dictated by job conditions at each location, but not more than 4 ft. where concrete will be exposed in the Work and 6 ft. at all other locations. Avoid large concentration of concrete in one location, which would produce unacceptable deflection in supporting formwork or steel decking.

D. Concrete flow: Keep surface of concrete level during placing with a minimum of concrete allowed to flow from one position to another. Carry concrete up uniformly for the length of walls being placed to reduce lateral flow of concrete to 5 ft. maximum.

E. Runways: Construct substantial runways and scaffolding to avoid movement and vibration in the forms and reinforcing steel as a result of transporting and placing concrete.

3.4 PLACING

A. General: Comply with the more restrictive requirements of ACI 304 and ACI 5.7 Preparation of Equipment and Place of Deposit. Do not place concrete in or under water.

B. Consolidation: Thoroughly consolidate concrete and work it around reinforcement and embedded items and into corners and angles of forms, by spading, rodding and tamping to exclude rock pockets, air bubbles and honeycombs, and to obtain required density and strength.

C. Internal vibration:
   1. Use mechanical vibrators to consolidate each layer with that previously placed, to completely embed reinforcement and fixtures and to bring fine materials to the faces and top surfaces to produce the proper finish.
   2. Assign at least one workman at each location where concrete is being placed to vibrate and consolidate the concrete in forms. Take care to avoid overvibration causing separation of ingredients. Keep extra standby vibrator at the site.
   3. Do not use vibrator to move concrete.

D. Flow of concrete: Keep surface of concrete level during placing, with a minimum of concrete allowed to flow from one position to another. Place concrete in a continuous operation until each section or panel has been completed.

E. Record: Keep records showing location, date and time of placement of all concrete on the Project.

F. Floor slabs: Shape slabs to the levels, slopes and elevations indicated and accurately pitch or grade to drainage fittings and fixtures installed in them. When placing slabs that are slopped

uphill, deposit concrete from bottom to top, to minimize tension cracking.

1. Over vapor retarder use screed pads to hold screed posts.
2. Comply with recommendations of ACI 302.1R at concrete slabs to reduce plastic and drying shrinkage cracks.

G. Wall supported elements: Under normal weather conditions, wait at least 2 hours after depositing concrete in walls and columns before placing concrete in supported floors. Consider beams, girders, capitals and brackets as part of the floor systems.

H. Temperature: Do not place concrete when the temperatures of the materials in contact with the concrete, and the ambient temperature exceed the ranges recommended in ACI 305 and 306, if it is likely to exceed these temperature before the concrete has taken its initial set, unless special precautions recommended by ACI 305 and 306 are provided.

I. Construction joints: Refer also to Section 031000 - Concrete Formwork for additional provisions on this subject. Comply with the more restrictive requirements of ACI 318 6.4 Construction Joints and the following:
   1. Location: Locate joints to least impair the strength and appearance of the structure. Obtain the Architect's approval of all construction joint locations before casting concrete. In general construction joints shall be located as follows, unless otherwise indicated on the Drawings:
      a. In walls locate at the underside of floors or slabs, and at the top of footings or floor slabs.
      b. In slabs on grade locate joints as detailed on the Drawings, but not more than 15' o.c.; off set not less than 5 ft., with a minimum of 2 offsets. Allow proper time lapse in placing of floor sections adjoining prior placings.
      c. In all cases make construction joints perpendicular to the main reinforcement. Continue reinforcement across joints.
   2. Provide keyways at least 1 1/2" deep in construction joints in slabs, and between walls and footings; use prefabricated bulkheads specified for slabs.
   3. Keep exposed face of construction joints continuously moist from time of initial set until subsequent placing of concrete against them, but not to exceed the curing period. When not damp, wet (do not saturate) the contact surface of joints for a minimum of 24 hours before placing adjoining concrete.
      a. Before placing adjoining concrete, clean contact surfaces to remove all laitance, loosened particles of aggregate or damaged concrete, and expose sound, coarse aggregates solidly embedded in the matrix.
      b. To achieve the above, the contact surface may be washed with clean water under pressure (jet blast), may be sandblasted, or in areas which will be concealed from view when the building is completed an approved structural adhesive may be used on clean, structurally sound concrete. Remove wash water entirely from surface.
      c. If a contact surface becomes coated with foreign materials of any nature after being cleaned, clean again to suitable condition.

3.5 **TOLERANCES**

A. Tolerances for Concrete Construction and Materials shall conform to all requirements of ACI 117, Standard Specifications for Tolerances for Concrete Construction and Materials, published by the American Concrete Institute, except as modified by the requirements of these Specifications.
   1. Formed Surfaces: Maintain bowing, warping, and dimensional tolerances within the maximum tolerances stated in ACI 117 for Class A surfaces.
      a. Overall Dimension for Height and Width: Plus zero to minus 3/32-inch for surfaces that are 10 feet and over.
      b. Thickness: Plus-or-minus 1/8-inch maximum.
      c. Openings: Accurate to within a tolerance of plus 1/8-inch to minus zero.
      d. Exposed Slab Edges: Free of jogs exceeding 1/8-inch.
   2. Concrete Slabs: Floor finish tolerances shall be measured in accordance with ASTM E 1155 Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System (Inch-Pound Units) for the following conditions:

B. Concrete Door Sills:
   1. Slabs Under Roll-up Doors: 1/8-inch from level along line under partition or door.

C. Levelness tolerances shall be measured within 72 hours after slab concrete placement and report provided to Architect for review.

D. Owner reserves the right to test floors and concrete members for conformance to ACI 117 - Tolerance Specifications by Use of the Dipstick Floor Profiler. Should tolerances not be within the limits specified, the Contractor shall be required to pay the cost of the tests, as well as the repairs required to bring work into compliance.

E. Correction Procedures:
   1. High spots on slabs which are to receive floor covering shall be ground down to meet specified tolerances.
   2. Low spots on slabs which are to receive floor covering shall be filled to meet specified tolerances.

3.6 FLOOR AND SLAB CURING AND FINISHING SCHEDULE

Location:	**Finishing:**	**Curing and Sealing:**
Interior concrete floors, to be covered by direct application of ceramic, quarry or stone tile or microtopping.	Smooth trowel finish with light broom texture; FF35-FL25 SOV (Specified Overall Value) / FF24-FL16 MLV (Minimum Local Value).	Moist cure only. Do not apply sealer or hardener.
Interior concrete floors to receive adhesively applied or loose laid floor covering or coating.	Smooth trowel finish; FF35-FL25 SOV / FF24-FL16 MLV, except resilient athletic flooring FF50-FL30 SOV / FF25-FL17 MLV	Moist cure only; do not use curing compound. After curing is completed, clean floor with suitable cleaning agents and apply concrete hardening

		compound
Interior concrete floors to remain exposed, in service areas and equipment rooms.	Smooth trowel finish; FF35-FL25 SOV / FF24-FL16 MLV. Provide overall slope as indicated on the Drawings, within Floor Levelness FL criteria specified above.	Moist cure only; do not use curing compound. After curing is completed, clean floor with suitable cleaning agents and apply concrete hardening compound.
Interior concrete floors to receive color stain finish and remain exposed.	Burnished trowel finish; FF35-FL25 SOV / FF24-FL16 MLV	Apply curing compound recommended by color stain manufacturer. After curing is completed, clean concrete floor with specified color concrete cleaner, leaving surface suitable for color stain application. Apply color stain according to manufacturer's instructions and recommendations, to achieve finish according to reviewed samples and mock-ups. After stain has set, neutralize color stain, clean floor and apply specified sealer for colored concrete.
Interior concrete floors and concrete topping on metal decking, concrete to remain exposed, such as in service areas and equipment rooms.	Smooth trowel finish; FF45-FL35 SOV (Specified Overall Value) / FF30-FL25 MLV (Minimum Local Value). Provide overall slope as indicated on the Drawings, within Floor Levelness FL criteria specified above.	Apply curing compound. After curing is completed, clean floor with suitable cleaning agents and apply concrete hardening compound.
Interior concrete on metal decking or metal pans, to receive adhesively-applied or loose laid floor covering.	Smooth trowel finish; FF35-FL25 SOV / FF24-FL16 MLV.	Apply curing compound. After curing is completed, clean floor with suitable cleaning agents to dustfree condition, leaving surface suitable for adhesive application of finish floor coverings. Verify moisture vapor transmission rate.
Interior concrete on metal decking or metal pans, to be covered by direct application of ceramic,	Smooth trowel finish with light broom texture; FF35-FL25 SOV / FF24-FL16	Apply curing compound. Do not apply sealer or hardener.

quarry or paver tile.	MLV.	
Exterior slabs on grade (not paving).	Trowel finish with medium broom texture, FF20-FL15 SOV, sloped to drain.	Moist cure only; do not use curing compound. After curing, clean concrete and apply concrete hardening and sealing compound.

3.7 FINISH OF FORMED SURFACES

A. Patching Concrete:
   1. Fill all rock pockets, "honeycombs" and random holes in excess of 3/16-inch, or heavy concentrations of air holes, damage resulting from removal of nails, rod and cone ties, separators and core samples, etc. unless indicated otherwise. Chip away defective areas to solid concrete, forming perpendicular edges or slightly undercut edges. Drench area of patch and surrounding area with water. Pack full with mortar (sacking slurry) mix. Match surrounding concrete surfaces in color and texture using part white Portland cement, if necessary. Remove fins and irregularities in exposed concrete surfaces while concrete is green. Neatly patch exposed exterior surfaces of concrete, as required, irregularities ground smooth and sacked and patched to leave a smooth surface ready for painting.

B. Finishing Formed Surfaces:
   1. Immediately after forms have been removed, examine all surfaces. Exposed surfaces to have a smooth architectural finish. Repair surfaces having bulges, honeycomb, voids, gravel pockets or other defects with dry pack or cement grout, as directed, and finish flush with adjoining concrete surfaces. Concrete surfaces that will remain exposed in the finished work shall have all traces of pointing, patching and surface irregularities removed by rubbing and honing with carborundum stones to produce uniformly smooth finish.

3.8 FINISHING FLATWORK

A. Protection:
   1. Protect work of other trades from damage by covering it with heavy kraft paper securely taped in place. Leave protection in place as long as its need exists.
      a. Control the use of water and other contaminants within the building so that no damage to previously installed work or existing structure and finish occurs.

B. Compacting and floating:
   1. Bring slabs to proper elevations and strike off with a straightedge. Remove excess water and laitance.
      a. Compact and consolidate to embed coarse aggregates.
         1) Float and test surfaces with a 10 ft. straightedge and eliminate high and low spots to comply with tolerances specified.
         2) From this point, use the methods and tools necessary to produce surface tolerances and finishes specified.
      b. Use screeds of type and spacing required to produce specified slab tolerances.

C. Screeding: At concrete for floor/roof to be placed over metal deck:
   1. The steel angle closure at metal deck edges is not intended to serve as a screed.
      a. Use adjustable screeds at all screeded points and adjust to compensate for existing deflection and for deflection of deck and beams occurring during concreting operations.
      b. Continuously monitor screeds and floors during concrete placement and finishing and adjust concrete floor thickness as required (minimum thickness per drawings to be maintained) to obtain level floors.

D. Moisture control: In addition to other finishing requirements, use a water fog spray to reduce plastic shrinkage cracks during flatwork finishing operations when conditions of low humidity and/or high temperature exist.
   1. Immediately after concrete has been brought to a flat surface and the shiny film of moisture disappears, restore it and maintain until final troweling by applying a light film of moisture with an atomizing type fog sprayer.
      a. Use frequent light applications of moisture rather than excessive amounts at any one time. Adjust the amount and frequency of fog spray as required by variable conditions of weather, wind, temperature and humidity.

E. General requirements:
   1. Finish surfaces to produce a uniform appearance throughout area involved and throughout adjacent areas with the same treatment.
      a. Where concrete finishing occurs adjacent to finished metal or other surfaces, particularly where serrated or indented surfaces occur, remove all traces of cement film before allowing to harden.
      b. Use no troweling machines within 12" of electrical junction and outlet boxes which are set to finish flush with concrete floors. Float and trowel such areas by hand with wood floats and steel trowels, taking care to see that concrete is finished flush with box cover and matches adjacent surfaces.

F. Schedule of finishes: Match approved sample panels.
   1. Float all monolithic slab surfaces unless otherwise specified.
      a. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently to permit the operation of power-driven float, or both. Consolidate the surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units.
         1) Finish surfaces to receive elastomeric coatings and waterproofing to produce a uniform texture and finish throughout acceptable to the waterproofing and elastomeric coating manufacturer.
         2) Steel trowel concrete slabs which have no other specified finish to a hard, dense, burnished surface.

(a) After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.

(b) Consolidate the concrete surface by final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with surface plane tolerance specified.

3) Use abrasive aggregate (non slip) finish for stair treads and landings where applied finishes are not used.

(a) Raised Cast-In-Place Curbs, Cast-In-Place Stairs, and Concrete Landings: Trowel finish with final finish to be a medium broom finish. At concrete stairs and landing surfaces exposed to weather, render non-slip by uniformly sprinklering wetted non-slip abrasive grit evenly over finish concrete to exhibit 65-75 percent, or roughly 1/4 pound per square foot minimum of abrasive aggregate material as called for on item 2.01,K above. Just before performing retroweling, lightly rub the hardened green concrete to expose grains and expose cement film.

(b) Pan Filled Stairs and Landings: Provide a water resistant concrete mix that is finished with a medium broom finish.

4) Finish all flatwork at parking areas, including ramps, with a hand troweled finish to produce a uniform coarse / heavy "sweated" swirl pattern.

5) Exterior flatwork: As specified in Section 033150.

2. Bring the concrete slabs, using screed, to the required floor level and strike off true with a straightedge. Remove excess water and laitance. Compact with a grid tamper, if desired, then float and trowel finish as specified. Test the surface with a straightedge to detect high and low spots and eliminate any which may exist. Tolerance not to exceed 1/4-inch along a 10-foot straightedge in the final concrete finish surface.

a. Measurement lines shall not cross construction-joints or grade breaks.

b. Sidewalks: Provide a medium broom finish

c. Handicap Ramps- Accessibility Compliance: At ‘Path of Travel’ (ramps), concrete surfaces shall be finished with a heavy broom finish at slopes exceeding 6 percent, and medium broom finish at slopes up to 6 percent. Provide with a tactile warning of 1/4-inch wide x 1/4-inch deep grooves at 3/4-inch on center with configurations as shown on the drawings, or as required for handicap accessibility in accordance with California Building Code with Title 24 CCR amendments.

d. Finish on all exterior exposed poured-in-place concrete walls, all surfaces of beams, spandrel and all four sides of perimeter column surfaces, to be "sack" finished and when completed, shall be smooth, free from air, pin or rock pockets and/or discoloration or defects; uniform color and texture, free of dust and ready to paint. All score joints and grooves shall be straight, true and uniform.

e. Interior Beams: Finish to a smooth Class A natural form finish with steel forms exhibiting a dense, smooth surface free of rock pockets, air and pin holes, and other defects. Sparse areas (less than one square foot) of air/pin holes less than 3/16-inch in diameter shall be acceptable. Junctures of beams to girders and beams/girders with

columns and slab soffits shall be uniform in detail and true to line. Sack all beams and girders to achieve the specified steel form finish.

f. Poured Interior Columns: Have all projections removed and rock pockets and air and pin holes filled and ground smooth and left dust-free to receive paint. All column chamfers shall be ground smooth, and be consistent from top of floor slab to soffit.

g. Radius-tooled Edges: 1/4-inch radius typical for all slabs not metal edged and the tops of walls and beams where indicated unless noted otherwise.

h. Interior Soffit Treatment: Underside of slabs and beams to have fins, projections including any deck panel buttons, removed including all nails, staples, bolts, wood form chips and other protrusions and have all voids filled. Fill all threaded deck panel inserts; remove grease prior to filling. Mortar used for filling shall match adjacent concrete in color and texture.

3.9 CONTROL JOINTS

A. Locate control joints on grade slabs where shown on the drawings or as follows:

1. Provide saw cuts at all column centerlines and at uniform intervals no more than 20 feet on center in each direction. Submit proposed layout for approval by the Engineer. Resulting panels shall not exceed 400 square feet.
    a. Provide keyed joints at all slab on grade construction joints except where otherwise detailed on structural drawings.
2. Approved method for saw cutting is to be by wet, soft cut, within 6 hours of pour following final troweling/finishing, 1/4 the depth of the slab, (1-inch minimum) unless indicated otherwise on Drawings.
3. Retaining Walls (Where occurs): Provide vertical control joints as detailed on the Drawings at intervals not to exceed 60 feet, unless otherwise noted. Control joints shall be provided at each face of the wall and shall align with each other. Seal outside (dirt side) face as recommended by the waterproofing company and as acceptable to the Architect.

3.10 SACKED FINISH

A. Remove all fins and projections from concrete surfaces.

1. Apply the pre-packaged slurry specified hereinbefore. Only upon special approval of the Architect may the Contractor proportion the slurry from one part cement to 1-1/2 parts sand, passing a No. 16 sieve, by damp loose volume, mixed with sufficient water and bond enhancing acrylic admixture to form a grout having the consistency of thick paint.
2. Prior to applying slurry to surfaces, dampen concrete sufficiently to prevent water absorption. Spread slurry over surfaces with a clean sponge rubber float or burlap pads to completely fill all holes and imperfections. Float surface vigorously and, while slurry is still plastic, remove excess slurry.
3. Allow to dry and then rub with burlap to completely remove dry slurry so that no visible film remains. The entire sacking operation for any area must be completed the day it is started. Surface when completed shall be smooth, free from air, pin or rock pockets and/or discoloration or defects, uniform in color and texture, free of dust and ready to paint.

3.11 DEFECTIVE CONCRETE

A. Work that is not formed or is not true to alignment, not plumb or level or is not true to grades and levels, or has voids, rock pockets, sawdust, wood or debris embedded in it, or does not fully conform to the Contract Documents for required strength, will be considered as defective material and/or faulty workmanship, and when directed, shall be removed and replaced at the Contractor's expense with work that conforms to the indicated requirements.
   1. Markings:
      a. At expansion joints and elsewhere as indicated, mark slabs with a 1/4" radius rounded edging or marking tool. In textured work edge and mark slabs, after texturing, with a combination edging/ smoothing tool approximately 1-1/2" wide.
         1) Where saw cutting is indicated, time this operation so that it is performed as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by the saw, but before shrinkage stresses have developed sufficiently to produce cracking. Saw cutting shall be performed on the same day as placement of the concrete.
         2) Make marking lines straight, or curved as indicated, equally spaced and parallel to adjacent lines and/or walls, edges and other construction, and of uniform depth and cross section, with intersections accurately formed.

B. Curbs: Immediately after removing forms finish faces and top with a steel trowel

3.12 CURING

A. General: Coordinate curing methods with requirements of manufacturers whose materials with be applied over concrete surfaces.

B. Formed concrete: Wet the tops and exposed portions of formed concrete, keep moist and at a temperature of not less than 50 deg F until forms are removed, but for not less than 7 days duration. If forms are removed before 14 days after concrete is cast, coat concrete with curing compound as specified for flatwork below.

C. Concrete flatwork:
   1. After finishing, spray the specified curing compound uniformly in 2 coats at 90 deg. to each other not exceeding coverage rates recommended by the manufacturer. Inspect treated surfaces daily for 14 days for evidence of drying. Re wet the surfaces and apply a new application of curing compound if premature drying occurs, as soon as can be done after finishing without marring the surfaces.
   2. Remove sealer residue after curing period is completed.

3.13 MISCELLANEOUS CONCRETE WORK

A. Equipment bases and foundations:
   1. Provide machine and equipment bases and foundations where indicated on Drawings.

2. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing the machines and equipment.
3. Prior to pouring equipment bases, verify sizes and adequacy of base with actual equipment to be supplied. Base sizes shown on the Drawings reflected requirements of primary name brand equipment supplier.

B. Pits, trenches and curbs: Construct pits for elevators, transformers, pumps, valves, trenches, curbs, gutters, and other miscellaneous concrete work.

C. Grouting and dry-packing: Install as indicated and required, except for items grouted by other trades. Comply with the grout manufacturer printed instructions and the following.
1. Mix material with sufficient water so it flows under its own weight for grout, and to just moisten and bind the material together for drypack.
2. Place dry-pack by forcing and rodding to fill all voids and provide complete bearing under plates. Place fluid grout from one side only and puddle to completely fill voids; do not remove dams or forms until grout attains initial set. Finish exposed surfaces smooth, and damp cure at least 3 days.

D. Concrete fill in stair pans: Coat steel with bonding agent and fill pans with a mix containing 3/8" maximum aggregate size. Reinforce the mix with 2" x 2" x 16 gage welded wire mesh at midpoint.

E. Where concrete shown in drawing to be over stryofoam, provide styrofoam per section 313219.

3.14 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.15 FIELD QUALITY CONTROL

A. Concrete quality control (refer also to Section 014000): The following will be performed by the Owner’s Inspectors. Additional tests may be made by the Contractor, for its convenience, at the Contractor's expense.
1. Samples will be taken during progress of the work to determine slump, compression strength, aggregate sieve analysis, and grout mix tests, with assistance furnished by the Contractor.
2. *Per ACI 318 5.6.2.1 provide* 4 cylinders will be made for each day's pour, or for each 150 cubic yards, or once for each 5,000 sq. ft. of surface area, whichever is less, for each type of concrete being cast.
3. 1 cylinder shall be tested at 7 days, and 2 cylinders at 28 days. The remaining cylinder will be kept in reserve in case tests are unsatisfactory.
4. Samples will be made in accordance with ASTM C172.

5. Specimens will be made and laboratory cured in accordance with ASTM C31.
6. The 28 day values shall be the criteria for acceptance of concrete regarding strength only.
   a. 7 day tests may be regarded as indicative of compliance or non compliance with the 28 day strength requirements, and the Contractor should be guided accordingly in matter of adjusting proportions, if necessary, and notify the Architect.
   b. 7 day tests shall also be a guide to the Contractor regarding time for form removal.
7. Slump tests will be made for each set of tests cylinders in accordance with ASTM C143.

B. Tests evaluation:
1. Concrete cylinder test shall be evaluated in accordance with ACI 214 and 318.
2. If 28 day test results indicate that concrete strength is not as specified, core concrete as instructed by the Architect in accordance with ASTM C42.
   a. Plug core hole solid as specified in Article 3.04 of this Section.
   b. The cost of cores, tests and patching shall be borne by the Contractor.
3. In the event that additional core tests do not show strength required, or as determined by load tests made in accordance with ACI 318, the defective concrete shall be removed and replaced, or shall be reinforced as directed by the Architect, at the Contractor's expense.
4. If core tests results fall below design strength specified, adjust the concrete mix or water content for future batches, at no additional cost to the Owner.

3.16 PROTECTING/CLEANING

A. Protect finished concrete surfaces from stains, abrasions and other damages until acceptance by the Architect.
1. Cover concrete with non-staining, waterproof tarpaulins or similar form of protection when performing other work adjacent to concrete surfaces.
2. Protect exposed edges of concrete by boarding.
3. Do not allow fire in direct contact with concrete.
4. Provide adequate protection against injurious action by sun or wind. Protect fresh concrete from heavy rain and mechanical injury.

B. Upon completion, wash and clean exposed concrete and leave free of oil, paint, plaster and foreign substances, ready to receive applied finishes or to be left exposed.

3.17 DEFECTIVE CONCRETE

A. Concrete which does not meet the requirements of the Contract Documents will be deemed defective.

B. Remove defective concrete as directed by the Architect and replace with concrete meeting the requirements of the Contract Documents, at no additional cost to the Owner.

END OF SECTION

SECTION 051200 - STRUCTURAL STEEL FRAMING

<<<<<< UPDATE NOTES

PART 1 GENERAL

2.1 SECTION INCLUDES

A. Structural steel framing members, support members, suspension cables, sag rods, and struts.

B. Base plates, shear stud connectors and expansion joint plates.

C. Grouting under base plates.

2.2 RELATED REQUIREMENTS

A. Section 014000 - Quality Requirements for independent testing agency procedures and administrative requirements.v

B. Section 013300 - Submittals Procedures.

C. Division 1 Section “Submittal Procedures” Appendix A “Green Building Product Information Submittal Form”.

D. Division 3 Section "Cast-In-Place Concrete" for setting of anchor bolts, concrete foundations, and for as-built survey of concrete work.

E. Division 5 Section "Metal Fabrications" for steel lintels or shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other metal items not defined as structural steel.

F. Section 051214 - Architecturally Exposed Structural Steel (AESS)

G. Section 052100 - Steel Joist Framing.

H. Section 053100 - Steel Decking: Support framing for small openings in deck.

I. Section 055000 - Metal Fabrications: Steel fabrications affecting structural steel work.

J. Section 078100 - Applied Fire Protection: Fireproof protection to framing and metal deck systems.

K. Division 9 painting Sections for surface preparation and priming requirements.

2.3 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION:

A. Anchors for casting into concrete.

B. Loose bearing plates to receive Structural Steel.

2.4 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents, or exposed to public view.

2.5 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual 2023.

B. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges 2016.

C. AISC S348 - Specification for Structural Joints Using ASTM A325 or A490 Bolts; 2004.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.

F. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished 2018.

G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.

H. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength; 2004e01.

I. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength 2014.

J. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric) 2014.

K. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength 2014a.

L. ASTM A490M - Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric) 2014a.

M. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.

N. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2021a.

O. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric) 2021a.

P. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel; 2007.

Q. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2006a.

R. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) 2020.

S. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments 2019.

T. ASTM E709 - Standard Guide for Magnetic Particle Testing 2021.

U. ASTM F436 - Standard Specification for Hardened Steel Washers 2011.

V. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners 2013.

W. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength 2020.

X. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.

Y. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2008.

2.6 SUBMITTALS

A. Product Data:
   1. Producer’s or Manufacturer’s Specifications recommended installation instructions, laboratory test reports and other data required to prove compliance with the specified requirements.
      a. Structural steel including chemical and physical properties.
      b. Bolts, nuts, and washers including mechanical properties and chemical analysis.
      c. Shop primers.
   2. Nonshrink grout.

B. Shop Drawings: Show complete details and schedules for fabrication of structural steel components and shop assembly of members.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Provide setting drawings, templates and directions for installing anchor bolts and other embedded structural steel.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
   4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

5. Identify shop drawing details by reference to Sheet and Detail Number on the Contract Drawings.
6. Submit erection plan sequence and procedures.

C. Welding certificates: Submit Certificates certifying welders employed on the work verifying AWS qualifications within the previous 12 months.

D. Qualification Data: For Installer, fabricator, professional engineer, and testing agency.

E. Manufacturer's Mill Certificate: Submittal shall certify that products meet or exceed specified requirements.

F. Mill Test Reports: Submit manufacturer's certificates indicating structural strength, destructive and non-destructive test analysis.

G. Test Reports: Submit reports of tests conducted on shop and field welded and bolted connections, including data on type of tests conducted and test results.

H. Shop and Field inspection is required.

I. Provide manufacturer's information/data sheet or a letter from the manufacturer indicated the location of manufacture, amount of recycled content (post consumer and post industrial percentage) in the product, and the location of raw material harvest if within 500 miles of the project site.

2.7 FIELD MEASUREMENTS

A. Verify that field measurements, lines, grades and elevations agree with measurements shown on the Contract Drawings. Concrete Contractor shall furnish the Steel Contractor accurate as-built drawing of bolt settings.

B. Contractor shall be entirely responsible for the correctness, conformity, accuracy and execution of structural steel work.

2.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CASE or CSE.

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Cbd or Sbd.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1, P2, P3 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

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

E. Comply with applicable provisions of the following specifications and documents:
   1. 2013 California Building Code, Title 24.
   2. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
      a. Paragraph 4.2.1 of the above code is hereby modified by deletion of the following sentence:
         1) "This approval constitutes the owner's acceptance of all responsibility for the design adequacy of any detail configuration of connections developed by the fabricator as part of his preparation of these shop drawings."
      b. Paragraph 4.2.2 is deleted in its entirety.
      c. Paragraph 7.9.3 of the above code is hereby modified by the deletion of the following sentence:
         1) "The contract documents specify the sequence of schedule of placement of such elements."
   3. American Welding Society "Code D1-1 Structural Welding Code".
   4. A.I.S.C. Specifications for Design, Fabrication and Erection of Structural Steel for Buildings.
   5. R.C.R.B.S.J. Specifications for "Structural Joints Using ASTM A325 Bolts".

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

G. Fabricate structural steel members in accordance with AISC "Steel Construction Manual."

2.9 REGULATORY REQUIREMENTS

A. Comply with applicable provisions of the following building codes, including special inspection provisions:
   1. California Building Code (CBC), Chapter 17 and 22.

B. Comply with applicable provisions of the following specifications and documents as modified by the building codes:
   1. AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," except as follows.
      a. Modify paragraph 4.2.1 by deletion of the sentence: "This approval constitutes the Owner's acceptance of all responsibility for the design adequacy of any connections designed by the fabricator as part of his preparation of these shop drawings."
      b. Modify paragraph 7.9.3 by deletion of the sentence: "The contract documents specify the sequence and construction of placement of such elements."
   2. AISC 341 and AISC 341s1, "Seismic Provisions for Structural Steel Buildings" and Supplement No. 1.
   3. AISC 360, "Specification for Structural Steel Buildings," including high-seismic applications.
   4. AWS D1.1/D1.1M, "Structural Welding Code-Steel".
   5. AWS D1.8/D1.8, "Structural Welding Code-Seismic Supplement".

6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."Steel Structures Painting Council.
7. SSPC, "Steel Structures Painting Manual, Volume 2, Systems and Specifications".

2.10 DELIVERY, STORAGE, AND HANDLING

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

B. Deliver materials, structural steel and components to the job site properly marked to identify location for which they are intended. Use markings corresponding to markings shown on the approved shop drawings.

C. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.

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

2.11 COORDINATION

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

PART 2 PRODUCTS

3.1 MATERIALS

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

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Channels, Angles, M-shapes, S-Shapes: ASTM A 36.

D. Plate and Bar: ASTM A 36, or ASTM A 572, Grade 50 where indicated on Contract Drawings.

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

F. Steel Pipe: ASTM A 53, Type E or S, Grade B welded seamless pipe, Standard weight class or as indicated on Contract Drawings, Black finish except where indicated to be galvanized.

G. Welding Electrodes: Comply with AWS requirements.

H. Shear Stud Connectors: Made from ASTM A 108 Grade 1015 bars.

I. High-Strength Structural Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M). see plans.

J. High-Strength Structural Bolts: ASTM A490 or ASTM A490M; Type 1 alloy steel, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436 washers.

K. Grout: Non-shrink, non-metallic aggregate type, complying with {\rs\#1} and capable of developing a minimum compressive strength of 8000 psi at 28 days.

3.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M) or ASTM A 490 as indicated, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish, except all components exposed to the weather shall be hot-dipped galvanized.
   1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type, finish to match bolts. Provide mechanically deposited zinc coating with baked epoxy-coated finish where exposed to the weather.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers with plain finish, except all components exposed to the weather shall be hot-dipped galvanized.
   1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type, finish to match bolts.

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

D. Unheaded Anchor Rods: ASTM F 1554, Grade 105.
   1. Configuration: Straight.
   2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel, Type DH.
   3. Plate Washers: ASTM A 36/A 36M carbon steel.
   4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
   5. Finish: Plain.

E. Headed Anchor Rods: ASTM A 307, Grade A, straight.
   1. Configuration: Straight.

2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel, Type DH.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
5. Finish: Plain.

F. Threaded Rods: ASTM F 1554, Grade 36, 55, 105, or as indicated on Contract Documents.
1. Configuration: Straight.
2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel, Type DH.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
5. Finish: Plain.

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

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

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

J. Structural Slide Bearings: Low-friction assemblies, of configuration indicated, that provide vertical transfer of loads and allow horizontal movement perpendicular to plane of expansion joint while resisting movement within plane of expansion joint.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable substituted product by one of the following:
a. Amscot Structural Products Corp.
b. Fluorocarbon Company Limited.
c. R.J. Watson Bridge & Structural Engineered Systems.
d. Seismic Energy Products, L.P.
2. Mating Surfaces: PTFE and PTFE.
3. Coefficient of Friction: Not more than 0.10.
4. Design Load: Not less than 6,000 psi (41 MPa).
5. Total Movement Capability: 2 inches (50 mm).

3.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

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

3.4 GROUT

A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration. Grout shall have a minimum compressive strength of not less than 3000 psi in 7 days, or as indicated on Contract Drawings.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time. Grout shall have a minimum compressive strength of not less than 3000 psi in 7 days, or as indicated on Contract Drawings.

3.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Load and Resistance Factor Design Specification for Structural Steel Buildings."
   1. Camber structural-steel members where indicated.
   2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
   3. Mark and match-mark materials for field assembly.
   4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

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

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

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning or SSPC-SP 3, "Power Tool Cleaning."

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

G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

H. Bases and Bearing Plates: Shop weld to columns and members attached to concrete.

3.6 SHOP CONNECTIONS

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

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
   1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
   2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
   3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
      a. Grind butt welds flush.
      b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to SSPC-SP 2, "Hand Tool Cleaning." or SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils . Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils .

3.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.
   1. Fill vent holes and grind smooth after galvanizing.
   2. Galvanize structural steel members as indicated on Contract Drawings. Provide minimum 1.25 oz/sq.ft. galvanized coating.

3.9 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
   1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Conform to the inspection requirements of CBC Chapter 17.
   1. Inspection of Shop Fabrication: CBC 1704.2.5
      a. Inspection of shop fabrication shall be required for significant structural detailed connection and fabrication work as directed by CBC and the enforcment agency. This inspection shall be made by a qualified inspector approved by th eenforcement agency. The inspector shall furnish the Architect, Structural Engineer and the enforcment agency with a report that the materials and workmanship conform to the approved plans and specifications.

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

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

E. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1, *IDI.8, AISC 341 Appendix Q*, and the following inspection procedures, at testing agency's option *and as required in the above referenced standards* :
   1. Liquid Penetrant Inspection: ASTM E 165.
   2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   3. Ultrasonic Inspection: ASTM E 164.
   4. Radiographic Inspection: ASTM E 94.

F. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
   1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
   2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

G. Visual Inspection of Seam Welds at Inside and Outside of HSS products in accordance with DSA Bulletin 17-03.
   1. Review manufacturer's Material Test Report (MTR). Verify that material properties are as specified by DSA-approved documents, and that materials are readily identifiable and traceable to a MTR.
   2. Sample unidentifiable material for testing. Testing of materials must be performed by a laboratory accepted in the DSA Laboratory Evaluation and Acceptance Program (LEA).
   3. Conduct a thorough visual examination of the seam weld area in hollow structural sections (HSS) for visible discontinuities. Visual examination shall include as a minimum the

exterior of the seam weld and the interior at each end.

4. Conduct a thorough visual examination of surfaces of structural plate for visible lamination discontinuities.

H. Determine mechanical properties in conformance with ASTM A 370 of the following materials:
   1. Structural steel shapes and tubing.
   2. Anchor bolts.
   3. Filler metals for welding.
   4. High-strength threaded fasteners.

PART 3 EXECUTION

4.1 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

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

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

4.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
   1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

4.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges."

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
   1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of base plate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.

4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Surveys: Establish permanent benchmarks necessary for accurate erection of structural steel. Check elevations of concrete surfaces, and locations of anchor bolts and similar items, before erection proceeds.

E. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

F. Splice members only where indicated, unless, with the Engineer’s approval, splices not indicated would result in lower costs due to reduced shipping or other expenses. For splices not indicated, submit structural calculations prepared and signed by a Civil engineer licensed to practice where the project is located.

G. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

H. Do not use thermal cutting during erection, unless approved specifically by the Engineer. When gas cutting is permitted, finish the gas cut section to a sheared appearance.

I. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

4.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

B. Weld Connections: Comply with AWS D1.1 *and D1.8* for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and

Bridges" for mill material.

4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
   a. Grind butt welds flush.
   b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

4.5 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

4.6 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

B. Bolted Connections: Bolted connections will be tested and inspected according to CBC, AISC 360, and RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
   1. Bolt tightness shall be checked at the following rates:
      a. A minimum of 10 percent of all bolted joints, selected at random.
      b. A minimum of two bolts per joint.
      c. All high-strength bolts.

C. Welded Connections: Field welds will be visually inspected according to CBC and AWS D1.1/D1.1M, *D1.8, and AISC 341 Appendix Q.*
   1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M, *D1.8, and AISC 341 Appendix Q*. and the following inspection procedures, at testing agency's option *as required by the above referenece standards*:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.

D. Complete Penetration Groove Welds *per AISC 341 Appendix Q5.2:* Complete penetration groove welds contained in the beam to column joints of the moment frames shall be tested 100 percent either by ultrasonic testing ~~or by radiography.~~ *and 25 precent by magnetic particle testing.*
   1. At other than moment frame beam to column connections, base metal thicker than 1-1/2-inches, when subjected to through-thickness weld shrinkage strains, shall be ultrasonically inspected for discontinuities directly behind such welds. Test shall be performed
   2. Backing Strips: Backing bar of the bottom flange of moment frame beam shall be removed. Back-gouge weld root to sound material. Provide magnetic particle test for defects. Reweld root area with 5/16-inch fillet weld.

E. Shear Connectors: In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Revise subparagraph below if an actual amount or percentage of shear connectors requires testing.
3. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

F. Deficiencies: Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.
1. Reinspection: After correction of deficiencies, additional inspections and tests will be performed to verify that structural steel Work complies with the requirements.
2. Reinspection Costs: Cost of reinspections shall be the responsibility of the Contractor.

4.7 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780 and the repair paint manufacturer's written instructions..

B. Touch-up Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
2. Primed structural steel members showing evidence of rusting over 25 percent or more of any surface after erection shall be rejected.

C. Painting: see additional requirements in Division 9.

END OF SECTION

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SECTION 055000 - METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 099113 - Exterior Painting: Paint finish.

1.3 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.

C. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements 2008 (Reaffirmed 2018).

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.

G. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications 2023.

H. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.

I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.

J. 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.

K. ASTM B177/B177M - Standard Guide for Engineering Chromium Electroplating 2011 (Reapproved 2021).

L. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

M. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

N. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2023).

O. ASTM A588 - High Strength, low-alloy (HSLA) Steel for structural steel plate, up to 50 ksi, for welded construction with atmospheric corrosion resistance ; 2010.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283 and ASTM A588.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Slotted Channel Fittings: ASTM A1011/A1011M.

F. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M) Type 1, plain.

G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

H. Shop and Touch-Up Primer: _____, complying with VOC limitations of authorities having jurisdiction.

I. Touch-Up Primer for Galvanized Surfaces: Dry-Galv manufactured by American Solder and Flux or Galvalloy manufactured by Master Builders Inc., complying with VOC limitations of authorities having jurisdiction.

J.

2.2 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
   1. High Performance Organic Coatings: AAMA 2604AAMA 2604; multiple coats, thermally cured fluoropolymer system.

2.3 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by intermittent welds and plastic filler.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.4 FABRICATED ITEMS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
   1. Side Rails: 3/8 x 2 inches members spaced at 20 inches.
   2. Rungs: one inch diameter solid round bar spaced 12 inches on center.
   3. Space rungs 7 inches from wall surface.

B. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.

C. Lintels: As detailed; prime paint finish.

D. Louver/Fin panels
   1. Extruded aluminum profiles as indicated on the contract documents.
   2. Attachment to steel supports with countersunk stainless steel fastners painted to match aluminum finish. Panelization of fins is allowed and should provide for alignment, installation and spacing tolerances.

E. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.

F. Corten (A588) Steel planters.

G. Steel guardrails.

H. Aluminum plate guardrails.

2.5 PREFABRICATED LADDERS

2.6 FINISHES - STEEL

A. Prime paint steel items.

B. Prime Painting: One coat.

C. Chrome Plating: ASTM B177/B177M, nickel-chromium alloy, thickness of _____ , satin finish.

2.7 FINISHES - ALUMINUM

A. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system; custom color to match approved sample.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Obtain approval prior to site cutting or making adjustments not scheduled.

END OF SECTION

SECTION 057500 - DECORATIVE FORMED METAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fabrications made of formed metal sheet, secondary supports, and anchors to structure, including:
   1. Metal display cases.

1.2 RELATED REQUIREMENTS

A. Section 088853 - Resistant/Forced Entry Laminated Glass.

1.3 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2023.

B. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip 2023a.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.

D. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements 2022.

E. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs 2022.

F. ASTM F594 - Standard Specification for Stainless Steel Nuts 2022.

G. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2023).

H. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel 2017, with Amendment (2021).

I. NAAMM AMP 500-06 - Metal Finishes Manual 2006.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
   1. Differentiate between shop and field fabrication.
   2. Indicate substrates and adjacent work with which the fabrications must be coordinated.
   3. Include large-scale details of anchorages and connecting elements.

4. Include large-scale details or schematic, exploded or isometric diagrams to fully explain assembly with glazing at a scale of not less than 3 inches per 12 inches.

C. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product in color and texture.

D. Fabricator's Qualification Statement.

E. Maintenance Data: Care of finishes and warranty requirements.

F. Executed Warranty: Submit warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating products specified in this section.
1. With not less than three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
1. Protect finishes by applying heavy duty removable plastic film during production.
2. Package for protection against transportation damage.
3. Provide markings to identify components consistently with drawings.
4. Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Solid Metal Plate Material Manufacturers:
1. KH Metals & Supply; www.khmetals.com/.
2. Industrial Metal Supply Co.; www.industrialmetalsupply.com/.
3. Other approved equal.

2.2 FORMED METAL FABRICATIONS - GENERAL

A. Shop Assembly: Preassemble items to greatest extent possible. Minimize field splices and field assembly. Disassemble only as necessary for transportation and handling. Mark items clearly for assembly and installation.

B. Coordination: Match dimensions and attachment of formed metal items to adjacent construction. Produce integrated assemblies. Closely fit joints; align edges and flat surfaces unless indicated otherwise.

C. Forming: Profiles indicated. Maximize lengths. Fold exposed edges to form hem indicated or ease edges to radius indicated with concealed stiffener. Provide flat, flush surfaces without cracking or grain separation at bends.

D. Reinforcement: Increase metal thickness; use concealed stiffeners, backing materials or both. Provide stretcher leveled standard of flatness and stiffness required to maintain flatness and hold adjacent items in flush alignment.

E. Anchors: Straps, plates and anchors as required to support and anchor items to adjacent construction.

F. Supports: Miscellaneous framing, mounting, clips, sleeves, fasteners and accessories required for installation.

G. Welding and Brazing: Weld or braze joints continuously. Grind, fill or dress to produce smooth, flush, exposed surfaces. Do not discolor metal. Grind smooth, polish, and restore damaged finishes to required condition.
   1. Ease exposed edges to small uniform radius.
   2. Welded Joints:
      a. Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
      b. Stainless Steel: Perform welding in accordance with AWS D1.6/D1.6M.

2.3 MATERIALS

A. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections exposed to view on finished units.

B. Stainless Steel Sheet: ASTM A666, Type 316; stretcher-leveled.

C. Anchors, Clips and Accessories: Use one of the following:
   1. Stainless steel complying with ASTM A276/A276M, ASTM A480/A480M, or ASTM A666.
   2. Exterior Locations or in Contact with Stainless Steel:
      a. Bolts: Stainless steel; ASTM F593, Group 1 (A1).
      b. Nuts: Stainless steel; ASTM F594.
   3. Structural Anchors: Provide anchors where work is indicated to comply with design loads.
      a. Type: Provide torque-controlled expansion anchors.
      b. Capacity: When tested according to ASTM E488/E488M; four times the load imposed when installed in concrete.
   4. Nonstructural Anchors: Provide powder-actuated fasteners where work is not indicated to comply with design loads. Provide size and number required for load, installation, and as recommended by manufacturer, unless indicated otherwise.

2.4 FINISHES

A. Finishes, General: Comply with NAAMM AMP 500-06.
   1. Complete mechanical finishes before fabrication. After fabrication, finish joints, bends, abrasions and surface blemishes to match sheet or plate.
   2. Protect mechanical finishes on exposed surfaces from damage.
   3. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.

B. Stainless Steel Finishes:
   1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
   2. Polished Finishes: Comply with NAAMM AMP 500-06; grind and polish surfaces to uniform finish free of cross scratches. Run grain of directional finishes with long dimension of each item.
      a. Directional Satin: No. 4.
   3. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify dimensions, tolerances, and interfaces with other work.

B. Verify substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Notify Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent work areas and finish surfaces from damage during installation.

3.3 INSTALLATION - SHEET METAL AND PLATE FABRICATIONS

A. Locate and place decorative formed sheet metal items level and plumb; align with adjacent construction. Cut, drill and fit as required to install.

B. Do not cut or abrade sheet metal finishes that cannot be completely restored in the field. Return such items to manufacturer or fabricator for required alterations and refinishing or provide new items.

C. Use concealed anchorages where possible. Provide washers where needed on bolts or screws to protect metal surfaces and make weathertight connection.

D. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers indicated.

E. Corrosion Protection: Apply permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with incompatible substrate materials. Prevent corrosion damage to material and finish.

3.4 CLEANING

A. Restore finishes damaged during installation and construction period. Return items that cannot be refinished in the field to manufacturer or fabricator. Refinish entire unit or provide new units.

B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.

C. Remove temporary coverings and protection of adjacent work areas.

D. Clean installed products in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Protect installed products from damage during construction.

END OF SECTION

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SECTION 079005 - JOINT SEALERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sealants and joint backing.

B. Silicone joint sealants.

C. Urethane joint sealants.

D. Acoustical joint sealants.

1.2 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 078400 - Firestopping: Firestopping sealants.

C. Section 088001 - Glazing: Glazing sealants and accessories.

D. Section 093000 - Tiling: Sealant used as tile grout.

1.3 REFERENCE STANDARDS

A. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2022.

B. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016 (Reapproved 2023).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other sections referencing this section.

1.5 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures.

B. Product Data: Provide data indicating sealant chemical characteristics.

C. Samples: Submit four samples, 4 inches long in size illustrating sealant colors for selection.

D. LEED Report: Submit VOC content documentation for all non-preformed sealants and primers. See Section 01 8113 - Sustainable Design Requirements (LEED).

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.7 MOCK-UP

A. Provide mock-up of sealant joints in conjunction with window, wall, and air barrier system under provisions of Section 01 4339 - Mockup Requirements.

B. Construct mock-up with specified sealant types and with other components noted.

C. Locate where directed.

D. Mock-up may remain as part of the Work.

1.8 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.9 WARRANTY

A. See Section 01 7700 - Closeout Procedures, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.1 **MATERIALS, GENERAL**

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
   1. Architectural Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

C. Low-Emitting Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
   1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

E. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

F. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

G. Colors of Exposed Joint Sealants: Match Architect's custom color samples.

H. Basis of Design Products: Products listed are those that appear to meet the most stringent requirements of joint movement, modulus, low-VOC content, paintability and SWRI listing. Provide one of the products listed in each class, or comparable substituted products.

2.2 PRODUCT USAGE

A. General: Provide sealants in not less than the following circumstances:
   1. Where expansion and contraction occurs.
   2. Between materials and products where infiltration of moisture, water, light, or air blown particles may occur.
   3. Between materials and products in, or penetrating, sound-insulated walls, partitions, and related construction.
   4. Between dissimilar materials where they join on a surface or corner.

B. Exterior: Provide types of sealants at the following locations:
   1. Traffic Bearing Joints in Paved Areas:
      a. Level Areas up to 1 Percent Slope: Type A1 and Type A2.
      b. Horizontal Joints Exceeding 1 Percent Slope, and on Vertical Ris- ers: Type A2.
      c. Concrete Slab Joint Filler: Type G1.
   2. Structural Joints with Movement up to 50 Percent of Joint Width: Type B1 or Type C1 or Type D1, as appropriate, or as indicated on Contract Drawings.
   3. Non-Dynamic Joints:
      a. General Use: Type B2 or Type C1.
      b. Wall Penetrations: Type E1 or Type C1.

C. Interior: Provide sealants at the following locations:
   1. Non Fire-resistive Rated Construction, Paintable:
      a. Interior Static Joints: Type E1 or Type E2 or Type F1.
      b. Ceramic Tile and Plumbing Fixture Conditions: Type D2.

c. Wall Penetrations: Type E1.
d. Interior Door and Window Perimeters: Type E2 or Type F1.
e. Acoustical Applications: Type F2.

D. Glazing Systems: Provide sealants at the following locations:
1. Aluminum Frames:
a. Exterior Perimeter Weather Seals: Type D1.
b. Interior Perimeter Air Seals: Type B2 or Type C1 or Type D1.
c. Internal Construction Sealants: Type C1 or Type D1.
d. Glazing Sealants: Type D1.

E. Use only materials recommended by manufacturer for each specific application.

2.3 MATERIALS

A. Sealants: Provide the following types in colors to match adjacent materials.
1. Type A1 - Polyurethane Traffic Grade Sealant: Two-part, self- leveling; ASTM C 920, Type M, Grade P, Class 25, Use T; Shore hardness 30-40. Acceptable products:
a. Pecora NR-200 Urexpan.
b. PRC Permapol RC-2SL.
c. Sikaflex 2c SL.
d. Sonneborn Sonolastic SL 2
e. Tremco Vulkem 245 SL (255 at wide joints).
f. Substitutions: See Section 01 2500 - Substitution Procedures.
2. Type A2 - Polyurethane Traffic Grade Sealant: Two-part, non-sag, cold- applied, chemically cured, traffic grade, Shore A of 40+; ASTM C 920, Type M, Grade NS, Class 25, Use T, M, A, and O. Acceptable products:
a. Pecora Dynatred.
b. Sikaflex 2c NS.
c. Tremco Vulkem 227.
d. Substitutions: See Section 01 2500 - Substitution Procedures.
3. Type B1 - Polyurethane High Performance Sealant: Two-part, non- sag, highly adhesive and elastic, general purpose, wide range of avail- able colors; ASTM C 920, Type M, Grade NS, Class 25, Use NT, M, A, G, and O; UL classified; Shore hardness 15-30. Acceptable products:
a. Pecora Dynatrol II.
b. PRC Permapol RC-2.
c. Sikaflex 2c NS.
d. Sonneborn Sonolastic NP 2.
e. Tremco Vulkem 922 or Dymeric Plus.
f. Substitutions: See Section 01 2500 - Substitution Procedures.
4. Type B2 - Polyurethane General Purpose Sealant: One-part, non- sag, low-modulus moisture cured; ASTM C 920, Type S, Grade NS, Class 25, Use NT, M, A, and O. Acceptable products:
a. Pecora Dynatrol I.
b. PRC Permapol RC-1.

c. PTI 7130.
d. Sikaflex 15 LM.
e. Sonneborn Sonolastic NP 1.
f. Tremco Vulkem 116, 230, 921, or Dymonic.
g. Substitutions: See Section 01 2500 - Substitution Procedures.

5. Type C1 - Modified Silicone (Silyl-terminated Polyether) Sealant: One-part, non-sag, low-modulus, high-elongation and compression recovery, highly adhesive, zero VOC, odorless, and non-staining. Acceptable products:
   a. Sonneborn Sonolastic 150, Sonolastic 150 Tint Base, or equal.
6. Type D1 - Silicone High Performance Sealant: One-part, non-sag, low-modulus, high-elongation and compression recovery, highly ad- hesive, ASTM C 920, Type S, Grade NS, Class 25, Use NT G, M, and O; UL classified. Acceptable products:
   a. Dow Corning:
      1) 791 for sealing
      2) 795 for structural glazing
      3) 983 two-part.
   b. GE Silpruf.
   c. Pecora 864.
   d. Pecora 898 for mildew resistant
   e. Rhodorsil 5C.
   f. Sonneborn Sonolastic Omniseal.
   g. Tremco Spectrem 1.
   h. Substitutions: See Section 01 2500 - Substitution Procedures.
7. Type D2 - Silicone General Purpose and Sanitary Sealant: One-part, non-sag, primerless, sanitary, and highly flexible, ASTM C 920, Class
   a. 25; USDA approved. Acceptable products:
   b. Dow Corning 786.
   c. GE Gesil N 2500/2600 Series or SCS1702 Sanitary Sealant.
   d. Pecora 898 or 863.
   e. Rhodorsil 6B.
   f. Sonneborn Sonolastic OmniPlus.
   g. Tremco Spectrem 2.
   h. Substitutions: See Section 01 2500 - Substitution Procedures.
8. Type E1 - Acrylic Terpolymer Sealant: One-part, non-sag, highly adhesive and elastic; FS TT-S-00230. Acceptable products:
   a. Pecora 60+ Unicrylic.
   b. Tremco Mono.
9. Type E2 - Acrylic Latex Sealant: One-part non-sag; ASTM C 834.
   a. Acceptable products:
   b. Pecora AC-20.
   c. PTI 738.
   d. Sonneborn Sonolac.
   e. Tremco Acrylic Latex 824.
   f. Substitutions: See Section 01 2500 - Substitution Procedures.

10. Type F1 - Butyl General Purpose Sealant: One-part, non-sag; FS TT- S-1657, Type 1, gun grade. Acceptable products:
    a. Pecora BC-158.
    b. PTI 707.
    c. Tremco Butyl.
    d. Substitutions: See Section 01 2500 - Substitution Procedures.
11. Type F2 - Butyl Acoustical Sealant: Butyl rubber, highly resilient, permanently flexible, shrink and stain resistant. Acceptable products:
    a. Pecora BA-98.
    b. PTI 808.
    c. Tremco Acoustical.
    d. Substitutions: See Section 01 2500 - Substitution Procedures.
12. Type G1 - Epoxy Concrete Joint Filler: Two-part epoxy. Acceptable products:
    a. Sonneborn Epolith G (non-sag).
    b. Sonneborn Epolith P (self-leveling).
    c. Tremco Vulkem 275.
    d. Substitutions: See Section 01 2500 - Substitution Procedures.

B. Backer Rod Material: Provide flexible and compressible closed cell non- gassing polyethylene foam, rounded at contact surfaces, compatible with sealant, and as recommended by sealant manufacturer.
    1. Backer rods shall be sized and shaped to control depth of sealant and to provide 20 percent to 50 percent compression upon insertion.

C. Accessory Materials:
    1. Joint Cleaner: Type recommended by manufacturer of sealant mate- rial.
    2. Non-staining Primer: Type recommended by manufacturer of sealant material.
    3. Bond Breaker: Pressure sensitive adhesive polyethylene tape.
    4. Masking Tape: Pressure sensitive adhesive paper tape.
    5. Gasketing Tape: Norex BCF butyl-coated foam extrusions with com- pressible PVC foam core, as manufactured by The Specialty Elastom- ers sector of Saint-Gobain Performance Plastics.
    6. Filler Gasket (at Glazing Adapters): Closed cell expanded neoprene, black premolded joint filler, equal to Everlastic Type NN1, 1040 Series, manufactured by Williams Products.

D. Colors: Custom Colors as Selected by the Architect to Match Adjacent Surfaces
    1. Window Frame Perimeter (Exterior): Provide custom colors as selected by Architect.
    2. Other: Match color of adjacent finished surface.

2.4 URETHANE JOINT SEALANTS

A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
    1. Products: Subject to compliance with requirements, provide one of the following:
        a. Sika Corporation, Construction Products Division; Sikaflex - 15LM.
        b. Tremco Incorporated; Vulkem 921.

c. Substitutions: See Section 01 2500 - Substitution Procedures.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Tremco Incorporated; Acoustical Sealant.
   2. USG; Sheetrock Brand Acoustical Sealant
   3. Owens Corning; QuietZone Acoustic Sealant
   4. Substitutions: See Section 01 2500 - Substitution Procedures.

2.6 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, of any of the following types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
   1. Type B (bicellular material with a surface skin).
   2. Type C (closed-cell material with a surface skin).
   3. Type O (open-cell material). Type O sealant backings shall not be used in horizontal surfaces.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.3 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker where joint backing is not used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

H. Tool joints concave.

3.4 CLEANING

A. Clean adjacent soiled surfaces.

3.5 PROTECTION

A. Protect sealants until cured.

END OF SECTION

SECTION 088853 - RESISTANT/FORCED ENTRY LAMINATED GLASS

SECTION 08 88 53 SECURITY GLAZING /

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Laminated security glazing, bullet-resistant glass, forced entry resistant glazing.

B. Related Sections
   1. Specifier's note: List all related sections
      a. Drawings, General and Supplementary Conditions of the Contract, Division 1 and the following Specification Sections, apply to this Section.

1.2 REFERENCES

A. Specifier's note: Delete all reference standards that are not actually required and add any additional standards necessary.
   a. ANSI Z97.1 - American National Standard for Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
   b. ASTM C1036 - Standard Specification for Flat Glass.
   c. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass -- Kind HS, Kind FT Coated and Uncoated Glass.
   d. ASTM C1349 - Standard Specification for Architectural Flat Glass Clad Polycarbonate.
   e. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
   f. ASTM F1233 - Standard Test Method for Security Glazing Materials and Systems.
   g. ASTM F1915 – Standard Test Method for Glazing for Detention Facilities
   h. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
   i. HP White TP-0500 - Transparent Materials for Use in Forced Entry or Containment Barriers. Earlier versions of this standard will not be accepted.
   j. Walker, McGough, Foltz and Lyerla - WMFL 8801 Attack Resistant Standard.
   k. Underwriter's Laboratories - UL 752 Bullet Resisting Equipment.
   l. National Institute of Justice - NIJ 0108.01 Ballistic Resistant Protective Materials.
   m. GANA Glazing Manual; Glass Association of North America.
   n. GANA Sealant Manual; Glass Association of North America.
   o. GANA Laminated Glass Design Guide; Glass Association of North America.
   p. Oldcastle BuildingEnvelope® - Glazing Instructions.

1.3 DEFINITIONS

A. Bullet-Resistant Glass: A multiple lamination of glass or glass and plastic that is designed to resist penetration from medium-to-super-power small arms and high-power rifles and to

minimize spalling.

B. Forced Entry Glass: A multiple lamination of glass or glass and plastic that is designed to resist penetration from physical attack.

1.4 SYSTEM DESCRIPTION

A. Design Requirements
   1. Provide glazing systems capable of withstanding normal thermal movements, windloads and impact loads, without failure, including loss due to defective manufacture, fabrication and installation; deterioration of glazing materials; and other defects in construction.
   2. Provide glass products in the thicknesses and strengths (annealed or heat-treated) required to meet or exceed the following criteria based on project loads and in-service conditions per ASTM E1300.
      a. Minimum thickness of annealed or heat-treated glass products is selected, so the worst-case probability of failure does not exceed the following:
         1) 8 breaks per 1000 for glass installed vertically or not over 15 degrees from the vertical plane and under wind action.
         2) 1 break per 1000 for glass installed 15 degrees or more from the vertical plane and under action of wind and/or snow.

1.5 SUBMITTALS

A. Submit 12-inch (305mm) square samples of each type of glass indicated (except clear monolithic glass products), and 12-inch (305mm) long samples of each color required (except black) for each type of sealant or gasket exposed to view.

B. Submit manufacturer’s product data for each security glazing type, including type of materials, thickness, method of test, test performance report and glazing and cleaning instructions.

C. Glazing contractor shall obtain compatibility and adhesion test reports from sealant manufacturer, indicating that glazing materials were tested for compatibility and adhesion with glazing sealant, as well as other glazing materials including insulating units.

D. Glazing Contractor shall provide test reports showing that the glass meets the requirements of any security test reports specified on drawings.

1.6 QUALITY ASSURANCE

A. Manufacturers Qualifications: Firm experienced in manufacturing security glass, types as specified, with minimum documented 5 years of successful in-service performance.

B. Installers Qualification: Engage a firm experienced in installing security glass, types as specified, with minimum documented 5 years of successful in-service performance.

C. Testing Agencies: Subject to compliance with requirements, acceptable testing agencies are:

1. HP White Laboratories, Inc.
2. Warnock-Hersey International
3. Wiss, Janney, Elstner Associates, Inc.
4. Underwriters Laboratories, Inc.
5. Intertek

D. Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this section or referenced standards.
   1. GANA Publications
   2. AAMA Publications

E. Single-source fabrication responsibility: All fabricated glass shall be processed and supplied by a single fabricator.

1.7 DELIVERY, STORAGE AND HANDLING

A. Comply with manufacturer's instruction for receiving, handling, storing and protecting glass & glazing materials.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

D. Exercise exceptional care to prevent edge damage to glass and damage/deterioration to coating on glass.

1.8 PROJECT / SITE CONDITIONS

A. Environmental Requirements: Installation of glass products at ambient air temperature below 40 degrees F (4.4 degrees C) is prohibited.

B. Field Measurements: When construction schedule permits, verify field measurements with drawing dimensions prior to fabrication of glass products.

1.9 WARRANTY

A. Provide written 5-year warranty from date of manufacture for laminated security glass. Warranty covers deterioration due to normal conditions of use and not to handling installing, protecting and maintaining practices contrary to glass manufacturer's published instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Approved Manufacturers: Subject to compliance with requirements, provide products from one of the following manufacturers:
    a. Oldcastle BuildingEnvelope.
    b. Or approved equal.

2.2 MATERIALS

A. Security Glass Types
    1. Provide glass types as indicated.

B. Laminated Assemblies: Laminated security glass assemblies are to be bonded with polyvinyl and/or aliphatic polyurethane interlayers, as required, and fabricated in an autoclave using heat, plus pressure producing products free of foreign substances and air pockets.

C. Forced Entry Security Glazing – Glass-Clad Polycarbonates.
    1. Type SG-FE5- Glass-clad polycarbonate, Clear: Inner and outer lites shall be 3mm heat strengthened glass with a multiply polycarbonate core. Overall nominal thickness shall be 3/4". Product shall comply with the following standards:
        a. HPW-TP-0500, Forced Entry Level 3 and Ballistics Level B, .9mm (ballistics stoppage spall penetration).
        b. WMFL 30-Minute Attack Resistance.
        c. Earlier versions of the HP White standard will not be accepted.
        d. Basis for design Oldcastle BuildingEnvelope ArmorProtect Plus #123000.
        e. PVB to provide UVA resistance.

D. Glazing Products
    1. Select appropriate glazing sealants, tapes, gaskets and other glazing materials of proven compatibility with other materials that they contact. These include, but are not limited to, glass products, insulating glass unit seals and glazing channel substrates under installation and service conditions, as demonstrated by testing and field experience.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification and Conditions
    1. Verify that site conditions are acceptable for installation of the glass.
    2. Verify openings for glazing are correctly sized and within tolerance.
    3. Verify that the minimum required face and edge clearances are being followed.
    4. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protection
    1. Handle and store product according to manufacturers' recommendations.

B. Surface Preparation
   1. Clean and prepare glazing channels and other framing members to receive glass.
   2. Remove coatings and other harmful materials that will prevent glass and glazing installation required to comply with performance criteria specified.

3.3 INSTALLATION

A. Install products using the recommendations of manufacturers of glass, sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those in the “GANA Glazing Manual”.

B. Install glass in prepared glazing channels and other framing members.

C. Install setting blocks in rabbets as recommended by referenced glazing standards in GANA Glazing Manual and IGMA Glazing Guidelines.

D. Provide bite on glass, minimum edge and face clearances and glazing material tolerances recommended by GANA Glazing Manual.

E. Provide weep system as recommended by GANA Glazing Manual.

F. Set glass lites in each series with uniform pattern, draw, bow and similar characteristics.

G. Distribute the weight of the glass unit along the edge rather than at the corner.

H. Comply with manufacturer’s and referenced industry recommendations on expansion joints and anchors, accommodating thermal movement, glass openings, use of setting blocks, edge, face and bite clearances, use of glass spacers, edge blocks and installation of weep systems.

I. Protect glass from edge damage during handling and installation.

J. Prevent glass from contact with contaminating substances that result from construction operations, such as weld spatter, fireproofing or plaster.

3.4 CLEANING

A. Clean excess sealant or compound from glass and framing members immediately after application, using solvents or cleaners recommended by manufacturers.

B. Glass to be cleaned according to:
   1. GANA Glass Informational Bulletin GANA 01-0300 - Proper Procedures for Cleaning Architectural Glass Products.
   2. GANA Glass Information Bulletin GANA TD-02-0402 – Heat-Treated Glass Surfaces Are Different.

C. Do not use scrapers or other metal tools to clean glass.

END OF SECTION

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. High performance coatings.

B. Surface preparation.

1.2 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

C. SCAQMD 1113 - Architectural Coatings 1977, with Amendment (2016).

D. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

E. SSPC-SP 6 - Commercial Blast Cleaning 2007.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide high performance coating products from the same manufacturer.
   1. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.

B. High-Performance Coatings:
   1. PPG Paints; _____: www.ppgpaints.com/#sle.
   2. Tnemec Company, Inc; _____: www.tnemec.com/#sle. Basis of Design.
   3. Carboline, Co.; www.carboline.com/.
   4. Substitutions: Section 016000 - Product Requirements.

2.2 TOP COAT MATERIALS

A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
   1. Volatile Organic Compound (VOC) Content:
      a. Provide coatings that comply with the most stringent requirements specified in the following:

1) 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
2) SCAQMD 1113 Rule.

b. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

2. Colors: As indicated.

B. Spot Primer for Unprimed and Zinc-Rich-Primed Surfaces:
1. Product: "Hydro-Zinc Series 94-H20" primer manufactured by the Tnemec Co., or equal.
2. Number of Coats: One.
3. Product Characteristics:
a. Dry Film Thickness, per coat, 2.5 - 3.5 mil.
b. Colors: Greenish-gray or other standard color furnished by the primer manufactuer.

C. Spot Primer for other Shop-Primed Surfaces: Spot primer compatible with the original shop primer used per Section 051200.

D. Epoxy Intermediate Coat:
1. Product: "Hi-Build Epoxoline II Series L69" two-component plyamidoamine epoxy manufactured by the Tnemec Co., or equal.
2. Number of Coats: One.
3. Product Characteristics:
a. Dry film thickness, per coat, 6.0 - 10.0 mil.
b. Sheen: Satin.

E. Hybrid Polyurethane Top Coat:
1. Product: "UVX Series 750" two-component polyurethane manufactured by the Tnemec Co., or equal.
2. Number of Coats: Two.
3. Product Characteristics:
a. Dry film thickness, per coat, 2.5 - 5.0 mil.
b. Sheen: Semi-gloss.

F. Primers: As recommended by coating manufacturer for specific substrate, unless otherwise specified.

2.3 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by coating manufacturer.

B. Urethane, Zinc-Rich Shop Primer:
1. Product: "Tneme-Zinc, Series 90-97" two-component primer manufactured by the Tnemec Co., or equal.
2. Number of Coats: One.

3. Product Characteristics:
   a. Dry Film Thickness, per coat, 2.5 - 3.5 mil.
   b. Colors: Reddish-gray or other standard color furnished by the primer manufactuer.

2.4 SURFACE PREPARATION

A. Unprimed steel surfaces:
   1. SSPC-SP6/NACE 3 Commercial Blast Cleaning or ISO Sa 2 Thorough Blast Cleaning with a minimum angular anchor profile of 1.5 mils.
   2. If conditions will not permit SSPC-SP6/NACE 3, in moderate exposures Series L69 may be applied to SSPC-SP2 or SP3 Hand or Power Tool Cleaned surfaces (SSPC Rust Grade Condition C).

2.5 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not begin application of coatings until substrates have been properly prepared.

C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

3.2 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.

C. Remove finish hardware, fixture covers, and accessories and store.

D. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning", and protect from corrosion until coated.

E. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.3 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

3.4 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in MPI - Architectural Painting and Specification Manual.

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.5 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for general requirements for field inspection.

B. Dry Film Thickness Testing: Owner will engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
1. Touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, and specified thickness, Contractor shall pay for retesting and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations, and specified thickness.

3.6 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.7 PROTECTION

A. Protect finished work from damage.

END OF SECTION

SECTION 107500 - FLAGPOLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes ground-set flagpoles made from aluminum .

1.2 RELATED REQUIREMENTS

A. Division 03 Section Cast-in-Place Concrete

B. Division 07 Section Joint Sealants

1.3 SUBMITTALS

A. Product Data: For each type of flagpole required.

B. Shop Drawings: Include elevations and details showing general arrangement, jointing, fittings and accessories, grounding, and anchoring and supporting systems.
   1. Include details of foundation system for ground-set flagpoles.

C. Structural Calculations: For flagpoles indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Finish Samples for Verification: For each finished material used for flagpoles and accessories.

E. Qualification Data: For professional engineer.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flagpole as a complete unit, including fittings, accessories, bases, and anchorage devices, from a single manufacturer.
   1. Obtain through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Flagpole; a Kearney-National Inc. Company (Basis of Design); Model as indicated on drawings.

2.2 FLAGPOLES

A. Flagpole Construction, General: Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
   1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
   2. For tapered flagpoles, provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
   3. Capacity: 1 each 60-inch by 96-inch flags, unless otherwise noted.

B. Exposed Height: 35 feet.

C. Aluminum Flagpoles: Provide cone -tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/ (B 241M), Alloy 6063, with a minimum wall thickness of 3/16 inch (4.8 mm). Heat treat after fabrication to comply with ASTM B 597, Temper T6.

D. Foundation Tube: Galvanized corrugated-steel foundation tube, 0.064-inch- (1.6-mm-) minimum nominal wall thickness. Provide with 3/16-inch (4.8-mm) steel bottom plate and support plate; 3/4-inch- (19-mm-) diameter, steel ground spike; and steel centering wedges all welded together. Galvanize steel parts, including foundation tube, after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole.
   1. Provide flashing collar of same material and finish as flagpole.

E. Sleeve for Aluminum Flagpole: foundation sleeve, made to fit flagpole, for casting into concrete foundation.
   1. Provide flashing collar of same material and finish as flagpole.

2.3 FITTINGS

A. Finial Ball: Manufacturer's standard flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
   1. 0.063-inch (1.6-mm) spun aluminum, finished to match flagpole .

B. Internal Halyard, Cam Cleat System: 5/16-inch- (8-mm-) diameter, braided polypropylene halyard; cam cleat; and concealed revolving truck assembly with plastic-coated counterweight and sling. Provide flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

C. Halyard Flag Snaps: Provide two stainless-steel swivel snap hooks per halyard.
   1. Provide with neoprene or vinyl covers.

D. Plastic Halyard Flag Clips: Made from injection-molded, UV-stabilized, acetal resin (Delrin). Clips attach to flag and have two eyes for inserting both runs of halyards. Provide two flag clips per halyard.

1. Product: Subject to compliance with requirements, provide "Quiet Halyard Flagclasp" by Lingo Inc.; Acme Flagpole Division.

2.4 MISCELLANEOUS MATERIALS

A. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi. (20 MPa, unless otherwise indicated.)

B. Sand: ASTM C 33, fine aggregate.

C. Elastomeric Joint Sealant: Single-component neutral-curing silicone joint sealant complying with requirements in Division 07 Section "Joint Sealants" for Use NT (nontraffic) and for Use M, G, A, and, as applicable to joint substrates indicated, O joint substrates.

2.5 FINISHES

A. Metal Finishes, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Aluminum: Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
1. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms and foundation tube, sleeve, or anchor bolts in position, to prevent displacement during concreting.

D. Place concrete immediately after mixing. Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use nonstaining curing compound.

E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.2 FLAGPOLE INSTALLATION

A. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.

B. Foundation-Tube Installation: Install flagpole in foundation tube, seated on bottom plate between steel centering wedges. Plumb flagpole and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch (50-mm) layer of elastomeric joint sealant and cover with flashing collar.
   1. Top of footing shall be below grade, not visible.

C. Baseplate Installation: Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

3.3 CLEANING

A. Clean jobsite of excess materials. Remove excess materials if required.

B. Clean flagpole surface of any dirt, grime, excess grout, etc if required.

END OF SECTION

SECTION 220130 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Piping tube and fitting materials.
2. Pipe joining materials.
3. Transition fittings.
4. Dielectric fittings.
5. Mechanical sleeve seals.
6. Sleeves.
7. Escutcheons.
8. Grout.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Concrete bases.
12. Supports and anchorages.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

C. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

D. The following are industry abbreviations for plastic materials:
1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

E. The following are industry abbreviations for rubber materials:
1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes 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 pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS MATERIALS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 PIPE JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:
   1. ABS Piping: ASTM D 2235.
   2. CPVC Piping: ASTM F 493.
   3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
   4. PVC to ABS Piping Transition: ASTM D 3138.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.3 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
   1. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
   2. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.

3. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Refer to individual Division 23 piping Sections for dielectric fittings not listed below.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.5 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: Stainless steel. Include two for each sealing element.
   3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms for concrete foundation walls below grade.

F. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.7 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw. Polished chrome-plated and rough brass.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw. Polished chrome-plated and rough brass.

E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.8 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psi 28-day compressive strength, unless otherwise indicated in the structural drawings.
   3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
   1. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
   2. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
   3. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
   4. Install piping to permit valve servicing.
   5. Install piping at indicated slopes.
   6. Install piping free of sags and bends.
   7. Install fittings for changes in direction and branch connections.
   8. Install piping to allow application of insulation.

C. Select system components with pressure rating equal to or greater than system operating pressure.

3.2 ESCUTCHEONS

A. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
   1. New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
      c. Insulated Piping: One-piece, stamped-steel type with spring clips.
      d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
      g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
      h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

3.3 PENETRATIONS AND SLEEVES

A. Sleeves are not required for core-drilled holes.

B. Permanent sleeves are not required for holes formed by removable PE sleeves.

C. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
   b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
   c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
   d. Seal space outside of sleeve fittings with grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

D. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Install steel pipe for sleeves smaller than 6 inches in diameter.
   2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
   3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

E. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

F. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.

G. Verify final equipment locations for roughing-in.

H. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.4 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
   3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
   4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
   5. PVC Nonpressure Piping: Join according to ASTM D 2855.
   6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
   1. Plain-End Pipe and Fittings: Use butt fusion.
   2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.5 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
   3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
   4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.6 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Grease fittings shall be installed in accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.7 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic requirements as indicated in the California Building Code.
   1. Construct concrete bases of dimensions indicated, but not less than 6 inches larger in both directions than supported unit, vibration isolator, or seismic restraint. Verify requirements with equipment anchor bolt edge distances.
   2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
   3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section; unless otherwise indicated in structural drawings.

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.9 GROUTING

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Grout Installation:
1. Clean surfaces that will come into contact with grout.
2. Provide forms as required for placement of grout.
3. Avoid air entrapment during placement of grout.
4. Place grout, completely filling equipment bases.
5. Place grout on concrete bases and provide smooth bearing surface for equipment.
6. Place grout around anchors.
7. Cure placed grout.

END OF SECTION 230130

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe sleeves.

B. Manufactured sleeve-seal systems.

1.2 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 099113 - Exterior Painting: Preparation and painting of exterior piping systems.

1.3 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2022a.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2023a.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified this section.
   1. Minimum three years experience.

C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.7 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 PIPE SLEEVES

A. Manufacturers:
   1. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/#sle.

B. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
   4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

C. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc coated or cast iron pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.2 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Manufacturers:
   1. Advance Products & Systems, LLC; Innerlynx: www.apsonline.com/#sle.
   2. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.

B. Modular/Mechanical Seal:
   1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
   2. Provide watertight seal between pipe and wall/casing opening.
   3. Elastomer element size and material in accordance with manufacturer's recommendations.
   4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.2 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

E. Structural Considerations:
   1. Do not penetrate building structural members unless indicated.

F. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
   2. Aboveground Piping:
      a. Pack solid using mineral fiber complying with ASTM C592.
      b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
   3. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.
   4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

G. Manufactured Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.

3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

H. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.3 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

SECTION 220519 - METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 **RELATED DOCUMENTS**

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to this section.

1.2 **SUMMARY**

A. Section Includes:
   1. Dial-Type pressure gages.
   2. Test plugs.
   3. Test-plug kits.

B. Static pressure gauges.

1.3 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments 2022.

B. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi 2004 (Reaffirmed 2017).

C. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers 2014 (Reapproved 2020).

D. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers 2014 (Reapproved 2021).

E. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

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

C. Product Certificates: For each type of meter and gage, from each manufacturer.

D. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 PRODUCTS

2.1 **PRESSURE GAGES**

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Miljoco Corporation.
      b. Watts Reulator Co.; a div. of Watts Water Technologies, Inc.
   2. Standard: ASME B40.100.
   3. Case: Sealed type(s); cast aluminum or drawn steel; 4-1/2 inch (114-mm) nominal diameter.
   4. Pressure--Element Assembly: Bourdon tube unless otherwise indicated.
   5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
   6. Movement: Mechanical, with link to pressure element and connection to pointer.
   7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa)
   8. Pointer: Dark-colored metal.
   9. Window: Glass.
   10. Ring: Brass.
   11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Ametek Inc, US Gauge.
      b. Ashcroft Inc.
      c. Flo-Flab Inc.
      d. Marsh Bellofram.
      e. Miljoco Corporation.
      f. Noshok.
      g. Palmer Wahl Instrumentation Group.
      h. Reotemp Instrument Corporation.
      i. Tel-Tru Manufacturing Company.
      j. Trerice, H.O. Company.
      k. Weiss Instruments, Inc.
      l. Wika Instrument Corporation - USA.
      m. Winters Instruments - US
   2. Standard: ASME B40.100.
   3. Case: Sealed type; plastic; 4-1/2 inch (114-mm) nominal diameter.
   4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
   5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
   6. Movement: Mechanical, with link to pressure element and connection to pointer.

7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa).
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.2 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads.

2.3 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work included, but are not limited to, the following:
1. Miljoco Corporation.
2. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
3. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4 or NPS 1/2 (DN 8 of DN 15), ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.4 TEST-PLUG KITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work included, but are not limited to, the following:
1. Miljoco Corporation.
2. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
3. Weiss Instruments, Inc.

B. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. Low-Range Thermometer: Small, bimetallic insertion type with 1 to 2 inch (25 to 51 mm) diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F (minus 4 to plus 52 deg C).

D. High-Range Thermometer: Small, bimetallic insertion type with 1 to 2 inch (25 to 51 mm) diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F (minus 18 to plus 104 deg C).

E. Pressure Gage: Small, Bourdon-tube insertion type with 2 to 3 inch (51 to 76 mm) diameter dial and probe. Dial range shall be at least 0 to 200 psig (0 to 1380 kPa).

F. Carrying Case: Metal or plastic, with formed instrument padding.

2.5 PRESSURE GAUGES

A. Manufacturers:
1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
2. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
3. Omega Engineering, Inc: www.omega.com/#sle.

B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
1. Case: Steel with brass bourdon tube.
2. Size: 4-1/2 inch diameter.
3. Mid-Scale Accuracy: One percent.
4. Scale: Psi and kPa.

2.6 PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

D. Syphon: Steel, Schedule 40, 1/4 inch angle or straight pattern.

2.7 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

B. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with Nordel core for temperatures up to 350 degrees F.

C. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with Viton core for temperatures up to 400 degrees F.

D. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gauges, one gauge adapters with 1/8 inch probes, two 1 inch dial thermometers.

2.8 STATIC PRESSURE GAUGES

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
   2. Omega Engineering, Inc: www.omega.com/#sle.
   3. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.

B. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

C. Inclined manometer, red liquid on white background with black figures, front recalibration adjustment, 3 percent of full scale accuracy.

D. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending a minimum of 2 inches (51mm) into fluid and in vertical position in piping tees.

B. install themowells of sizes required to match themometer connections. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

F. Install test plugs in piping tees.

G. Install themometers in the following locations:
   1. Inlet and outlet of each water heater.
   2. Inlet and outlet of each domestic water heat exchanger.
   3. inlet and outlet of each domestic hot-water storage tank.
   4. Inlet and outlet of each remote domestic water chiller.

H. Intall pressure gages in the following locations:
   1. Building water service entrance into the building.
   2. Inlet and outlet of each pressure-reducing valve.
   3. Suction and discharge of each domestic water pump.

3.2 **CONNECTIONS**

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold Water Piping: 0 - 100 deg F (Minus 20 to plus 50 deg C).

B. Scale Range for Domestic Hot Water Piping: 0 - 250 deg F (0 to 150 deg C).

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Water Piping: 0 - 160 psi (0 to 1100 kPa).

B. Install in accordance with manufacturer's instructions.

C. Install positive displacement meters with isolating valves on inlet and outlet to AWWA M6. Provide full line size valved bypass with globe valve for liquid service meters.

D. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.

END OF SECTION

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Applications.

B. General requirements.

C. Ball valves.

D. Butterfly valves.

E. Gate valves.

F. Plug valves.

1.2 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping.

1.3 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.

I. TFE: Tetrafluoroethylene.

1.4 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 A536 - Standard Specification for Ductile Iron Castings 1984, with Editorial Revision (2019).

L. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings 2015 (Reapproved 2021).

M. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.

N. AWWA C606 - Grooved and Shouldered Joints 2022.

O. MSS SP-45 - Drain and Bypass Connections 2020.

P. MSS SP-67 - Butterfly Valves 2022.

Q. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends 2011.

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. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.

X. NSF 372 - Drinking Water System Components - Lead Content 2022.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, 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. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

E. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.6 QUALITY ASSURANCE

A. Manufacturer:
   1. Obtain valves for each valve type from single manufacturer.
   2. 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.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
   2. Protect valve parts exposed to piped medium against rust and corrosion.
   3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
   4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
   5. Secure check valves in either the closed position or open position.
   6. Adjust butterfly valves to closed or partially closed position.

B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.
   2. Store valves in shipping containers and maintain in place until installation.
      a. Store valves indoors in dry environment.
      b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

1.8 EXERCISE THE FOLLOWING PRECAUTIONS FOR HANDLING:

A. Handle large valves with sling, modified to avoid damage to exposed parts.

B. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Unless otherwise indicated, general duty valaves shall be provided from one of the following manufacturers:
   1. Apollo Valves: www.apollovalves.com
   2. NIBCO: www.nibco.com
   3. Viega LLC: www.viega.com
   4. Substitutions: See Section 016000 - Product Requirements.

2.2 APPLICATIONS

A. See drawings for specific valve locations.

B. Provide the following valves for the applications if not indicated on drawings:
   1. Shutoff: Ball, butterfly, gate or plug.
   2. Dead-End: Single-flange butterfly (lug) type.
   3. Throttling: Provide globe, angle, ball, or butterfly.

C. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

D. Required Valve End Connections for Non-Wafer Types:
   1. Steel Pipe:
      a. 2 NPS and Smaller: Threaded ends.
      b. 2-1/2 NPS to 4 NPS: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
      c. Grooved-End Copper Tubing and Steel Piping: Grooved.
   2. Copper Tube:
      a. 2 NPS and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
      b. 2-1/2 NPS to 4 NPS: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.

E. Low Pressure, Compressed Air Valves 150 psig or Less:
   1. 2 NPS and Smaller:
      a. Bronze: Provide with solder-joint ends.
      b. Ball: One piece, full port, brass or bronze with brass trim.
      c. Bronze Lift Check: Class 125, bronze disc.

d. Bronze Swing Check: Class 125, bronze disc.
e. Bronze Gate: Class 125, NRS.

2. 2-1/2 NPS and Larger:
a. Iron, 2-1/2 NPS to 4 NPS: Provide with threaded ends.
b. Iron Single-Flange Butterfly: 200 CWP, NBR Seat, aluminum-bronze disc.
c. Iron Grooved-End Butterfly: 175 CWP.
d. Iron Swing Check: Class 125, metal seats.
e. Iron Grooved-End Swing Check: 300 CWP.
f. Iron Center-Guided Check: Class 125, compact-wafer, metal seat.
g. Iron Plate-Type Check: Class 125; single plate; metal seat.
h. Iron Gate: Class 125, NRS.

2.3 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 NPS and larger.
2. Handwheel: Valves other than quarter-turn types.
3. Hand Lever: Quarter-turn valves 6 NPS and smaller except plug valves.
4. Wrench: Plug valves with square heads.
5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator, of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

D. Valves in Insulated Piping: With 2 NPS 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.
2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
3. Pipe Flanges and Flanged Fittings 1/2 NPS through 24 NPS: 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. Valve Materials for Potable Water: NSF 61 and NSF 372.

H. Bronze Valves:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

I. Valve Bypass and Drain Connections: MSS SP-45.

J. Source Limitations: Obtain each valve type from a single manufacturer.

2.4 BRASS BALL VALVES

A. One-Piece, Reduced-Port with Brass Trim:
1. Comply with MSS SP-110.
2. CWP Rating: 400 psig.
3. CWP Rating: 600 psig.
4. Body: Forged brass.
5. Ends: Threaded.
6. Seats: PTFE.
7. Stem: Brass.
8. Ball: Chrome-plated brass.

B. Two Piece, Full Port and Regular Port with Brass Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Forged brass.
5. Ends: Threaded.
6. Seats: PTFE.
7. Stem: Brass.
8. Ball: Chrome-plated brass.
9. Manufacturers:
a. Apollo Valves; _____: www.apollovalves.com/#sle.
b. Substitutions: See Section 016000 - Product Requirements.

C. Three Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Forged brass.
5. Ends: Threaded.
6. Seats: PTFE.
7. Stem: Stainless steel.
8. Ball: Stainless steel, vented.

2.5 BRONZE BALL VALVES

A. One Piece, Reduced Port with Bronze Trim:
   1. Comply with MSS SP-110.
   2. SWP Rating: 400 psig.
   3. CWP Rating: 600 psig.
   4. Body: Bronze.
   5. Ends: Threaded.
   6. Seats: PTFE or ____.
   7. Stem: Bronze.
   8. Ball: Chrome plated brass.

B. Two Piece, Full Port with Bronze Trim:
   1. Comply with MSS SP-110.
   2. SWP Rating: 150 psig.
   3. CWP Rating: 600 psig.
   4. Body: Bronze.
   5. Ends: Threaded.
   6. Seats: PTFE.
   7. Stem: Bronze.
   8. Ball: Chrome plated brass.
   9. Manufacturers:
      a. Apollo Valves: www.apollovalves.com/#sle.
      b. Viega LLC: www.viega.com/#sle.

C. Three Piece, Full Port with Stainless Steel Trim:
   1. Comply with MSS SP-110.
   2. SWP Rating: 150 psig.
   3. CWP Rating: 600 psig.
   4. Body: Bronze.
   5. Ends: Threaded.
   6. Seats: PTFE
   7. Stem: Stainless steel.
   8. Ball: Stainless steel, vented.
   9. Manufacturers:
      a. Apollo Valves; _____: www.apollovalves.com/#sle.
      b. Viega LLC; _____: www.viega.com/#sle.
      c. _____.

2.6 STAINLESS STEEL BALL VALVES

A. One-Piece, Standard Port with Stainless-Steel Trim:
   1. Comply with MSS SP-110.
   2. SWP Rating: 150 psig.
   3. CWP Rating: 800 psig.
   4. Body: Stainless steel.
   5. Ends: Threaded.

6. Seats: PTFE.
7. Stem: Stainless steel.
8. Ball: Stainless steel.
9. Manufacturers:
    a. Viega LLC: www.viega.com/#sle.

B. Two Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 1000 psig.
4. Body: Stainless steel.
5. Seats: PFTE.
6. Stem: Stainless steel.
7. Ball: Stainless steel.
8. Manufacturers:
    a. Apollo Valves: www.apollovalves.com/#sle.
    b. Viega LLC: www.viega.com/#sle.

C. Three Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 1000 psig.
4. Body: Stainless steel.
5. Seats: PFTE.
6. Stem: Stainless steel.
7. Ball: Stainless steel.
8. Bolts: Stainless steel.
9. Manufacturers:
    a. Apollo Valves: www.apollovalves.com/#sle.
    b. Viega LLC: www.viega.com/#sle.

2.7 IRON BALL VALVES

A. Class 125, Full Port, Stainless Steel Trim:
1. Comply with MSS SP-72.
2. CWP Rating: 200 psig.
3. Body: ASTM A536 Grade 65-45-12, ductile iron.
4. Ends: Flanged.
5. Seats: PTFE.
6. Stem: Stainless steel.
7. Ball: Stainless steel.
8. Operator: Lever, with locking handle.
9. Manufacturers:
    a. Apollo Valves: www.apollovalves.com/#sle.
    b. Ferguson Enterprises Inc: www.fnw.com/#sle.

2.8 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Lug type: Bi-directional dead-end service without use of downstream flange.
   1. Comply with MSS SP-67, Type I.
   2. CWP Rating: 200 psig.
   3. Body: ASTM A126, cast iron or ASTM A536, ductile iron.
   4. Stem: One or two-piece stainless steel.
   5. Seat: EPDM.
   6. Disc: Coated ductile iron.
   7. Manufacturers:
      a. Apollo Valves; _____: www.apollovalves.com/#sle.

2.9 IRON, GROOVED-END BUTTERFLY VALVES

A. CWP Rating: 175 psig (1200 kPa).
   1. Comply with MSS SP-67, Type I.
   2. Body: Coated ductile iron.
   3. Stem: Two-piece stainless steel.
   4. Disc: Coated ductile iron.
   5. Disc Seal: EPDM.

2.10 BRONZE GATE VALVES

A. Non-Rising Stem (NRS) or Rising Stem (RS):
   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.
   9. Manufacturers:
      a. Apollo Valves: www.apollovalves.com/#sle.
      b. Ferguson Enterprises Inc: www.fnw.com/#sle.

2.11 IRON GATE VALVES

A. NRS or OS & Y:
   1. Comply with MSS SP-70, Type I.
   2. Class 125: CWP Rating: 200 psig:.
   3. Body: ASTM A126, gray iron with bolted bonnet.
   4. Ends: Flanged.
   5. Trim: Bronze.
   6. Disc: Solid wedge.

7. Packing and Gasket: Asbestos free.
8. Manufacturers:
    a. Apollo Valves: www.apollovalves.com/#sle.
    b. Ferguson Enterprises Inc: www.fnw.com/#sle.

2.12 BRONZE GLOBE VALVES

A. Class 125: CWP Rating: 200 psig:.
    1. Comply with MSS SP-80, Type 1.
    2. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
    3. Ends: Threaded joint.
    4. Stem: Bronze.
    5. Disc: Bronze, PTFE, or TFE.
    6. Packing: Asbestos free.
    7. Handwheel: Malleable Iron.
    8. Manufacturers:
        a. Apollo Valves: www.apollovalves.com/#sle.

2.13 IRON GLOBE VALVES

A. Class 125: CWP Rating: 200 psig:.
    1. Comply with MSS SP-85, Type I.
    2. Body: Gray iron; ASTM A126, with bolted bonnet.
    3. Ends: Flanged.
    4. Trim: Bronze.
    5. Packing and Gasket: Asbestos free.
    6. Operator: Handwheel or chainwheel.
    7. Manufacturers:
        a. Apollo Valves: www.apollovalves.com/#sle.
        b. Ferguson Enterprises Inc: www.fnw.com/#sle.

2.14 STAINLESS STEEL GLOBE VALVES

A. Class 150: CWP Rating: 300 psig:.
    1. Comply with ASME B16.34 for pressure-temperature range.
    2. Body: 316L stainless steel, with bolted bonnet.
    3. Ends: Flanged.
    4. Trim: Stainless steel.
    5. Packing and Gasket: Asbestos free.
    6. Operator: Handwheel.
    7. Manufacturers:
        a. Ferguson Enterprises Inc: www.fnw.com/#sle.

2.15 LUBRICATED PLUG VALVES

A. Regular Gland and Cylindrical with Flanged Ends:

1. Comply with MSS SP-78, Type II.
2. Class 125: CWP Rating: 200 psig.
3. Class 250: CWP Rating: 400 psig.
4. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
5. Pattern: Regular or short.
6. Plug: Cast iron or bronze with sealant groove.

PART 3 EXECUTION

3.1 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.

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.

3.2 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. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

D. 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.
   3. Orient plate-type and center-guided into horizontal or vertical position, between flanges.

E. Provide chainwheels on operators for valves 4 NPS and larger where located 96 NPS or more above finished floor, terminating 60 NPS above finished floor.

END OF SECTION

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SECTION 221005 - PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Flanges, unions, and couplings.
   2. Manufactured sleeve-seal systems.
   3. Valves.

1.2 RELATED REQUIREMENTS

A. Section 312316 - Excavation.

B. Section 312316.13 - Trenching.

C. Section 312323 - Fill.

1.3 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems 2015 (Reaffirmed 2020).

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.

E. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes 2018.

F. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings—DWV 2022.

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. ASSE 1003 - Water Pressure Reducing Valves for Potable Water Distribution Systems 2023.

J. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.

K. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings 2021.

L. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2023a.

M. ASTM B32 - Standard Specification for Solder Metal 2020.

N. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes 2020.

O. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV) 2020.

P. ASTM D2321- Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

Q. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings 2020.

R. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2020.

S. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings 2020.

T. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing 2020.

U. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets 2020.

V. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2023.

W. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe 2014 (Reapproved 2021).

X. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2018.

Y. AWWA C550 - Protective Interior Coatings for Valves and Hydrants 2017.

Z. AWWA C651 - Disinfecting Water Mains 2014, with Addendum (2020).

AA. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2021.

BB. 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.

CC. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements 2018, with Editorial Revision (2020).

DD. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry 2018, with Editorial Revision (2020).

EE. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements 2017, with Editorial Revision (2020).

FF. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Product Origin: Each pipe and fitting shall be marked with the following: Manufacturer’s name or registered trademark, Country of Origin, date of manufacture (pipe materials only).

D. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

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.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

F. Made in USA: All piping products shall be manufactured and fabricated in the United States and produced from materials that is made and melted in the United States.

1.6 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.

1.7 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

2.2 NATURAL GAS PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Polyethylene Pipe: ASTM D2513, SDR 11.
   1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
   2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11 adn steel pipe complying with:
      a. ASTM A106 or A53, hot-dipped galvanized steel, Schedule 40, Type E, Grade B for sizes 1/2" - 1-1/2".
      b. ASTM A53, black steel, Schedule 40, Type E, Grade B for sizes 2" - 8".
   3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
      a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inet.
      b. Casing: Steel pipe with corrosion-protective coating covering and complying with:
         1) ASTM A106 or A53, hot-dipped galvanized steel, Schedule 40, Type E, Grade B for sizes 1/2" - 1-1/2".
         2) ASTM A53, black steel, Schedule 40, Type E, Grade B for sizes 2" - 8".
      c. Aboveground Portion: PE Transition fitting.
      d. Outlet shall be threaded or flanged or suitable for welded connection.
      e. Tracer wire connection.
      f. Ultraviolet sheild.
      g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
   4. Transition Service-Line Risers: Factory fabricated and leak tested.
      a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe with corrosion-protective coating covering for aboveground and complying with:
         1) ASTM A106 of A53, hot-dipped galvanized steel, Schedule 40, Type E, Grade B for sizes 1/2" - 1-1/2".
         2) ASTM A53, black steel, Schedule 40, Type E, Grade B for sizes 2" - 8".
      b. Outlet shall threaded or flanged or suitable for welded connection.
      c. Bridging sleeve over mechanical coupling.
      d. Factory-connected anode.
      e. Tracer wire connection.

f. Ultraviolet sheild.
g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

5. Plastic Mechanical Couplings, NPS 1-1/2" and Smaller: Capable of joining PE pipe to PE pipe.
   a. PE body with molded-in, stainless-steel support ring.
   b. Buna-nitrile seals.
   c. Acetal collets.
   d. Electro-zinc-plated steel stiffener.
6. Plastic Mechanical Couplings, NPS 2 and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
   a. Fiber-reinforced plastic body.
   b. PE body tube.
   c. Buna-nitrile seals.
   d. Acetal collets.
   e. Stainless-steel bolts, nuts, and washers.
7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
   a. Stainless-steel flanges and tube with epoxy finish.
   b. Buna-nitrile seals.
   c. Stainless-steel bolts, washers, and nuts.
   d. Factory-installed anode for steel-body couplings installed underground.

2.3 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53 type E grade B Schedule 40 black steel for sizes 2" - 8", ASTM A106 or ASTM A53 galvanized steel grade B for sizes 1/2" - 1-1/2".
   1. Wrought-Steel Welding Fittings: ASTM A234/A234M, for butt welding and socket welding.
   2. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
   3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint and threaded ends.
   4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
      a. Material Group: 1.1
      b. End Connections: Threaded or butt welding to match pipe.
      c. Lapped Face: Not permitted underground.
      d. Gaskets Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wounded metal gaskets.
      e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
   5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy adhesive, and PE
      a. Joint Cover Kits: Epoxy paint adhesive, and heat-shrink PE sleeves.
   6. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.4 NATURAL GAS PIPING, ABOVE GRADE

A. Pipe And Fittings - Interior:
   1. ASTM A53, Type F, Grade A, Black Steel, Schedule 40
      a. Thread pipe with tapered pipe threads complying with ASME B1.20.1
   2. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
   3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
   4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
      a. Material Group: 1.1.
      b. End Connections: Threaded or butt welding to match pipe.
      c. Lapped Face: Not permitted underground.
      d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
      e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground adn stainless steel underground.

B. Pipe And Fittings - Exterior:
   1. ASTM A53, Type F, Grade A, Hot-Dip Galvanized , Schedule 40
      a. Thread pipe with tapered pipe threads complying with ASME B1.20.1
      b. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
         1) Alkyd System: MPI EXT 5.1D.
            (a) Prime Coat: Alkyd anticorrosive metal primer.
            (b) Intermediate Coat: Exterior alkyd enamel matching topcoat.
            (c) Topcoat: Exterior alkyd enamel (semigloss).
            (d) Color: Gray.
   2. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
   3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
   4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
      a. Material Group: 1.1.
      b. End Connections: Threaded or butt welding to match pipe.
      c. Lapped Face: Not permitted underground.
      d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
      e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

2.5 **ENCASEMENT FOR UNDERGROUND PIPING**

A. High density cross laminated polyethylene film intended for encasement of underground piping for protection against corrosion.
   1. ASTM 1674 or AWWA C105
   2. Minimum thickness: 0.004-inch
   3. Form: Tube
   4. Color: Natural

2.6 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: ASME B16.39, Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 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.

2.7 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Manufacturers:
   1. The Metraflex Company; MetraSeal: www.metraflex.com/#sle.

B. Modular/Mechanical Seal:
   1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
   2. Provide watertight seal between pipe and wall/casing opening.
   3. Elastomer element size and material in accordance with manufacturer's recommendations.
   4. Glass reinforced plastic pressure end plates.

2.8 **BRONZE GATE VALVES**

A. Manufacturers:
   1. Type 1, Bronze, Nonrising-Stem Gate Valves:
      a. Watts
      b. Milwaukee Valve Company.
      c. Nibco, Inc.
   2. Type 2, Bronze, Rising-Stem, Solid-Wedge Gate Valves:
      a. Grinnell Corporation.
      b. Hammond Valve.
      c. Milwaukee Valve Company.
      d. Nibco, Inc.

B. Bronze Gate Valve, General: MSS SP-80, with ferrous-alloy handwheel.

C. Type 2, Class 200, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge and union-ring bonnet.

2.9 BALL VALVES

A. General Duty: Copper-Alloy Ball Valves:
   1. Manufacturers: Two-Piece, Copper-Alloy Ball Valves:
      a. Apollo Valves
      b. Viega LLC
      c. Watts
      d. Nibco Inc.
   2. Copper-Alloy Ball Valves, General: MSS SP-110
   3. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball, PTFE or TFE seats, and 600 psig (4140 kPa) minimum CWP rating and blowout-proof stem.
   4. Threaded end connection for NPS 2 inch and smaller.
   5. Flanged end connection for NPS 2-1/2 inch and larger.

B. General Duty: Ferrous-Alloy Ball Valves:
   1. Manufacturers:
      a. Apollo Valves
      b. Viega LLC
      c. Watts
   2. Ferrous-Alloy Ball Valves, General: MSS SP-72, with flange ends.
   3. Ferrous-Alloy Ball Valves: Class 300, full or regular port.
   4. Threaded end connection for NPS 2 inch and smaller.
   5. Flanged end connection for NPS 2-1/2 inch and larger.

C. Gas Service: Bronze Ball Valves, NPS 2 inch and smaller:
   1. Manufacturers:
      a. BrassCraft Manufacturing Company, a Masco Company.
      b. Conbraco Industries, Inc. Apollo Div.
      c. Lyall R.W. & Company, Inc.
      d. McDonald, A.Y. Mfg. Company.
      e. Perfection Corporation, a subsidiary of American Meter Company.
   2. Two-Piece, Full-Port, Bonze Ball Valves with Bronze Trim: MSS SP-110
   3. Body: Bronze, complying with ASTM B 584.
   4. Ball: Chrome-plated bronze.
   5. Stem: Bronze, blowout proof.
   6. Seats: Reinforced TFE, blowout proof.
   7. Ends: Threaded, NPS 2 inch and smaller.
   8. CWP Rating: 600 psig (4140 kPa).
   9. Listing: Valves NPS 1 inch and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.

10. Service for aboveground: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Gas Service: PE Ball Valve, complying with ASME B16.40.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Kerotest Manufacturing Corp.
      b. Lyall R.W. & Company, Inc.
      c. Perfection Corporation, a subsidiary of American Meter Company.
   2. Body: PE
   3. Ball: PE
   4. Stem: Acetal.
   5. Seats and Seals: Nitrile.
   6. Ends: Plain or fusible to match piping.
   7. CWP Rating: 80 psig (552 kPa).
   8. Operating Temperature: Minus 20 to plus 140 deg F (Minus 29 to plus 60 deg C).
   9. Operator: Nut or flat head for key operation.
   10. Include plastic valve extentsion.
   11. Include tamperproof locking feature for valves where indicated on Drawings.
   12. Service for underground.

2.10 PLUG VALVES

A. General Duty: Cast-Iron Plug Valves:
   1. Manufacturers: Lubricated-Type, Cast-Iron Plug Valves:
      a. Miliken Valve Co. Inc.
      b. Nordstrom Valve, Inc.
      c. Walworth Co.
   2. Non-lubricated-Type, Cast-Iron Plug Valves:
      a. General Signal, DeZurik Unit.
      b. Grinnell Corporation.
      c. Mueller Flow Technologies.
   3. Cast-Iron Plug Valves, General: MSS SP-78.
   4. Class 250 or 300, lubricated-type, cast-iron plug valves.
   5. Class 250, nonlubricated-type, cast-iron plug valves.

B. Gas Service: Bronze Plug Valves: MSS SP-78, NPS 2-1/2 inch and larger.
   1. Body: Bronze, complying with ASTM B 584.
   2. Plug: Bronze.
   3. Ends: Threaded, socket, or flanged.
   4. Operator: Square head or lug type with tamperproof feature where indicated.
   5. Pressure Class: 125 psig (862 kPa).
   6. Listing: Valves NPS 1 inch and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
   7. Service for aboveground: Suitable for natural-gas service with "WOG" indicated on valve body.

2.11 RELIEF VALVES

A. Pressure:
   1. Manufacturers:
      a. Apollo Valves: www.apollovalves.com/#sle.
      b. Watts Regulator Company: www.wattsregulator.com/#sle.
   2. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

B. Temperature and Pressure:
   1. Manufacturers:
      a. Apollo Valves: www.apollovalves.com/#sle.
      b. Watts Regulator Company: www.wattsregulator.com/#sle.
   2. 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.

2.12 STRAINERS

A. Size 2 inch and Under:
   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.

B. Size 1-1/2 inch to 4 inch:
   1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

C. Size 5 inch and Larger:
   1. Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

2.13 **PIPING SPECIALTIES**

A. Appliance Flexible Connectors:
   1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
   2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
   3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
   4. Operating-Pressure Rating: 0.5 psig.
   5. End Fittings: Zinc-coated steel.
   6. Threaded Ends: Comply with ASME B1.20.1.
   7. Maximum Length: 72 inches

B. Y-Pattern Strainers:
   1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
   2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.

3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig

C. Basket Strainers:
1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig

D. T-Pattern Strainers:
1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig

E. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 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.

3.3 **TRENCHING FOR UNDERGROUND PIPING**

A. Comply with requirements of Division 31.

B. Comply with recommendations of available geotechnical report

C. Installation and Construction: Trench excavation shall comply with AST D2321.
1. Fill material shall be free of roots, rocks, debris, and organic materials. Fill material shall swell less than 3% when compacted.

2. Sand bedding material shall be natural river or bank sand free of silt, clay, loam, friable or soluable materials, and organic materials. Graded in accordnace with ANSI/ASTM C136.
3. Trench backfill in layers.
4. Compact bedding before placing pipe.
5. Hand place fill material to six inches above top of pipe and compact fill without damaging piping.
6. Reaminder of fill may be placed in trench by gravity from height not exceeding 12-inches above trench.

3.4 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. Refer to Section 220516.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

I. Provide access where valves and fittings are not exposed.

J. Establish elevations of buried piping outside the building to ensure not less than 2 ft of cover.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

L. Provide support for utility meters in accordance with requirements of utility companies.

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

N. Excavate in accordance with Section 312316.

O. Install bell and spigot pipe with bell end upstream.

P. Install valves with stems upright or horizontal, not inverted. Refer to Section 220523.

Q. Sleeve pipes passing through partitions, walls and floors.

R. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

S. Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

T. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.5 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

D. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Install globe valves for throttling, bypass, or manual flow control services.

F. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.

G. Provide spring loaded check valves on discharge of water pumps.

H. Provide flow controls in water recirculating systems where indicated.

END OF SECTION

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SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Nonmetallic-sheathed cable.

C. Underground feeder and branch-circuit cable.

D. Service entrance cable.

E. Armored cable.

F. Metal-clad cable.

G. Power and control tray cable.

H. Manufactured wiring systems.

I. Wiring connectors.

J. Electrical tape.

K. Heat shrink tubing.

L. Oxide inhibiting compound.

M. Wire pulling lubricant.

N. Cable ties.

1.2 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 260505 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.

C. Section 260513 - Medium-Voltage Cables: Cables and terminations for systems 601 V through 35,000 V.

D. Section 260519.13 - Undercarpet Electrical Power Cables: Flat conductor cable and fittings for undercarpet power distribution.

E. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

F. Section 260536 - Cable Trays for Electrical Systems: Additional installation requirements for cables installed in cable tray systems.

G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 262100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conductors.

I. Section 263100 - Photovoltaic Collectors: Additional wiring requirements for photovoltaic systems.

J. Section 284600 - Fire Detection and Alarm: Fire alarm system conductors and cables.

K. Section 312316 - Excavation.

L. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.

M. Section 312323 - Fill: Bedding and backfilling.

1.3 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 D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape 2017.

G. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes 2020.

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. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable 2018.

K. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF) 2007.

L. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy 2021.

M. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

N. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. UL 4 - Armored Cable Current Edition, Including All Revisions.

P. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.

Q. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.

R. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.

S. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.

T. UL 486D - Sealed Wire Connector Systems Current Edition, Including All Revisions.

U. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables Current Edition, Including All Revisions.

V. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape Current Edition, Including All Revisions.

W. UL 719 - Nonmetallic-Sheathed Cables Current Edition, Including All Revisions.

X. UL 854 - Service-Entrance Cables Current Edition, Including All Revisions.

Y. UL 1277 - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members Current Edition, Including All Revisions.

Z. UL 1569 - Metal-Clad Cables Current Edition, Including All Revisions.

1.4 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 with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.

3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. 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.

C. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.

D. Manufactured Wiring System Shop Drawings: Provide plan views indicating proposed system layout with components identified; indicate branch circuit connections.

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 routingfor underground circuits.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Manufactured Wiring Systems Cable Assemblies: One of each configuration, 6 feet length.

1.6 QUALITY ASSURANCE

A. Conform to 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.8 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 Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.1 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.
   1. Exceptions:
      a. Use manufactured wiring systems for branch circuits where concealed under raised floors.
         1) Exception: Provide single conductor building wire in raceway for circuit homerun from distribution box to panelboard.
      b. Use power and control tray cable or metal-clad cable for installation in cable tray.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Armored 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.
   2. In addition to other applicable restrictions, may not be used:
      a. Unless approved by 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.
      f. For isolated ground circuits.

F. Metal-clad cable is not permitted.
   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.
   2. In addition to other applicable restrictions, may not be used:
      a. Unless approved by 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.

2.2 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. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductor Material:
   1. Provide copper conductors except where aluminum conductors are specifically indicated. Substitution of aluminum conductors for copper is not permitted. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
   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.
   4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.

H. Minimum Conductor Size:12 AWG.
   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.

I. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

J. 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:
   a. 480Y/277 V, 3 Phase, 4 Wire System:
      1) Phase A: Brown.
      2) Phase B: Orange.
      3) Phase C: Yellow.
      4) Neutral/Grounded: Gray.
   b. 208Y/120 V, 3 Phase, 4 Wire System:
      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.
      4) Neutral/Grounded: White.
   c. Equipment Ground, All Systems: Green.
   d. Isolated Ground, All Systems: Green with yellow stripe.
   e. Travelers for 3-Way and 4-Way Switching: Pink.
   f. 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.

2.3 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
1. Copper Building Wire:
   a. Cerro Wire LLC: www.cerrowire.com.
   b. Encore Wire Corporation: www.encorewire.com/#sle.
   c. General Cable Technologies Corporation: www.generalcable.com/#sle.
   d. Southwire Company: www.southwire.com/#sle.
   e. Substitutions: See Section 016000 - Product Requirements.
2. Aluminum Building Wire (only where specifically indicated or permitted for substitution):
   a. Encore Wire Corporation: www.encorewire.com/#sle.
   b. Southwire Company: www.southwire.com/#sle.

c. Stabiloy, a brand of General Cable Technologies Corporation: www.stabiloy.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.

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.
2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
a. Size 4 AWG and Larger: Type XHHW-2.
b. Installed Underground: Type XHHW-2.
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.
2. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.

2.4 NONMETALLIC-SHEATHED CABLE

A. Manufacturers:
1. Cerro Wire LLC: www.cerrowire.com/#sle.
2. Encore Wire Corporation: www.encorewire.com/#sle.
3. Southwire Company: www.southwire.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type NM multiple-conductor cable listed and labeled as complying with UL 719, Type NM-B.

C. Conductor Stranding:
1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

2.5 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE

A. Manufacturers:
1. Cerro Wire LLC: www.cerrowire.com/#sle.
2. Encore Wire Corporation: www.encorewire.com/#sle.

3. Southwire Company: www.southwire.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.

C. Provide equipment grounding conductor unless otherwise indicated.

D. Conductor Stranding:
1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

E. Insulation Voltage Rating: 600 V.

F. Cable Jacket: Listed and labeled as sunlight resistant.

2.6 SERVICE ENTRANCE CABLE

A. Manufacturers:
1. Copper Service Entrance Cable:
a. Cerro Wire LLC: www.cerrowire.com/#sle.
b. Encore Wire Corporation: www.encorewire.com/#sle.
c. Southwire Company: www.southwire.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.
2. Aluminum Service Entrance Cable:
a. Encore Wire Corporation: www.encorewire.com/#sle.
b. General Cable Technologies Corporation
c. Sttabiloy
d. Southwire Company: www.southwire.com/#sle.

B. Service Entrance Cable for Underground Use: NFPA 70, Type USE single-conductor cable listed and labeled as complying with UL 854, Type USE-2, and with UL 44 Type RHH/RHW-2.

C. Conductor Stranding: Stranded.

D. Insulation Voltage Rating: 600 V.

2.7 ARMORED CABLE

A. Manufacturers:
1. AFC Cable Systems Inc: www.afcweb.com/#sle.
2. Encore Wire Corporation: www.encorewire.com/#sle.
3. Southwire Company: www.southwire.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type AC cable listed and labeled as complying with UL 4, 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.

E. Insulation: Type THHN.

F. Grounding: Combination of interlocking armor and integral bonding wire.
   1. Provide additional full-size integral insulated equipment grounding conductor for redundant grounding, suitable for general purpose, non-essential electrical systems in non-hazardous patient care areas of health care facilities.

G. Armor: Steel, interlocked tape.

2.8 POWER AND CONTROL TRAY CABLE

A. Manufacturers:
   1. Encore Wire Corporation: www.encorewire.com/#sle.
   2. General Cable Technologies Corporation
   3. Okonite: www.okonite.com/#sle.
   4. Southwire Company: www.southwire.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type TC cable listed and labeled as complying with UL 1277.

C. Where exposed run cable is indicated between cable tray and utilization equipment in qualifying industrial establishments as determined by authorities having jurisdiction, provide tray cable marked as Type TC-ER in accordance with NFPA 70.

D. Conductor Stranding: Stranded.

E. Insulation Voltage Rating: 600 V.

F. Insulation: Type XHHW or XHHW-2.

G. Grounding: Full-size integral equipment grounding conductor.

H. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.9 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 260526.

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.
   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.
      b. Ideal Industries, Inc: www.idealindustries.com/#sle.
      c. NSI Industries LLC: www.nsiindustries.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

H. Push-in Wire Connectors: Rated 600 V, 221 degrees F.
   1. Manufacturers:
      a. Ideal Industries, Inc: www.idealindustries.com/#sle.
      b. NSI Industries LLC: www.nsiindustries.com/#sle.
      c. Wago Corporation: www.wago.us/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

I. Mechanical Connectors: Provide bolted type or set-screw type.
   1. Manufacturers:

2.
   a. Burndy LLC: www.burndy.com/#sle.
   b. Bundy, LLC
   c. Ilsco: www.ilsco.com/#sle.
   d. Thomas & Betts Corporation: www.tnb.com/#sle.
   e. Substitutions: See Section 016000 - Product Requirements.

J. Compression Connectors: Provide circumferential type or hex type crimp configuration.
   1. Manufacturers:
      a. Burndy LLC: www.burndy.com/#sle.
      b. Thomas & Betts Corporation: www.tnb.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

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.
      b. Ilsco: www.ilsco.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

2.10 WIRING ACCESSORIES

A. Electrical Tape:
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Plymouth Rubber Europa: www.plymouthrubber.com/#sle.
   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.
      b. Burndy LLC: www.burndy.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

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.
      b. Ideal Industries, Inc: www.idealindustries.com/#sle.
      c. Ilsco: www.ilsco.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. American Polywater Corporation: www.polywater.com/#sle.
      c. Ideal Industries, Inc: www.idealindustries.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

E. Cable Ties: Material and tensile strength rating suitable for application.
   1. Manufacturers:
      a. Burndy LLC: www.burndy.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.1 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 field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

A. Circuiting Requirements:
   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 not permitted.
   8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
   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 armored cable (Type AC) in accordance with NECA 120.

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.

H. Terminate cables using suitable fittings.
   1. Armored Cable (Type AC):

a. Use listed fittings and anti-short, insulating bushings.
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.

2. 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.

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 contaminates. Do not use wire brush on plated connector surfaces.
5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
6. 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.

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. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

R. 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.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. 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 testing with SPDs connected.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

F. Chemically-enhanced ground electrodes.

G. Ground plate electrodes.

H. Ground enhancement material.

I. Ground access wells.

J. Pre-fabricated signal reference grids.

1.2 RELATED REQUIREMENTS

A. Section 096500 - Resilient Flooring: Static control flooring.

B. Section 260519 - 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 260536 - Cable Trays for Electrical Systems: Additional grounding and bonding requirements for cable tray systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 263100 - Photovoltaic Collectors: Additional grounding and bonding requirements for photovoltaic systems.

F. Section 265600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

G. Section 337900 - Site Grounding.

1.3 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 99 - Health Care Facilities Code 2021, with Amendment.

G. NFPA 780 - Standard for the Installation of Lightning Protection Systems 2023.

H. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   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. For signal reference grids, coordinate the work with access flooring furnished in accordance with Section 096900.
   4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Shop Drawings:
   1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

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.

E. Field quality control test reports.

F. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.6 QUALITY ASSURANCE

A. Conform to 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.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 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.

E. Grounding System Resistance:

1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. 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 either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
5. 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.
6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
7. 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 conductor provided for service-supplied system grounding to this ground bar.

a. Ground Bar Size: 1/4 by 2 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.

8. 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).
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 nearest effectively grounded metal building frame. 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 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.
12. Provide redundant grounding and bonding for patient care areas of health care facilities in accordance with NFPA 70 and NFPA 99.

K. Isolated Ground System:
1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated/insulated equipment grounding conductors.

2. Connect isolated/insulated equipment grounding conductors only to separate isolated/insulated equipment ground busses.
3. Connect the isolated/insulated equipment grounding conductors to the solidly bonded equipment ground bus only at the service disconnect or separately derived system disconnect. Do not make any other connections between isolated ground system and normal equipment ground system on the load side of this connection.

L. 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.
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.

2.2 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 260526:
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 gage 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.
a. Exceptions:
1) Use mechanical connectors for connections to electrodes at ground access wells.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections 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.
   b. Burndy LLC: www.burndy.com/#sle.
   c. Harger Lightning & Grounding: www.harger.com/#sle.
   d. Thomas & Betts Corporation: www.tnb.com/#sle.
   e. Substitutions: See Section 016000 - Product Requirements.
5. Manufacturers - Exothermic Welded Connections:
   a. Burndy LLC: www.burndy.com/#sle.
   b. Cadweld, a brand of Erico International Corporation: www.erico.com/#sle.
   c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.

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.

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.
      b. Erico International Corporation: www.erico.com/#sle.
      c. Galvan Industries, Inc: www.galvanelectrical.com/#sle.
      d. Harger Lightning & Grounding: www.harger.com/#sle.
      e. Substitutions: See Section 016000 - Product Requirements.

F. Ground Enhancement Material:
   1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.

G. 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.
   2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
   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".

PART 3 EXECUTION

3.1 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.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. 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.

D. Ground Plate Electrodes: Unless otherwise indicated, install ground plate electrodes at a depth of not less than 30 inches.

E. Make grounding and bonding connections using specified connectors.
   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.

F. Identify grounding and bonding system components in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

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

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 055000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 260533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

D. Section 260536 - Cable Trays for Electrical Systems: Additional support and attachment requirements for cable tray.

E. Section 260533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

F. Section 260548 - Vibration and Seismic Controls for Electrical Systems.

G. Section 262513 - Low-Voltage Busways: Additional support and attachment requirements for busway.

H. Section 263100 - Photovoltaic Collectors: Photovoltaic module mounting systems.

I. Section 265100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

J. Section 265133 - Luminaires, Ballasts, and Drivers - Lutron: Additional support and attachment requirements for luminaires.

K. Section 265600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.3 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 2023c.

F. MFMA-4 - Metal Framing Standards Publication 2004.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 5B - Strut-Type Channel Raceways and Fittings Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components 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 the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Architect of any conflicts with or deviations from the 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 in accordance with Section 033000.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

1. Fiberglass Channel (Strut) Framing Systems: Include requirements for strength derating according to ambient temperature.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

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: Include evidence of compliance with specified requirements.

G. 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.

1.6 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. Installer Qualifications for Field-Welding: As specified in Section 055000.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.

3. 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.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
6. Steel Components: Use corrosion resistant materials suitable for the 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: Comply with Section 260548.

C. Materials for Metal Fabricated Supports: Comply with Section 055000.

D. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.
3. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    b. Erico International Corporation: www.erico.com/#sle.
    c. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
    d. Thomas & Betts Corporation: www.tnb.com/#sle.
    e. Substitutions: See Section 016000 - Product Requirements.

E. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
1. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    b. Erico International Corporation: www.erico.com/#sle.
    c. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
    d. Thomas & Betts Corporation: www.tnb.com/#sle.
    e. Substitutions: See Section 016000 - Product Requirements.

F. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.

2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
3. 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.
4. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
5. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
6. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
   b. Thomas & Betts Corporation: www.tnb.com/#sle.
   c. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
   d. Substitutions: See Section 016000 - Product Requirements.
   e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

G. Fiberglass Channel (Strut) Framing Systems: Factory-fabricated continuous-slot fiberglass channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Channel Material: Use polyester resin or vinyl ester resin.
2. Minimum Channel Dimensions: 1-5/8 inch width by 1 inch height.
3. 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.
4. Manufacturers:
   a. Enduro Composites: www.endurocomposites.com/#sle.
   b. Substitutions: See Section 016000 - Product Requirements.
   c. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

H. 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.

I. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases 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.
1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.

2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
4. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
   b. Erico International Corporation: www.erico.com/#sle.
   c. PHP Systems/Design: www.phpsd.com/#sle.
   d. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
   e. Substitutions: See Section 016000 - Product Requirements.

J. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
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. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners are not permitted.
11. Hammer-driven anchors and fasteners are not permitted.
12. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.
    c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
14. Manufacturers - Mechanical Anchors:
    a. Hilti, Inc: www.us.hilti.com/#sle.
    b. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
    c. Powers Fasteners, Inc: www.powers.com/#sle.
    d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.

PART 3 EXECUTION

3.1 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.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect, 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 in accordance with Section 260548.

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.
   4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.
   5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

J. Conduit Support and Attachment: Also comply with Section 260533.13.

K. Cable Tray Support and Attachment: Also comply with Section 260536.

L. Box Support and Attachment: Also comply with Section 260533.16.

M. Busway Support and Attachment: Also comply with Section 262513.

N. Interior Luminaire Support and Attachment: Also comply with Section 265100.

O. Exterior Luminaire Support and Attachment: Also comply with Section 265600.

P. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

Q. Secure fasteners according to manufacturer's recommended torque settings.

R. Remove temporary supports.

S. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 260533.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Aluminum rigid metal conduit (RMC).

C. Intermediate metal conduit (IMC).

D. PVC-coated galvanized steel rigid metal conduit (RMC).

E. Flexible metal conduit (FMC).

F. Liquidtight flexible metal conduit (LFMC).

G. Electrical metallic tubing (EMT).

H. Rigid polyvinyl chloride (PVC) conduit.

I. Electrical nonmetallic tubing (ENT).

J. Liquidtight flexible nonmetallic conduit (LFNC).

K. Reinforced thermosetting resin conduit (RTRC).

L. Conduit fittings.

M. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete encasement of conduits.

B. Section 078400 - Firestopping.

C. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Metal clad cable (Type MC), armored cable (Type AC), and manufactured wiring systems, including uses permitted.

D. Section 260526 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.

E. Section 260529 - Hangers and Supports for Electrical Systems.

F. Section 260533.16 - Boxes for Electrical Systems.

G. Section 260533.23 - Surface Raceways for Electrical Systems.

H. Section 260548 - Vibration and Seismic Controls for Electrical Systems.

I. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

J. Section 262100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

K. Section 271000 - Structured Cabling: Additional requirements for communications systems conduits.

L. Section 312316 - Excavation.

M. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.

N. Section 312323 - Fill: Bedding and backfilling.

O. Section 337119 - Electrical Underground Ducts, Ductbanks, and Manholes.

1.3 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 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.

H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.

I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit 2018.

J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.

K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2021.

L. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT) 2014 (Reaffirmed 2019).

M. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.

O. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.

P. UL 360 - Liquid-Tight Flexible Metal Conduit Current Edition, Including All Revisions.

Q. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.

R. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.

S. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.

T. UL 1242 - Electrical Intermediate Metal Conduit-Steel Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. 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.

D. 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.

1.6 QUALITY ASSURANCE

A. Conform to 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.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal 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, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
   2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).

3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
4. Where rigid polyvinyl (PVC) conduit is provided, transition to 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 for bends.
6. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.

D. Embedded Within Concrete:
   1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
   2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
   3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from concrete.

E. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT). Do not use MC cable in walls or ceilings except for the final connection to lighting fixtures, and less than 6' lengths.

F. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

H. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

I. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
   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.

J. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.

K. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

2.2 CONDUIT REQUIREMENTS

A. 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 a mandrel through them.

B. Electrical Service Conduits: Also comply with Section 262100.

C. Communications Systems Conduits: Also comply with Section 271000.

D. Fittings for Grounding and Bonding: Also comply with Section 260526.

E. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

F. Provide products listed, classified, and labeled as suitable for the purpose intended.

G. Minimum Conduit Size, Unless Otherwise Indicated:
1. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
2. Underground, Interior: 3/4 inch (21 mm) trade size.
3. Underground, Exterior: 1 inch (27 mm) trade size.

H. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. Allied Tube & Conduit: www.alliedeg.com/#sle.
2. Republic Conduit: www.republic-conduit.com/#sle.
3. Wheatland Tube, a Division of Zekelman Industries www.wheatland.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

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.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.

c. Thomas & Betts Corporation: www.tnb.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.

2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the 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 set screw and compression (gland) type fittings are not permitted.

2.4 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. Allied Tube & Conduit: www.alliedeg.com/#sle.
2. Republic Conduit: www.republic-conduit.com/#sle.
3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.

C. Fittings:
1. Manufacturers:
   a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
   b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
   c. Thomas & Betts Corporation: www.tnb.com/#sle.
   d. Substitutions: See Section 016000 - Product Requirements.
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. Material: Use aluminum.
5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.5 INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
1. Allied Tube & Conduit www.alliedeg.com/#sle.
2. Republic Conduit: www.republic-conduit.com/#sle.
3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

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 Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.
   2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
   4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.6 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Thomas & Betts Corporation www.tnb.com/#sle.
   2. Robroy Industries www.robroy.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.

D. Interior Coating: Urethane, minimum thickness of 2 mil.

E. PVC-Coated Fittings:
   1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
   2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
   4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.

F. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

2.7 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
   2. Electri-Flex Company www.electriflex.com/#sle.
   3. International Metal Hose: www.metalhose.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

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 to be used.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
b. O-Z/Gedney, a brand of Emerson Electric Co www.emerson.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.

2.8 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
2. Electri-Flex Company: www.electriflex.com/#sle.
3. International Metal Hose: www.metalhose.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

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. Bridgeport Fittings Inc www.bptfittings.com/#sle.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.

2.9 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. Allied Tube & Conduit www.alliedeg.com/#sle.
2. Republic Conduit www.republic-conduit.com/#sle.
3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type EMT 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 Inc www.bptfittings.com/#sle.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.

d. Substitutions: See Section 016000 - Product Requirements.

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) or set-screw type.
   a. Do not use indenter type connectors and couplings.
   b. Do not use set-screw type connectors and couplings.
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.

2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   1. Cantex Inc: www.cantexinc.com/#sle.
   2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com/#sle.
   3. JM Eagle www.jmeagle.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

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.

2.11 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

A. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).

B. Supports: Per manufacturer's recommendations.

C. Fittings: Same type and manufacturer as conduit to be connected.

2.12 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

E. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

F. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

G. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

H. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for the conduit/duct arrangement to be installed.
   1. Products:
      a. Advance Products & Systems, LLC; Duct Bank Spacers: www.apsonline.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

I. 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 the casing and conduit/duct arrangement to be installed.
   1. Products:
      a. Advance Products & Systems, LLC; Bore Spacers: www.apsonline.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.1 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.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

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 the 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 all 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 conduits exposed:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
   6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all 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 the 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 the same area together on a common rack.

I. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide required vibration isolation and/or seismic controls in accordance with Section 260548.

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.
   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 non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
10. Use of spring steel conduit clips for support of conduits is not permitted.
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 (only where specifically indicated or permitted).
12. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the 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.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
8. Secure joints and connections to provide maximum 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. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
8. 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. Include proposed locations of penetrations and methods for sealing with submittals.
9. Provide metal escutcheon plates for conduit penetrations exposed to public view.
10. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

L. Underground Installation:
1. Provide trenching and backfilling in accordance with Section 312316.13.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 24 inches.
   b. Under Slab on Grade: 12 inches to bottom of slab.
3. Provide underground warning tape in accordance with Section 260553 along entire conduit length for service entrance where not concrete-encased.

M. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Include proposed conduit arrangement with submittals.
2. Maximum Conduit Size: 1 inch (27 mm) unless otherwise approved.
3. Install conduits within middle one third of slab thickness.
4. Secure conduits to prevent floating or movement during pouring of concrete.

N. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 033000 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

O. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.

P. 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.

Q. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
   1. Where conduits pass from outdoors into conditioned interior spaces.
   2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
   3. Where conduits penetrate coolers or freezers.

R. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

S. Provide grounding and bonding in accordance with Section 260526.

T. Identify conduits in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.4 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.5 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.

END OF SECTION

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SECTION 260533.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Boxes for hazardous (classified) locations.

E. Floor boxes.

F. Underground boxes/enclosures.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 078400 - Firestopping.

C. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

D. Section 260526 - Grounding and Bonding for Electrical Systems.

E. Section 260529 - Hangers and Supports for Electrical Systems.

F. Section 260533.13 - 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.

G. Section 260533.23 - Surface Raceways for Electrical Systems:
   1. Accessory boxes designed specifically for surface raceway systems.
   2. Lay-in wireways and wiring troughs with removable covers.

H. Section 260539 - Underfloor Raceways for Electrical Systems: Junction boxes for underfloor duct systems.

I. Section 260548 - Vibration and Seismic Controls for Electrical Systems.

J. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

K. Section 262726 - Wiring Devices:

1. Wall plates.
2. Floor box service fittings.
3. Poke-through assemblies.
4. Access floor boxes.
5. Additional requirements for locating boxes for wiring devices.

L. Section 262813 - Fuses: Spare fuse cabinets.

M. Section 271000 - Structured Cabling: Additional requirements for communications systems outlet boxes.

N. Section 337119 - Electrical Underground Ducts, Ductbanks, and Manholes: Concrete manholes for electrical systems.

1.3 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 FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports 2013 (Reaffirmed 2020).

E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports 2013 (Reaffirmed 2020).

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. SCTE 77 - Specifications for Underground Enclosure Integrity 2017.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

J. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.

K. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

L. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers Current Edition, Including All Revisions.

1.4 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 Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. 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.

C. Samples:
   1. Floor Boxes: Provide one sample(s) of each floor box proposed for substitution upon request.

D. 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.

E. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Keys for Lockable Enclosures: Two of each different key.

1.6 QUALITY ASSURANCE

A. Conform to 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.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 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.

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:
    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: Comply with Section 271000.
17. Wall Plates: Comply with Section 262726.
18. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com/#sle.
    c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com/#sle.
    d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
    e. Thomas & Betts Corporation: www.tnb.com/#sle.
    f. Substitutions: See Section 016000 - Product Requirements.

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.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
    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.
    b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
    c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com/#sle.
    d. Substitutions: See Section 016000 - Product Requirements.

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.
      b. Substitutions: See Section 016000 - Product Requirements.

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.
      b. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
      c. Hubbell Incorporated; Killark Products: www.hubbell-killark.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

F. Floor Boxes:
   1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 262726; 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.
   6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
      a. Manufacturers:
         1) Hubbell Incorporated; Quazite Products: www.hubbellpowersystems.com/#sle.
         2) MacLean Highline: www.macleanhighline.com/#sle.

3) Oldcastle Precast, Inc: www.oldcastleprecast.com/#sle.

4) Substitutions: See Section 016000 - Product Requirements.

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.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 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:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 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 262726.
   b. Communications Systems Outlets: Comply with Section 271000.
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 260533.13.
11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    a. Concealed above accessible suspended ceilings.
    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 260529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide required seismic controls in accordance with Section 260548.
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 constructed in accordance with Section 033000.

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.

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. Provide cast-in-place concrete collar constructed in accordance with Section 033000, minimum 10 inches wide by 12 inches deep, around enclosures that are not located in concrete areas.
   5. 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, using materials and methods specified in Section 078400.

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 260526.

V. Identify boxes in accordance with Section 260553.

3.3 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.4 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 260548 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 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. Seismic restraint systems.

1.2 RELATED REQUIREMENTS

A. Section 014533 - Code-Required Special Inspections and Procedures.

B. Section 033000 - Cast-in-Place Concrete.

C. Section 055000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

D. Section 260529 - Hangers and Supports for Electrical Systems.

1.3 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 (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.

1.4 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASCE 19 - Structural Applications of Steel Cables for Buildings 2016.

C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.

D. 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.

E. FEMA 413 - Installing Seismic Restraints for Electrical Equipment 2004.

F. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage 2012.

G. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components 2010, with Editorial Revision (2020).

I. MFMA-4 - Metal Framing Standards Publication 2004.

J. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   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. 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 non-essential components in consideration of seismic interaction.
   5. Notify Architect of any conflicts with or deviations from the 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 in accordance with Section 033000.

1.6 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. 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.

C. 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 method for spring element load capacities.
   2. Seismic Controls: Include seismic load capacities.

D. Shop Drawings - Vibration Isolation Systems:
   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.

E. 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.

F. 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 (Ip).
      d. For distributed systems, component materials and connection methods.
      e. Component amplification factor (ap) and component response modification factor (Rp), 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.

G. Certification for seismically qualified equipment; identify basis for certification.

H. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

I. 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.

J. Evidence of qualifications for seismic controls designer.

K. Evidence of qualifications for manufacturer.

L. Manufacturer’s detailed field testing and inspection procedures.

M. Field quality control test reports.

1.7 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 the State in which the Project is located 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.

E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 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. Equipment Isolation:
   1. Transformers:
      a. Specified vibration isolators are in addition to any factory-installed internal core and coil assembly vibration isolators unless otherwise indicated.
      b. Floor-Mounted Transformers, Non-Seismic Applications: Use resilent material isolator pads, resilient material isolator mounts, or open (unhoused) spring isolators.
      c. Floor-Mounted Transformers, Seismic Applications: Use seismic type resilient material isolator mounts or seismic type restrained spring isolators.
      d. Suspended Transformers, Non-Seismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
      e. Suspended Transformers, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
      f. Wall-Mounted Transformers, Non-Seismic Applications: Use resilient material isolator mounts.
      g. Wall-Mounted Transformers, Seismic Applications: Use seismic type resilient material isolator mounts.
      h. Minimum Static Deflection:
         1) Transformers Mounted on Grade-Level Slabs: 0.25 inch deflection unless otherwise indicated.
         2) Transformers Mounted at Above-Grade Levels: 0.5 inch deflection unless otherwise indicated.
   2. Engine Generators:
      a. Specified vibration isolators are in addition to any factory-installed internal vibration isolators between generator set and integral base unless otherwise indicated; obtain generator set manufacturer approval of applied vibration isolation.
      b. Non-Seismic Applications, Isolators Not Located Below Sub-Base Fuel Tank: Use housed spring isolators or restrained spring isolators.
      c. Non-Seismic Applications, Isolators Located Below Sub-Base Fuel Tank: Use restrained spring isolators.
      d. Seismic Applications: Use seismic type restrained spring isolators.
      e. Provide vibration-isolated concrete inertia bases where indicated.
      f. Minimum Static Deflection:

1) Generators Mounted on Grade-Level Slabs: 1 inch deflection unless otherwise indicated.
2) Generators Mounted at Above-Grade Levels: 2 inch deflection unless otherwise indicated.

E. 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:
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, Non-Seismic 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.

2.2 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: As indicated on drawings.

C. Seismic Qualification of Equipment:
1. Provide special certification for electrical equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.

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 Architect 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.

D. Premanufactured Modular Electrical Equipment: Where not otherwise seismically qualified, premanufactured modules 6 feet high and taller furnished under other sections to be designed in accordance with seismic provisions for nonbuilding structures.

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. Seismic Restraint Exemptions:
   a. Exemptions for Seismic Design Category C:
      1) Electrical components where either of the following apply:
         (a) The component importance factor (Ip) is 1.0 and the component is positively attached to the structure.
         (b) The component weighs 20 pounds or less or, in the case of a distributed system, 5 pounds per foot or less.
   b. Exemptions for Seismic Design Category D, E, and F:
      1) Discrete electrical components that are positively attached to the structure where either of the following apply:
         (a) The component weighs 400 pounds or less, has a center of mass located 4 feet or less above the adjacent floor level, flexible connections are provided between the component and associated ductwork, piping, and conduit, and the component importance factor (Ip) is 1.0.
         (b) The component weighs 20 pounds or less or, in the case of a distributed system, 5 pounds per foot or less.
   c. Conduit, Cable Tray, and Raceway Exemptions, All Seismic Design Categories:
      1) Raceways with component importance factor (Ip) of 1.0 where flexible connections are provided between cable tray or raceway and associated components, where cable tray or raceway is positively attached to the structure, and where one of the following apply:
         (a) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 3/8 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds or less.
         (b) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, and the

total weight supported by any single trapeze is 200 pounds or less.

(c) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 24 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds or less.

(d) Hanger supported conduits, cable trays, or raceways with individual rod hangers 3/8 inch or 1/2 inch in diameter not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single rod is 50 pounds or less.

2) Conduits less than 2-1/2 inch trade size.

d. Lighting Exemptions, All Seismic Design Categories:

1) Suspended luminaires where attachments are designed to accommodate 1.4 times the operating weight acting in both the vertical and horizontal directions and connections to structure allow for 360 degree range of motion in the horizontal plane; arrange to prevent impact between luminaires and the structure or other nonstructural components.

2) Lay-in luminaires weighing less than 56 pounds secured to ceiling grid and provided with safety wires in accordance with ASTM E580/E580M.

3. 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).
4. 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.
5. Seismic Type Vibration Isolators:
   a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
6. 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).
   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.
7. 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:
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.
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.

2.3 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Manufacturers:
1. Vibration-Isolated Equipment Support Bases:
a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
b. Mason Industries: www.mason-ind.com/#sle.
c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
2. Substitutions: See Section 016000 - Product Requirements.
3. 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.
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 concrete in accordance with Section 033000.

2.4 VIBRATION ISOLATORS

A. Manufacturers:
1. Vibration Isolators:
a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.

b. Mason Industries: www.mason-ind.com/#sle.
c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.

2. Substitutions: See Section 016000 - Product Requirements.
3. 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.
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 Non-Seismic 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, Non-Seismic:
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: Non-skid molded elastomeric isolator material or steel with non-skid elastomeric isolator pad with provisions for bolting to supporting structure as required.
c. Furnished with integral leveling device for positioning and securing supported equipment.
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, non-adjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
c. Bottom Load Plate: Steel with non-skid 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, Non-Seismic:
   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 non-skid 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, Non-Seismic:
   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, Non-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.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short circuiting of isolation.
8. Combination Resilient Material/Spring Isolator Hangers, Non-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) 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.
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.

2.5 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

A. Manufacturers:
   1. External Seismic Snubber Assemblies:
      a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
      b. Mason Industries: www.mason-ind.com/#sle.
      c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.
   3. 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.

2.6 SEISMIC RESTRAINT SYSTEMS

A. Manufacturers:
   1. Seismic Restraint Systems:
      a. Eaton Corporation: www.eaton.com/#sle.
      b. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
      c. Mason Industries: www.mason-ind.com/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.
   3. 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.
   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

3.1 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.

3.2 CODE-REQUIRED SPECIAL INSPECTIONS

A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 014533 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. Prior to starting work, Contractor 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.

D. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install products in accordance with applicable requirements of NECA 1 (general workmanship).

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.

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.
   e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. 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.

D. 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.

E. Seismic Controls:
1. Verify snubbing element air gaps.

F. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.5 ATTACHMENTS

A. Statement of special inspections.

END OF SECTION

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SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 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.

1.2 RELATED REQUIREMENTS

A. Section 099113 - Exterior Painting.

B. Section 099123 - Interior Painting.

C. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

D. Section 260536 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.

E. Section 260573 - Power System Studies: Arc flash hazard warning labels.

F. Section 262300 - Low-Voltage Switchgear: Factory-installed mimic bus.

G. Section 262726 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.

H. Section 263100 - Photovoltaic Collectors: Additional identification requirements for photovoltaic systems.

I. Section 271000 - Structured Cabling: Identification for communications cabling and devices.

1.3 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.

E. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

1.4 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.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

D. Samples:
1. Identification Nameplates: One of each type and color specified.
2. Warning Signs and Labels: One of each type and legend specified.

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.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.7 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 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. Switchgear:
         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) Use identification nameplate to identify main and tie devices.
         5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
         6) See Section 262300 for factory-installed mimic bus.
      b. Switchboards:
         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) Use identification nameplate to identify main overcurrent protective device.
         5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
      c. Motor Control Centers:
         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) Use identification nameplate to identify main overcurrent protective device.
         5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
      d. 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.

e. Transformers:
1) Identify kVA rating.
2) Identify voltage and phase for primary and secondary.
3) Identify power source and circuit number. Include location when not within sight of equipment.
4) Identify load(s) served. Include location when not within sight of equipment.

f. Enclosed switches, circuit breakers, and motor controllers:
1) Identify voltage and phase.
2) Identify power source and circuit number. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.

g. Busway:
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) Provide identification at maximum intervals of 40 feet.
5) Use identification nameplate to identify load(s) served for each plug-in unit. Include location when not within sight of equipment.

h. Time Switches:
1) Identify load(s) served and associated circuits controlled. Include location.

i. Enclosed Contactors:
1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).

4) Identify coil voltage.
5) Identify load(s) and associated circuits controlled. Include location.

j. Centralized Emergency Lighting Inverters:
1) Identify input and output voltage and phase.
2) Identify power source and circuit number for normal power source. Include location when not within sight of equipment.
3) Identify load(s) served. Include location.

k. Transfer Switches:
1) Identify voltage and phase.
2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.
4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.

l. Electricity Meters:
1) Identify load(s) metered.

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.

3. Emergency System Equipment:
a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
c. Use identification nameplate to identify emergency operating instructions for emergency system equipment.

4. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
5. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
6. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
7. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
8. 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.

9. 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.
10. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
11. 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 099123 and 099113.
12. Available Fault Current Documentation: 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. Elevator control panels.
    c. Industrial machinery.
13. Arc Flash Hazard Warning Labels: Comply with Section 260573.
14. 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.
15. 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".
16. 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".
17. 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 260519.
2. Identification for Communications Conductors and Cables: Comply with Section 271000.
3. 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.
4. 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.

d. In cable tray, at maximum intervals of 20 feet.

5. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
6. 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.
2. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.
   a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
      1) Color Code:
         (a) Emergency Power System: Red.
      2) Field-Painting: Comply with Section 099123 and 099113.
      3) Vinyl Color Coding Electrical Tape: Comply with Section 260519.
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 Cable Tray: Comply with Section 260536.

F. 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.
   a. Color-Coded Boxes: Field-painted in accordance with Section 099123 and 099113 per the same color code used for raceways.
3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
   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 with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

G. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 271000.
2. Wiring Device and Wallplate Finishes: Comply with Section 262726.
3. Factory Pre-Marked Wallplates: Comply with Section 262726.
4. 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.

5. 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.
6. 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.
7. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

H. Identification for Luminaires:
1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

I. Identification for Photovoltaic Systems: Comply with Section 263100

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Manufacturers:
   a. Brimar Industries, Inc: www.brimar.com/#sle.
   b. Kolbi Pipe Marker Co{CH#275749}: www.kolbipipemarkers.com/#sle.
   c. Seton Identification Products: www.seton.com/#sle.
   d. Substitutions: See Section 016000 - Product Requirements.
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.
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.
   b. Brother International Corporation: www.brother-usa.com/#sle.
   c. Panduit Corp: www.panduit.com/#sle.
   d. Substitutions: See Section 016000 - Product Requirements.

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".
      2) Fire Alarm System: Identify with text "FIRE ALARM".
   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 inch.
   b. Equipment Designation: 1/2 inch.
   c. Other Information: 1/4 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.
   b. Emergency Power System: White text on red background.
   c. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:
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.

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.
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:
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. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

2.3 WIRE AND CABLE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. HellermannTyton: www.hellermanntyton.com/#sle.
3. Panduit Corp: www.panduit.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split 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.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.4 VOLTAGE MARKERS

A. Manufacturers:
   1. Brady Corporation: www.bradyid.com/#sle.
   2. Brimar Industries, Inc: www.brimar.com/#sle.
   3.
   4. Seton Identification Products: www.seton.com/#sle.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

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".

F. Color: Black text on orange background unless otherwise indicated.

2.5 UNDERGROUND WARNING TAPE

A. Manufacturers:
   1. Brady Corporation: www.bradyid.com/#sle.
   2. Brimar Industries, Inc: www.brimar.com/#sle.
   3. Seton Identification Products: www.seton.com/#sle.

B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
   1. Exception: Use foil-backed detectable type tape where required by serving utility or where directed by Owner.

C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

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.

2.6 FLOOR MARKING TAPE

A. Manufacturers:
   1. Brady Corporation: www.bradyid.com/#sle.
   2. Brimar Industries, Inc: www.brimar.com/#sle.
   3. Seton Identification Products: www.seton.com/#sle.

B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches wide, with alternating black and white stripes.

2.7 WARNING SIGNS AND LABELS

A. Manufacturers:
   1. Brimar Industries, Inc: www.brimar.com/#sle.
   2. Clarion Safety Systems, LLC: www.clarionsafety.com/#sle.
   3. Seton Identification Products: www.seton.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
   1. Materials:
      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.
   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.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

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: Inside of equipment door.
   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.

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.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

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SECTION 260573 - POWER SYSTEM STUDIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. 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.

1.2 RELATED REQUIREMENTS

A. Section 260553 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

B. Section 261116 - Secondary Unit Substations.

C. Section 261300 - Medium-Voltage Switchgear.

D. Section 261321 - Air Interrupter Switches.

E. Section 261839 - Medium-Voltage Motor Controllers.

F. Section 262100 - Low-Voltage Electrical Service Entrance.
   1. Includes Utility Company contact information.

G. Section 262300 - Low-Voltage Switchgear.

H. Section 262413 - Switchboards.

I. Section 262416 - Panelboards.

J. Section 262419 - Motor-Control Centers.

K. Section 262513 - Low-Voltage Busways.

L. Section 262813 - Fuses.

M. Section 262816.13 - Enclosed Circuit Breakers.

N. Section 262816.16 - Enclosed Switches.

O. Section 262913 - Enclosed Controllers.

P. Section 263323 - Central Battery Equipment.

Q. Section 263533.16 - Low-Voltage Power Factor Correction Equipment.

1.3 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.

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.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.
   2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
   3. Notify Architect of any conflicts with or deviations from the 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.
   2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.
   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.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Study preparer's qualifications.

C. Field testing agency's qualifications.

D. Study reports, stamped or sealed and signed by study preparer.

E. 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.

F. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.

G. Site-specific arc flash hazard warning labels.

H. Field quality control reports.

I. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

J. 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.

1.6 POWER SYSTEM STUDIES

A. Scope of Studies:
   1. Perform analysis of new electrical distribution system as indicated on drawings.
   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.

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:
   1. 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 262100 for Utility Company contact information.
      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 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:

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.
      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 achieve full selective coordination while providing adequate protection for equipment and conductors.

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. To clarify IEEE 1584 statement that "equipment below 240 V need not be considered unless it involves at least one 125 kVA or larger low-impedance transformer in its immediate power supply" for purposes of studies, study preparer to include equipment rated less than 240 V fed by transformers less than 125 kVA in calculations.
      b. 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.
      c. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 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.
   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 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 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.
   c. Identify locations where the calculated maximum incident energy exceeds 40 calories per sq cm.

1.7 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located 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 the manufacturer of the electrical distribution equipment.
   2. Study preparer may be employed by field testing agency.
   3. Acceptable Study Preparers:

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.

C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
   1. Acceptable Software Products:

a. EasyPower LLC: www.easypower.com/#sle.
b. ETAP/Operation Technology, Inc: www.etap.com/#sle.
c. Power Analytics Corporation: www.poweranalytics.com/#sle.
d. SKM Systems Analysis, Inc: www.skm.com/#sle.

PART 2 PRODUCTS

2.1 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 260553.
   2. 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" where calculated incident energy is less than 40 calories per square cm.
      b. Include red header that reads "DANGER" where calculated incident energy is 40 calories per square cm or greater.
      c. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
      d. 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) Date calculations were performed.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install arc flash warning labels in accordance with Section 260553.

3.2 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Adjust equipment and protective devices for compliance with studies and recommended settings.

E. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.

F. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

3.3 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. 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.

3.4 ATTACHMENTS

A. Previous studies.

B. Existing drawings.

END OF SECTION

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SECTION 260583 - WIRING CONNECTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical connections to equipment.

1.2 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 260533.13 - Conduit for Electrical Systems.

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 262726 - Wiring Devices.

E. Section 262816.16 - Enclosed Switches.

F. Section 262913 - Enclosed Controllers.

1.3 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.

1.4 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.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

1.6 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

2.1 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Conform to 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.

B. Disconnect Switches: As specified in Section 262816.16 and in individual equipment sections.

C. Wiring Devices: As specified in Section 262726.

D. Flexible Conduit: As specified in Section 260533.13.

E. Wire and Cable: As specified in Section 260519.

F. Boxes: As specified in Section 260533.16.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 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.

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.

END OF SECTION

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SECTION 260916 - ELECTRIC CONTROLS AND RELAYS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pushbutton and selector switches.

B. Control stations and panels.

C. Relays and time-delay relays.

D. Control power transformers.

1.2 RELATED REQUIREMENTS

A. Section 260533.16 - Boxes for Electrical Systems: Cabinets and terminal blocks.

1.3 REFERENCE STANDARDS

A. NEMA ICS 1 - Industrial Control and Systems General Requirements 2022.

B. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2008 (Reaffirmed 2020).

C. NEMA ICS 6 - Industrial Control and Systems: Enclosures 1993 (Reaffirmed 2016).

D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Submit to NEMA ICS 1 indicating control panel layouts, wiring connections and diagrams, dimensions, support points.

C. Product Data: Provide for each component showing electrical characteristics and connection requirements.

D. 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 starting of product.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of Project.

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.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Allen-Bradley/Rockwell Automation: ab.rockwellautomation.com/#sle.

C. Eaton Corporation: www.eaton.com/#sle.

D. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

2.2 COMPONENTS

A. Control Switches and Stations:
1. Contacts: NEMA ICS 2, Form Z.
2. Contact Ratings: NEMA ICS 2, A150.
3. Selector Switch Operators: Two position rotary selector switch.
4. Pushbutton Operator: Unguarded type.
5. Control Stations: Standard duty oiltight type pushbutton station.

B. Magnetic Control Relays: NEMA ICS 2, Class A300.
1. Contacts: NEMA ICS 2, Form Z.
2. Contact Ratings: NEMA ICS 2, Class A150.
3. Coil Voltage: 120 volts, 60 Hz, AC.

C. Solid-State Relays: NEMA ICS 2.
1. Contacts: NEMA ICS 2, Form Z.
2. Contact Ratings: NEMA ICS 2, Class A150.
3. Coil Voltage: 120 volts, 60 Hz, AC.

D. Interval Timing Relays: NEMA ICS 2, Class A300, repeat cycle timer.
1. Contacts: NEMA ICS 2, Form Z.
2. Contact Ratings: NEMA ICS 2, Class A150.
3. Coil Voltage: 120 volts, 60 Hz, AC.

E. Clock Timers: NEMA ICS 2, Class A300, 24 hour timer.

1. Astronomical dial.
2. Contacts: NEMA ICS 2, Form Z.
3. Contact Ratings: NEMA ICS 2, Class A150.
4. Coil Voltage: 120 volts, 60 Hz, AC.

2.3 ENCLOSURES

A. Control Station Enclosures: NEMA ICS 6; Type 1.

B. Relay Enclosures: NEMA ICS 6; Type 1.

C. Fabrication: Shop fabricate control panels to NEMA ICS 1, using cabinets and terminal blocks furnished in accordance with Section 260533.16.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install individual relays and time-delay relays in enclosures.

C. Make electrical wiring interconnections as indicated.

END OF SECTION

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SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 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. Control accessories.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 260573 - Power System Studies.

F. Section 260918 - Remote Control Switching Devices: Remotely controlled devices for lighting control, including networked lighting controls, programmable relay panels, and remote control switching relays.

G. Section 262726 - Wiring Devices: Devices for manual control of lighting, including wall switches.
   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.

H. Section 262813 - Fuses.

I. Section 262913 - Enclosed Controllers : General purpose contactors.

J. Section 265100 - Interior Lighting.

K. Section 265561 - Theatrical Lighting: Controls for stage lighting units.

L. Section 265600 - Exterior Lighting.

1.3 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 2023.

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.

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.

1.4 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 Architect 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.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. 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.

C. Shop Drawings:
1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.

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. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Locking Receptacle-Mounted Outdoor Photo Controls: Five percent of total quantity installed for each type, but not less than two of each type.
   3. Indicating Lights: Two of each different type.

H. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.6 QUALITY ASSURANCE

A. Conform to 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 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.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for all occupancy sensors.

C. Provide five year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.

D. Provide two year manufacturer warranty for all daylighting controls.

PART 2 PRODUCTS

2.1 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

C. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.2 OCCUPANCY SENSORS

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Lutron Electronics Company, Inc: www.lutron.com/#sle.
3. Sensor Switch Inc: www.sensorswitch.com/#sle.
4. WattStopper: www.wattstopper.com/#sle.
5. Substitutions: See Section 016000 - Product Requirements.
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.
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.
    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 262726, 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.

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 262726, 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.
2) Lutron Maestro Occupancy Sensor Dimmer Series; www.lutron.com/#sle.
3) Lutron Maestro 0-10V Dimmer Sensor Series; www.lutron.com/#sle.
4) Substitutions: See Section 016000 - Product Requirements.

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.
      (b) Lutron Radio Powr Savr Wireless Sensors; www.lutron.com/#sle.
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:

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.
      1) Products:
         (a) Lutron LOS-CUS Series; www.lutron.com/#sle.
   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.
   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.
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.
   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.
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.
   b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet.

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.

G. Luminaire Mounted Occupancy Sensors: Designed for direct luminaire installation and control, suitable for use with specified luminaires.

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.

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.

2.3 OUTDOOR MOTION SENSORS

A. 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.

B. Sensor Technology: Passive Infrared (PIR) designed to detect occupancy by sensing movement of thermal energy between zones.

C. 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.

D. Turn-Off Delay: Field adjustable, with time delay settings available up to 15 minutes.

E. Integral Photocell: For dusk to dawn operation.

F. Manual Override: Activated by switching power off to unit and then back on.

G. Load Rating: 1,000 W incandescent and fluorescent load at 120 V ac.

H. 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.

2.4 TIME SWITCHES

A. Manufacturers:
   1. Intermatic, Inc: www.intermatic.com/#sle.
   2. Tork, a division of NSI Industries LLC: www.tork.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.
   4. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. Digital Electronic Time Switches:
   1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
   2. Program Capability:
      a. 24-Hour Time Switches: Single channel, with same schedule for each day of the week and skip-a-day feature to omit selected days.
      b. 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.
      c. 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.
   3. Schedule Capacity: Not less than 16 programmable on/off operations.
   4. Provide automatic daylight savings time and leap year compensation.
   5. Provide power outage backup to retain programming and maintain clock.
   6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
   7. Input Supply Voltage: As indicated on the drawings.
   8. Output Switch Configuration: As required to control the load indicated on drawings.
   9. Output Switch Contact Ratings: As required to control the load indicated on drawings.
   10. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:

2.5 IN-WALL TIME SWITCHES

2.6 IN-WALL INTERVAL TIMERS

2.7 OUTDOOR PHOTO CONTROLS

A. Manufacturers:
   1. Intermatic, Inc: www.intermatic.com/#sle.
   2. Tork, a division of NSI Industries LLC: www.tork.com/#sle.

B. Stem-Mounted Outdoor Photo Controls:
   1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
   2. Housing: Weatherproof, impact resistant polycarbonate.

3. Photo Sensor: Cadmium sulfide.
4. Provide external sliding shield for field adjustment of light level activation.
5. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
6. Voltage: As required to control the load indicated on the drawings.
7. Failure Mode: Fails to the on position.
8. Load Rating: As required to control the load indicated on the drawings.
9. Provide accessory wall-mounting bracket where indicated or as required to complete installation.

C. Locking Receptacle-Mounted Outdoor Photo Controls
1. 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.
2. Housing: Weatherproof, impact resistant UV stabilized polypropylene, color to be selected.
3. Photo Sensor: Cadmium sulfide.
4. 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.
5. Voltage: As required to control the load indicated on the drawings.
6. Failure Mode: Fails to the on position.
7. Load Rating: As required to control the load indicated on the drawings.
8. Surge Protection: 160 joule metal oxide varistor.
9. Provide the following accessories where indicated or as required to complete installation:
   a. Receptacle: Complying with ANSI C136.10.
   b. Mounting Bracket.
   c. Shorting Cap: Suitable for replacing locking photo control to complete circuit.

2.8 DAYLIGHTING CONTROLS

A. Manufacturers:
1. Hubbell Control Solutions: www.hubbell.com/hubbellcontrolsolutions/en/#sle.
2. Lutron Electronics Company, Inc: www.lutron.com/#sle.
3. Sensor Switch Inc: www.sensorswitch.com/#sle.
4. WattStopper: www.wattstopper.com/#sle.

B. 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.

C. 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.
1. Sensor Type: Filtered silicon photo diode.
2. Sensor Range:
   a. Indoor Photo Sensors: 5 to 100 footcandles.
   b. Outdoor Photo Sensors: 5 to 250 footcandles.

c. Atrium Photo Sensors: 200 to 2,500 footcandles.
d. Skylight Photo Sensors: 1,000 to 6,000 footcandles.
e. Open Loop Photo Sensors: 3 to 6,000 footcandles.

3. 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.
   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.

D. Dimming Photo Sensors: Photo sensor units with integral controller compatible with specified dimming ballasts, for direct continuous dimming of up to 50 ballasts.

E. 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.
1. 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.
2. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
3. Control Capability:
   a. Single Zone Switching Modules: Capable of controlling one programmable channel.
   b. Multi-Zone Switching Modules: Capable of controlling up to three separately programmable channels.

F. 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.
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.

G. 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.

1. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
2. Control Capability: Capable of controlling up to three separately programmable channels, with up to 50 ballasts per channel.
3. Dimming and Fade Rates: Adjustable from 5 to 60 seconds.
4. Cut-Off Delay: Selectable and adjustable from 0 to 20 minutes.

H. 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.
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.

I. Power Packs for Low Voltage Daylighting Control Modules:
1. 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.
2. Input Supply Voltage: Dual rated for 120/277 V ac.
3. Load Ratings: As required to control the load indicated on drawings.

J. Accessories:
1. Where indicated, provide compatible accessory wall switches for manual override control.
2. Where indicated, provide compatible accessory wireless controls for manual override control.
    a. Products:
        1) Lutron Pico Wireless Controls; www.lutron.com/#sle.

PART 3 EXECUTION

3.1 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 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.

3.2 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.

3.3 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. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of lighting control devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switch Occupancy Sensors: 48 inches above finished floor.
      b. In-Wall Time Switches: 48 inches above finished floor.
      c. In-Wall Interval Timers: 48 inches above finished floor.
   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 to obtain direction prior to proceeding with work.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 262726.

G. Provide required supports in accordance with Section 260529.

H. 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.

I. Identify lighting control devices in accordance with Section 260553.

J. Occupancy Sensor Locations:
   1. Location Adjustments: Do not make adjustments to locations without obtaining approval from the Architect.

K. 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.

L. 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.

M. Daylighting Control Photo Sensor Locations:
   1. Location Adjustments: Do not make adjustments to locations without obtaining approval from the Architect.
   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.

N. 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.

O. 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.

P. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

Q. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. 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.

D. Test time switches to verify proper operation.

E. Test outdoor photo controls to verify proper operation, including time delays where applicable.

F. 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.

G. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.5 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 Architect.

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 Architect. 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 Architect.

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 Architect.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.7 COMMISSIONING

A. See Section 019113 - General Commissioning Requirements for commissioning requirements.

3.8 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

D. Training: Train 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.
   4. Location: At project site.

END OF SECTION

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SECTION 262100 - LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical service requirements.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Materials and installation requirements for cast-in-place concrete equipment pads.

B. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 260526 - Grounding and Bonding for Electrical Systems.

D. Section 260529 - Hangers and Supports for Electrical Systems.

E. Section 260533.13 - Conduit for Electrical Systems.

F. Section 260533.23 - Surface Raceways for Electrical Systems: Wireways.

G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 262300 - Low-Voltage Switchgear: Service entrance equipment.

I. Section 262413 - Switchboards: Service entrance equipment.

J. Section 262416 - Panelboards: Service entrance equipment.

K. Section 262713 - Electricity Metering: Non-utility electrical metering.

1.3 PRICE AND PAYMENT PROCEDURES

A. Allowances:
   1. See Section 012100 - Allowances, for allowances affecting this section.
   2. Include cash allowance for Utility Company charges associated with providing service.

B. Unit Prices:
   1. See Section 012200 - Unit Prices, for additional unit price requirements.
   2. Primary:
      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 Contractor 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.

1.4 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.

1.5 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.

1.6 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.
      c. Utility easement requirements.
      d. Utility Company charges associated with providing service.
   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. Notify Architect 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 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. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.7 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

1.8 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.

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.

1.9 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

2.1 ELECTRICAL SERVICE REQUIREMENTS

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: As indicated on drawings.

C. Utility Company: As indicated on drawings.

D. Division of Responsibility: As indicated on drawings.

E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.1 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.

3.2 PREPARATION

A. Verify and mark locations of existing underground utilities.

3.3 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 support and attachment components in accordance with Section 260529.

E. Provide grounding and bonding for service entrance equipment in accordance with Section 260526.

F. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 260553.

3.4 PROTECTION

A. Protect installed equipment from subsequent construction operations.

END OF SECTION

SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General purpose transformers.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260533.13 - Conduit for Electrical Systems: Flexible conduit connections.

D. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
   1. Includes requirements for the seismic qualification of equipment specified in this section.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 262416 - Panelboards.

G. Section 262713 - Electricity Metering: Instrument transformers for electrical metering.

1.3 REFERENCE STANDARDS

A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers Current Edition.

B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers 2015.

C. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers 2013.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers 2015.

F. NEMA ST 20 - Dry Type Transformers for General Applications 2021.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

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. UL 506 - Standard for Specialty Transformers Current Edition, Including All Revisions.

K. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers Current Edition, Including All Revisions.

1.4 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. Coordinate the work with placement of supports, anchors, etc. required for mounting.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
   1. Vibration Isolators: Include attachment method and rated load and deflection.

C. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.

D. Manufacturer's equipment seismic qualification certification.

E. Source Quality Control Test Reports: Include reports for tests designated in NEMA ST 20 as design and routine tests.

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. Maintenance Data: Include recommended maintenance procedures and intervals.

I. Project Record Documents: Record actual locations of transformers.

1.6 QUALITY ASSURANCE

A. Conform to 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Ambient Temperature: Do not exceed the following maximum temperatures during and after installation of transformers.
   1. Greater than 10 kVA: 104 degrees F maximum.
   2. Less than 10 kVA: 77 degrees F maximum.

B. Ambient Temperature: Do not exceed 86 degrees F average or 104 degrees F maximum measured during any 24 hour period during and after installation of transformers.

1.9 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Eaton Corporation www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

E. Substitutions: See Section 016000 - Product Requirements.

2.2 TRANSFORMERS - GENERAL REQUIREMENTS

A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.

B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
   1. Altitude: Less than 3,300 feet.
   2. Ambient Temperature:
      a. Greater than 10 kVA: Not exceeding 104 degrees F.
      b. Less than 10 kVA: Not exceeding 77 degrees F.
   3. Ambient Temperature: Not exceeding 86 degrees F average or 104 degrees F maximum measured during any 24 hour period.

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.3 GENERAL PURPOSE TRANSFORMERS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.

B. Primary Voltage: 480 volts delta, 3 phase.

C. Secondary Voltage: 208Y/120 volts, 3 phase.

D. Insulation System and Allowable Average Winding Temperature Rise:

1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.

E. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.

F. Winding Taps:
1. Less than 3 kVA: None.
2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.

G. Energy Efficiency: Comply with 10 CFR 431, Subpart K.

H. Sound Levels: Standard sound levels complying with NEMA ST 20

I. Mounting Provisions:
1. Less than 15 kVA: Suitable for wall mounting.
2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
3. Larger than 75 kVA: Suitable for floor mounting.

J. Transformer Enclosure: Comply with NEMA ST 20.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
2. Construction: Steel.
   a. Less than 15 kVA: Totally enclosed, non-ventilated.
   b. 15 kVA and Larger: Ventilated.
3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
4. Provide lifting eyes or brackets.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.

C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Provide seismic restraints.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install transformers in accordance with NECA 409 and IEEE C57.94.

E. Use flexible conduit, under the provisions of Section 260533.13, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

F. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.

G. Install transformers plumb and level.

H. Transformer Support:
   1. Provide required support and attachment in accordance with Section 260529, where not furnished by transformer manufacturer.
   2. Use integral transformer flanges to support wall-mounted transformers.
   3. Unless otherwise indicated, mount floor-mounted transformers on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.
   4. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

I. Provide grounding and bonding in accordance with Section 260526.

J. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.

K. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Sections 7.2.1.1 and 7.2.1.2. Tests and inspections listed as optional are not required.
   1. 167 kVA single phase, 500 kVA three phase and smaller:
      a. Perform turns ratio tests at all tap positions.
   2. Larger than 167 kVA single phase and 500 kVA three phase:
      a. Verify that control and alarm settings on temperature indicators are as specified.

b. Perform excitation-current tests on each phase.
c. Measure the resistance of each winding at each tap connection.
d. Perform an applied voltage test on all high- and low-voltage windings-to-ground.

3.4 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from transformer components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 262300 - LOW-VOLTAGE SWITCHGEAR

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Low-voltage (600 V and less) arc-resistant metal-enclosed drawout switchgear and accessories for service and distribution applications.

B. Low-voltage power circuit breakers for switchgear.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
   1. Includes requirements for the seismic qualification of equipment specified in this section.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

G. Section 262100 - Low-Voltage Electrical Service Entrance.
   1. Includes Utility Company contact information.

H. Section 262413 - Switchboards.

I. Section 262419 - Motor-Control Centers.

J. Section 262513 - Low-Voltage Busways.

K. Section 262713 - Electricity Metering: For interface with equipment specified in this section.

L. Section 262813 - Fuses: Fuses for fusible switches.
   1. Includes requirements for spare fuses and spare fuse cabinets.

M. Section 264300 - Surge Protective Devices.

1.3 REFERENCE STANDARDS

A. ANSI C37.50 - American National Standard for Switchgear - Low Voltage AC Power Circuit Breakers Used In Enclosures - Test Procedures 2018.

B. ANSI C37.51 - American National Standard for Switchgear - Metal-Enclosed Low Voltage AC Power Circuit Breaker Switchgear Assemblies - Conformance Test Procedures 2018.

C. IEEE C37.13 - IEEE Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures 2015.

D. IEEE C37.16 - IEEE Standard for Preferred Ratings, Related Requirements, and Application Recommendations for Low-Voltage AC (635 V and below) and DC (3200 V and below) Power Circuit Breakers 2009.

E. IEEE C37.17 - IEEE Standard for Trip Systems for Low-Voltage (1000 V and below) AC and General Purpose (1500 V and below) DC Power Circuit Breakers 2022.

F. IEEE C37.20.1 - IEEE Standard for Metal-Enclosed Low-Voltage (1000 Vac and Below, 3200 Vdc and Below) Power Circuit Breaker Switchgear 2015, with Amendment (2020).

G. IEEE C37.20.7 - IEEE Guide for Testing Switchgear Rated up to 52 kV for Internal Arcing Faults 2017 (Corrigendum 2021).

H. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers 2016.

I. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

J. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

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 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.

N. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.

O. UL 1066 - Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures Current Edition, Including All Revisions.

P. UL 1558 - Switchgear Current Edition, Including All Revisions.

1.4 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.
4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
5. Notify Architect of any conflicts with or deviations Contract Documents. Obtain direction before proceeding with work.

B. Service Entrance Switchgear:
1. Coordinate with Utility Company to provide switchgear 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. See Section 262100 for Utility Company contact information and additional requirements.
4. Obtain Utility Company approval of switchgear prior to fabrication.
5. Preinstallation Meeting: Convene one week prior to commencing work of this section to review requirements with Utility Company representative.
6. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchgear, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, short-time current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Include dimensioned plan and elevation views of switchgear and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.
3. Include documentation demonstrating selective coordination upon request.
4. Include key-type mechanical interlock scheme with sequence of operations, as applicable.
5. Include proposed mimic bus single-line diagram arrangement.
6. Arc-Resistant Switchgear: Include proposed plenum arrangement, where applicable.
7. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Service Entrance Switchgear: Include documentation of Utility Company approval of switchgear.

F. Source Quality Control Test Reports: Include reports for tests designated in IEEE C37.20.1 as production tests.

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. Field Quality Control Test Reports.

I. Project Record Documents: Record actual installed locations of switchgear and final equipment settings.

J. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Enclosure Keys: Two of each different key.
   3. Circuit Breakers:
      a. Handles Necessary for Racking of Devices: One for each electrical room containing drawout switchgear.
      b. Lifting Yokes: One of each different yoke required, for each electrical room containing drawout switchgear.
      c. Removable Covers: One for blocking each different opening size when circuit breaker is temporarily removed from its compartment.
   4. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.6 QUALITY ASSURANCE

A. Conform to 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store switchgear in accordance with manufacturer's instructions and IEEE C37.20.1.

B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchgear, which is 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 switchgear internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Low-Voltage Switchgear - Basis of Design.

B. Low-Voltage Switchgear - Other Acceptable Manufacturers:
1. ABB/GE: www.geindustrial.com/#sle.
2. Eaton Corporation: www.eaton.com/#sle.
3. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
4. Siemens Industry, Inc: www.usa.siemens.com/#sle.

C. Substitutions: See Section 016000 - Product Requirements.

2.2 LOW-VOLTAGE SWITCHGEAR

A. Provide switchgear assemblies 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 standard (non-arc-resistant) type metal-enclosed drawout switchgear complying with IEEE C37.20.1 and ANSI C37.51; listed and labeled as complying with UL 1558; ratings, configurations and features as indicated on the drawings.

D. Configuration:
1. Compartmentalization: Provide barriered compartments for each overcurrent protective device, distribution bus, and rear cable connection area.
2. Arrangement: Rear accessible, front and rear aligned.
3. Rear Access: Bolted covers.

E. Arc-Resistance Rating:
1. Passes criteria for arc-resistant functionality when tested in accordance with applicable requirements of IEEE C37.20.7 for Type 2 accessibility.
2. Arc exhaust gases must be discharged through a plenum into designated area approved by Architect.

3. Arc resistant rating valid through maximum current of not less than the available fault current at the installed location.

F. Service Entrance Switchgear:
   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 for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.
   5. See Section 262100 for additional requirements.

G. Switchgear With Busway Transitions: Configured for bussed connection to busway provided in accordance with Section 262513.

H. Switchgear With Fire Pump Taps: Provide separate bussed vertical section with suitable lugs for fire pump connection to line side of main service disconnect device(s).

I. Provide integral top rail-mounted lifting device where indicated.

J. Seismic Qualification: Provide switchgear and associated components suitable for application under the seismic design criteria specified in Section 260548 where required. Include certification of compliance with submittals.

K. Service Conditions:
   1. Provide switchgear and associated components suitable for operation under the following service conditions without derating:
      a. Altitude: Less than 6,600 feet.
      b. Ambient Temperature: Between -22 degrees F and 104 degrees F.
   2. Provide switchgear and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

L. Short Circuit Current Rating:
   1. Provide switchgear with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

M. Short-Time Current (30-Cycle Withstand) Rating: Equivalent to specified short circuit current rating.

N. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

O. Bussing: Sized in accordance with UL 1558 temperature rise requirements.
   1. Main bus (horizontal cross bus) to be fully rated through full length of switchgear.

2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
3. Provide solidly bonded equipment ground bus through full length of switchgear, 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.

P. 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:

Q. Enclosures:
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. Finish: Manufacturer's standard unless otherwise indicated.
3. Enclosure Space Heaters:
   a. Provide in each switchgear section installed outdoors and in unconditioned indoor spaces.
   b. Size according to manufacturer's recommendations for worst case ambient temperature to prevent condensation.
   c. Heater Control: Thermostat.
   d. Heater Power Source: Provide connection to transformer factory-installed in switchgear or suitable external branch circuit as indicated or as required.
4. 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.
   d. Walk-in Enclosure Features:
      1) Personnel Doors: Open to exterior; equipped with panic hardware.
      2) Aisle lighting, with switch at each access door.
      3) GFCI duplex convenience receptacle.

R. Future Provisions:
1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
2. Arrange and equip through bus and ground bus to accommodate future installation of additional switchgear sections.

S. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list switchgear as a complete assembly including surge protective device.

T. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Provide separate neutral current sensor where applicable.

U. 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.

V. Owner Metering: Comply with Section 262713.

W. 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).
      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.
      h. Real energy (kWh).
      i. Reactive energy (kVARh).
      j. Apparent energy (kVAh).
      k. Current demand.
      l. Power demand: Real, reactive, and apparent.
   3. Meter Accuracy: Plus/minus 1.0 percent.
   4. Features:
      a. Communications Capability: Compatible with system indicated. Provide all accessories necessary for proper interface.
      b. KYZ pulse output.
      c. Adjustable demand interval.
      d. Remote monitoring capability via PC.

X. Instrument Transformers:
   1. Comply with IEEE C57.13.
   2. Select suitable ratio, burden, and accuracy as required for connected devices.
   3. Current Transformers: Connect secondaries to shorting terminal blocks.
   4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.3 LOW-VOLTAGE POWER CIRCUIT BREAKERS

A. Description: Quick-make, quick-break, trip-free low-voltage power circuit breakers with two-step stored energy closing mechanism; 100 percent rated; complying with IEEE C37.13, IEEE C37.16, IEEE C37.17, and ANSI C37.50; listed and labeled as complying with UL 1066; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity: Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.

C. Operation:
   1. Provide manually operated circuit breakers unless otherwise indicated.
   2. Provide electrically operated circuit breakers where indicated.
   3. Pad-Lock Provision: For preventing circuit breaker closing operation.

D. Construction: Drawout.
   1. Allows withdrawal of circuit breaker into test and disconnected positions, with racking position indication (connected, test, disconnected, withdrawn).
   2. Provide safety interlock to prevent racking of circuit breaker while in the ON position.
   3. Pad-Lock Provision: For preventing circuit breaker drawout operation.

E. Fused Circuit Breakers:
   1. Fuses: Class L, selected for coordination with circuit breaker trip units.
   2. Blown Fuse Protection: Provide blown fuse protection to trip circuit breaker in the event of the opening, or absence, of a fuse and to prevent closing of circuit breaker until reset operation is performed; provide blown fuse status indication.
   3. Where fuse is not integral with circuit breaker and mounted in a separate compartment, provide interlock to prevent fuse access with the circuit breaker in the ON position.

F. 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.
         1) Include instantaneous function for feeder circuit breakers.
         2) Omit instantaneous function or provide ability to turn instantaneous function off for main and tie circuit breakers.
      e. Ground fault pickup and delay where ground fault protection is indicated.
   2. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
   3. Provide communication capability where indicated: Compatible with system indicated.

G. 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. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
3. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
4. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.
5. Truck-Operated Cell Switch: For indicating circuit breaker racking position.

2.4 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Factory test switchgear according to IEEE C37.20.1, including the following production tests on each switchgear 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.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the switchgear and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive switchgear.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install switchgear in accordance with NECA 1 (general workmanship) and IEEE C37.20.1.

C. Arrange equipment to provide required clearances and maintenance access, including accommodations for drawout circuit breakers.

D. Provide required support and attachment in accordance with Section 260529.

E. Install switchgear plumb and level.

F. Unless otherwise indicated, mount switchgear on properly sized 4 inch high concrete pad constructed in accordance with Section 033000.

G. Provide grounding and bonding in accordance with Section 260526.

H. Install all field-installed devices, components, and accessories.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Set field-adjustable circuit breaker tripping function settings as indicated.

K. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

L. Identify switchgear in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.

C. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Before energizing switchgear, perform preoperation checks in accordance with IEEE C37.20.1.

E. Inspect and test in accordance with NETA ATS, except Section 4.

F. Perform inspections and tests listed in NETA ATS, Section 7.1.

G. Low-Voltage Power Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.2 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.
   1. Perform insulation-resistance tests on all control wiring with respect to ground.
   2. Test functions of the trip unit by means of secondary injection.

H. 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.

I. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

J. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.

K. Test shunt trips to verify proper operation.

L. Correct deficiencies and replace damaged or defective switchgear assemblies or associated components.

M. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of switchgear covers and doors.

3.5 CLEANING

A. Clean dirt and debris from switchgear enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred surfaces to match original factory finish.

3.6 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchgear 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.

3.7 PROTECTION

A. Protect installed switchgear assemblies from subsequent construction operations.

END OF SECTION

SECTION 262413 - SWITCHBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.

B. Overcurrent protective devices for switchboards.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
   1. Includes requirements for the seismic qualification of equipment specified in this section.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

G. Section 262100 - Low-Voltage Electrical Service Entrance.
   1. Includes Utility Company contact information.

H. Section 262300 - Low-Voltage Switchgear.

I. Section 262513 - Low-Voltage Busways.

J. Section 262813 - Fuses: Fuses for fusible switches.
   1. Includes requirements for spare fuses and spare fuse cabinets.

K. Section 264300 - Surge Protective Devices.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e, with Amendment (2017).

B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers 2016.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

D. NECA 400 - Standard for Installing and Maintaining Switchboards 2007.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.

G. NEMA PB 2 - Deadfront Distribution Switchboards 2011.

H. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards 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 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.

M. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.

N. UL 891 - Switchboards Current Edition, Including All Revisions.

O. UL 977 - Fused Power-Circuit Devices Current Edition, Including All Revisions.

P. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the electrical outage time with the school district for crossover of power when the new switchboard is installed. Do not disconnect power from the school without written authorization.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 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.
   3. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

5. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
6. Notify Architect of any conflicts with or deviations from the 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. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, 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.

C. 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.
1. Include dimensioned plan and elevation views of switchboards 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.

D. Manufacturer's equipment seismic qualification certification.

E. Service Entrance Switchboards: Include documentation of Utility Company approval of switchboard.

F. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 2 as production (routine) tests.

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. Field Quality Control Test Reports.

I. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.

J. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Enclosure Keys: Two of each different key.
3. Electronic Trip Circuit Breakers: Provide one portable test set.
4. Drawout Devices:
   a. Handles Necessary for Racking of Devices: One for each electrical room containing switchgear with drawout devices.
   b. Lifting Yokes: One of each different yoke required, for each electrical room containing drawout devices.
   c. Portable Lifting Devices: One for each electrical room containing switchboards with drawout devices and no integral top rail-mounted lifting device.
   d. Removable Covers: One for blocking each different opening size when device is temporarily removed from its compartment.
5. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.6 QUALITY ASSURANCE

A. Conform to 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 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.

1.8 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Substitutions: See Section 016000 - Product Requirements.

B. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

C. Source Limitations: Furnish switchboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 SWITCHBOARDS

A. Switchboard shall be provided with weatherproof enclosure suitable for outdoor location as required.

B. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. 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.

E. 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.

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 for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.
5. See Section 262100 for additional requirements.

G. Switchboards With Busway Transitions: Configured for bussed connection to busway provided in accordance with Section 262513.

H. Switchboards With Fire Pump Taps: Provide separate bussed vertical section with suitable lugs for fire pump connection to line side of main service disconnect device(s).

I. Switchboards With Drawout Devices: Provide integral top rail-mounted lifting device where indicated.

J. Seismic Qualification: Provide switchboards and associated components suitable for application under the seismic design criteria specified in Section 260548 where required. Include certification of compliance with submittals.

K. 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.

L. 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 indicated on the drawings.
2. 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 260573.
3. Minimum Rating: 65,000 rms symmetrical amperes.
4. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
5. Label equipment utilizing series ratings as required by NFPA 70.

M. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

N. 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.

O. 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.
   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: Aluminum.
   5. Ground Bus Material: Aluminum.

P. 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 unless otherwise indicated.
         2) Provide compression lugs where indicated.

Q. 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. Enclosure Space Heaters:
      a. Size according to manufacturer's recommendations for worst case ambient temperature to prevent condensation.
      b. Heater Control: Thermostat.
      c. Heater Power Source: Provide connection to transformer factory-installed in switchboard or suitable external branch circuit as indicated or as required.
   4. 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.

d. Walk-in Enclosure Features:
   1) Personnel Doors: Open to exterior; equipped with panic hardware.
   2) Aisle lighting, with switch at each access door.
   3) GFCI duplex convenience receptacle.

R. Future Provisions:
   1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
   2. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.

S. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list switchboards as a complete assembly including surge protective device.

T. 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 or residual ground fault detection method unless otherwise indicated.
      b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
      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.

U. 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.

V. Instrument Transformers:
   1. Comply with IEEE C57.13.
   2. Select suitable ratio, burden, and accuracy as required for connected devices.
   3. Current Transformers: Connect secondaries to shorting terminal blocks.
   4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. Fusible Devices:
   1. Fusible Switches:
      a. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings,

configurations, and features as indicated on the drawings.

b. Fuse Clips: As required to accept indicated fuses.
   1) Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

c. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

2. Fused Power-Circuit Devices:
   a. Description: Quick-make, quick-break, dead-front bolted-pressure contact switches and high-pressure butt contact switches listed and labeled as complying with UL 977; ratings, configurations, and features as indicated on the drawings.
   b. Bolted-Pressure Contact Switches: Devices with additional pressure or clamping action provided at both ends of switch blades when blades are in the fully closed position.
   c. High-Pressure Butt Contact Switches: Devices with butt-type contacts and spring-charged mechanism.
   d. Minimum Short Circuit Current Rating: 200,000 rms symmetrical amperes when protected by Class L fuses.
   e. Fuse Clips: As required to accept Class L fuses.
   f. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
   g. 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) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating switch position.
      3) Blown fuse protection and indication.

B. 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. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
      c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
   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.
   1) Provide thermal magnetic circuit breakers unless otherwise indicated.
   2) Provide electronic trip circuit breakers where indicated.

b. Minimum Interrupting Capacity:
   1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
   2) 14,000 rms symmetrical amperes at 480 VAC.

c. 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.
   1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
   2) Provide interchangeable trip units where indicated.

d. 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.
      (c) Short time pickup and delay.
      (d) Instantaneous pickup.
      (e) Ground fault pickup and delay where ground fault protection is indicated.
   2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
   3) Provide communication capability where indicated: Compatible with system indicated.

e. Provide the following circuit breaker types where indicated:
   1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
   2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

f. 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) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
4) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
5) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

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. Operation:
      1) Provide manually operated circuit breakers unless otherwise indicated.
      2) Provide electrically operated circuit breakers where indicated.
      3) Pad-Lock Provision: For preventing circuit breaker closing operation.
   c. Construction:
      1) Provide fixed-mount circuit breakers unless otherwise indicated.
      2) Provide drawout circuit breakers where indicated.
   d. Drawout Circuit Breakers:
      1) Allows withdrawal of circuit breaker into test and disconnected positions, with racking position indication (connected, test, disconnected, withdrawn).
      2) Provide safety interlock to prevent racking of circuit breaker while in the ON position.
      3) Pad-Lock Provision: For preventing circuit breaker drawout operation.
   e. Minimum Interrupting Capacity:
      1) 42,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      2) 65,000 rms symmetrical amperes at 480 VAC.
   f. 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.

2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
3) Provide communication capability where indicated: Compatible with system indicated.

g. Provide the following circuit breaker types where indicated:
1) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

h. 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) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
3) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
4) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.4 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. 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

3.1 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.

3.2 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 260529.

F. Provide required seismic controls in accordance with Section 260548.

G. Install switchboards plumb and level.

H. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Section 033000.

I. Provide grounding and bonding in accordance with Section 260526.

J. Install all field-installed devices, components, and accessories.

K. Provide fuses complying with Section 262813 for fusible switches as indicated.

L. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

M. Set field-adjustable circuit breaker tripping function settings as indicated.

N. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

O. Provide filler plates to cover unused spaces in switchboards.

P. Identify switchboards in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.

C. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.

E. Inspect and test in accordance with NETA ATS, except Section 4.

F. Perform inspections and tests listed in NETA ATS, Section 7.1.

G. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

H. 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 _____ amperes. Tests listed as optional are not required.

I. 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.

J. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

K. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.

L. Test shunt trips to verify proper operation.

M. Correct deficiencies and replace damaged or defective switchboards or associated components.

N. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of switchboard covers and doors.

3.5 CLEANING

A. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

B. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.

C. Repair scratched or marred surfaces to match original factory finish.

3.6 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. 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.

3.7 PROTECTION

A. Protect installed switchboards from subsequent construction operations.

END OF SECTION

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SECTION 262416 - PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
   1. Includes requirements for the seismic qualification of equipment specified in this section.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

G. Section 262200 - Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.

H. Section 262813 - Fuses: Fuses for fusible switches and spare fuse cabinets.

I. Section 264300 - Surge Protective Devices.

1.3 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.

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.

1.4 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 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 Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

C. 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.

D. Manufacturer's equipment seismic qualification certification.

E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

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 locations of panelboards and actual installed circuiting arrangements.

I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Panelboard Keys: Two of each different key.

1.6 QUALITY ASSURANCE

A. Conform to 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 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.

1.8 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.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

E. Substitutions: See Section 016000 - Product Requirements.

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.

2.2 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 260548 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.

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.

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.

K. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

L. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list and label panelboards as a complete assembly including surge protective device.

M. 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.

N. 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.

O. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

P. 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.

Q. Provide the following features and accessories where indicated or where required to complete installation:
1. Feed-through lugs.
2. Sub-feed lugs.

2.3 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution 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: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase and Neutral Bus Material: Aluminum.
   2. Ground Bus Material: Aluminum.

D. Circuit Breakers:
   1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
   2. Provide thermal magnetic circuit breakers unless otherwise indicated.
   3. Provide electronic trip circuit breakers where indicated.

E. Enclosures:
   1. Provide surface-mounted enclosures unless otherwise indicated.
   2. Fronts: Provide trims to cover access to load terminals, wiring gutters, and other live parts, with exposed access to overcurrent protective device handles.
   3. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   4. 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.
   5. Provide clear plastic circuit directory holder mounted on inside of door.

2.4 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: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Aluminum.
   3. Ground Bus Material: Aluminum.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:

1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Fusible Switches:
1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
2. Fuse Clips: As required to accept indicated fuses.
3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
4. Conductor Terminations:
   a. Provide compression lugs unless otherwise indicated.
   b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

B. Molded Case Circuit Breakers:
1. 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.
2. Interrupting Capacity:
   a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      2) 14,000 rms symmetrical amperes at 480 VAC.
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
   a. Provide compression lugs unless otherwise indicated.
   b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. 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.
   a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
   b. Provide interchangeable trip units where indicated.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   a. Provide the following field-adjustable trip response settings:

1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
2) Long time delay.
3) Short time pickup and delay.
4) Instantaneous pickup.
5) Ground fault pickup and delay where ground fault protection is indicated.

b. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
c. Provide communication capability where indicated: Compatible with system indicated.

6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
   a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
   c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
   d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
   e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
8. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
9. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
10. Do not use tandem circuit breakers.
11. Do not use handle ties in lieu of multi-pole circuit breakers.
12. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
13. Provide the following features and accessories where indicated or where required to complete installation:
    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
    c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
    d. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
    e. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.6 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.1 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.

3.2 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 260529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. 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.

I. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.

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 260526.

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. Provide fuses complying with Section 262813 for fusible switches as indicated.

N. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

O. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

P. Set field-adjustable circuit breaker tripping function settings as indicated.

Q. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 260573.

R. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

S. Provide filler plates to cover unused spaces in panelboards.

T. 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.

U. Identify panelboards in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. 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 _____ amperes. Tests listed as optional are not required.
1. Perform insulation-resistance tests on all control wiring with respect to ground.
2. Test functions of the trip unit by means of secondary injection.

E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

F. Test GFCI circuit breakers to verify proper operation.

G. Test AFCI circuit breakers to verify proper operation.

H. Test shunt trips to verify proper operation.

I. 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.

J. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 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.

3.5 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

SECTION 262713 - ELECTRICITY METERING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Equipment for Owner electricity metering:
   1. Single circuit electricity meters.
   2. Multi-circuit electricity meters.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260533.16 - Boxes for Electrical Systems: Cabinets and enclosures for metering system components.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262100 - Low-Voltage Electrical Service Entrance: Requirements for Utility Company electricity metering.

F. Section 262300 - Low-Voltage Switchgear: For interface with meters specified in this section.

G. Section 262413 - Switchboards: For interface with meters specified in this section.

H. Section 262416 - Panelboards: For interface with meters specified in this section.

I. Section 262419 - Motor-Control Centers: For interface with meters specified in this section.

J. Section 262813 - Fuses.
   1. Includes requirements for spare fuses and spare fuse cabinets.

1.3 REFERENCE STANDARDS

A. ANSI C12.1 - Electric Meters - Code for Electricity Metering 2022.

B. ANSI C12.20 - American National Standard for Electricity Meters - 0.1, 0.2, and 0.5 Accuracy Classes 2018, with Errata.

C. IEC 62053-21 - Electricity Metering Equipment - Particular Requirements - Part 21: Static Meters for AC Active Energy (Classes 0,5, 1 and 2) 2020.

D. IEC 62053-22 - Electricity Metering Equipment - Particular Requirements - Part 22: Static Meters for AC Active Energy (Classes 0,1S,0,2S and 0,5S) 2020.

E. IEC 62053-23 - Electricity Metering Equipment - Particular Requirements - Part 23: Static Meters for Reactive Energy (Classes 2 and 3) 2020.

F. IEEE 1459 - IEEE Standard Definitions for the Measurement of Electric Power Quantities Under Sinusoidal, Nonsinusoidal, Balanced, or Unbalanced Conditions 2010.

G. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers 2016.

H. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

I. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

J. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work to provide equipment suitable for interface with electricity metering systems to be provided.
   2. Coordinate the work with other installers to provide communication lines required for electricity metering system interface.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Conduct meeting with facility representative and other related equipment manufacturers to discuss electricity metering system interface requirements.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for electricity metering systems and associated components and accessories. Include ratings, configurations, standard wiring diagrams, dimensions, service condition requirements, and installed features.

C. Shop Drawings: Include system interconnection schematic diagrams showing all factory and field connections. Include requirements for interface with other systems.

D. 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.

E. Field Quality Control Test Reports.

F. Project Record Documents: Record actual installed locations of meters and final equipment settings.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Enclosure Keys: Two of each different key.
   3. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.6 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Electricity Meters - Basis of Design: Veris Industries as indicated under product description below;

B. Electricity Meters - Other Acceptable Manufacturers:
   1. Veris Industries; E5x Series Enhanced Power and Energy Meter:
   2. Same as manufacturer of electrical distribution equipment used for this project.
      a. ABB/GE: www.geindustrial.com/#sle.

b. Eaton Corporation: www.eaton.com/#sle.
c. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
d. Siemens Industry, Inc: www.usa.siemens.com/#sle.

C. Substitutions: See Section 016000 - Product Requirements.

D. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

E. Source Limitations: Furnish electricity meters produced by a single manufacturer and obtained from a single supplier.

2.2 EQUIPMENT FOR OWNER ELECTRICITY METERING

A. Provide microprocessor-based digital electricity metering systems including all instrument transformers, wiring, and connections necessary for measurements specified.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide electricity metering systems and associated components compatible with the equipment and associated circuits to be metered.

D. Service Conditions: Provide electricity meters suitable for operation under the service conditions at the installed location.

E. Enclosures:
1. Where not furnished by manufacturer, provide required cabinets and enclosures in accordance with Section 260533.16.
2. 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 or Type 4.
3. Provide lockable door(s) for outdoor locations.
4. Finish: Manufacturer's standard unless otherwise indicated.

F. Instrument Transformers:
1. Comply with IEEE C57.13, where applicable.
2. Select suitable ratio, burden, and accuracy as required for connected devices.
3. Current Transformers: Compatible with connected meters; replace meters damaged by connection of incompatible current transformers. Provide shorting terminal blocks for connection of secondaries where applicable.
4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

G. Interface with Other Work:
1. Interface with electrical power monitoring system.

2. Interface with building automation system.

2.3 SINGLE CIRCUIT ELECTRICITY METERS

A. Single Circuit Electricity Meter - Basis of Design: Veris Industries; E5x Series Enhanced Power and Energy Meter with LCD screen interface; 5-year warranty; utilizes voltage mode CTs that do not require terminal shorting blocks; compatible with solid-core, split-core, and rope CTs.
   1. Accuracy:
      a. Real/Active Power/Energy: Revenue grade; plus/minus 0.2 percent, complying with ANSI C12.20 accuracy and IEC 62053-22, Class 0.2S.
      b. Reactive Power/Energy: Plus/minus 2.0 percent, complying with IEC 62053-23, Class 2.
   2. Measured Parameters:
      a. Real/active energy (kWh); per phase and total of all phases.
      b. Reactive energy (kVARh) and apparent energy (kVAh); total of all phases.
      c. Net present demand over a user-specified interval (block or sliding window); real/active power (kW), reactive power (kVAR), and apparent power (kVA).
      d. Maximum (peak) demand intervals; real/active power (kW), reactive power (kVAR), and apparent power (kVA).
      e. Real/active power (kW), reactive power (kVAR), and apparent power (kVA); per phase and total of all phases.
      f. Models Available with Bi-directional Energy Measurements:
         1) Real/active energy (kWh) and apparent energy (kVAh); imported (from the grid), exported (to the grid), and signed net total.
         2) Reactive energy (kVARh); imported (from the grid) and exported (to the grid), per quadrant as defined by IEEE 1459.
         3) Maximum demand; real/active power (kW), reactive power (kVAR), and apparent power (kVA); imported (from the grid) and exported (to the grid).
      g. Current; per phase and average of all phases.
      h. Voltage; line-to-line and line-to-neutral; per phase and average of all phases.
      i. Power factor; per phase and average of all phases.
      j. Frequency.
   3. Models Available with Data Logging: Logs and retains in non-volatile memory up to 5760 measurement records at time intervals determined by Demand Interval duration setting (up to 60 days of readings at 15 minute intervals).
   4. Alarm capability, with configurable setpoints.
      a. Low power factor.
      b. Current over range.
      c. Voltage over range.
      d. Frequency out of range.
      e. Models available with pulse output overrun.

5. Models Available with Pulse Contact Accumulator Input(s): Up to two; user-configurable to support measurement of other related energy values (gas, water, steam, etc.) using pulse-output transducers.
6. Outputs:
   a. Models Available with Phase Loss Alarm Output: One; user-configurable phase loss threshold.
   b. Models Available with Pulse Output(s): Up to two.
7. Communications: Compatible with connected systems. Provide all accessories necessary for proper interface.
   a. Models available with Serial Communications:
      1) RS-485, 2-wire; support for Modbus RTU protocol.
      2) RS-485, 2-wire; support for BACnet MS/TP protocol.
      3) LON FT, 2-wire; support for LonTalk protocol.

2.4 MULTI-CIRCUIT ELECTRICITY METERS

A. Multi-Circuit Electricity Meter - Basis of Design: Veris Industries; E3x Series Panelboard Monitoring System; 5-year warranty; utilizes voltage mode CTs that do not require shorting terminal blocks.
   1. Metering Capacity: As indicated or as required for circuits to be monitored (configurations available for monitoring up to 84 branch circuits, two 3-phase main devices, and two neutrals with one meter).
   2. Accuracy:
      a. Real/Active Power/Energy (for models that measure this parameter): Revenue grade; plus/minus 1.0 percent (including branch CTs); complying with ANSI C12.1 and IEC 62053-21, Class 1.
      b. Voltage (for models that measure this parameter): Plus/minus 0.5 percent.
      c. Current: Plus/minus 0.5 percent.
   3. Measured Parameters at Main Device:
      a. Current; per phase and average of all phases.
      b. Maximum current; per phase and maximum average of all phases.
      c. Current demand; per phase and average of all phases.
      d. Maximum current demand; per phase and maximum average of all phases.
      e. Models available with measurements for:
         1) Current phase angle.
         2) Real/active energy (kWh); per phase and total of all phases.
         3) Snapshot of total energy as of the completion of the most recent demand interval; per phase and total of all phases.
         4) Real/active power (kW); per phase and total of all phases; available signed to indicate whether energy is being imported or exported.
         5) Apparent power (kVA); per phase and total of all phases.

6) Power factor; per phase and total, based on three-phase breaker rotation, signed, to indicate leading or lagging current.
7) Voltage, line-to-line and line-to neutral; per phase and average of all phases.
8) Voltage phase angle.
9) Frequency; phase A.

4. Measured Parameters at Branch Circuits:
   a. Current; per branch and average of all phases for multi-phase logical circuits.
   b. Maximum current; per branch and maximum average of all phases for multi-phase logical circuits.
   c. Current demand; per branch and average of all phases for multi-phase logical circuits.
   d. Maximum current demand; per branch and maximum average of all phases for multi-phase logical circuits.
   e. Models available with measurements for:
      1) Current phase angle.
      2) Real/active power (kW); per branch and total of all phases for multi-phase logical circuits; available signed to indicate whether energy is being imported or exported.
      3) Real/active power (kW) demand; per branch and total of all phases for multi-phase logical circuits.
      4) Real/active power (kW) demand maximum; per branch and total of all phases for multi-phase logical circuits.
      5) Real/active energy (kWh); per branch and total of all phases for multi-phase logical circuits.
      6) Snapshot of total energy as of the completion of the most recent demand interval; per branch and total of all phases for multi-phase logical circuits.
      7) Apparent power (kVA); per branch and total of all phases for multi-phase logical circuits.
      8) Power factor; per branch and average of all phases for multi-phase logical circuits, signed to indicate leading or lagging current.
5. Alarm capability, with configurable setpoints.
   a. Current over/under range.
   b. Models available with voltage over/under range.
6. Communications: Compatible with connected systems. Provide all accessories necessary for proper interface.
   a. Models Available with Serial Communications:
      1) RS-485, 2-wire or 4-wire; support for Modbus RTU protocol.
      2) RS-485, 2-wire; support for Modbus RTU and BACnet MS/TP protocols.
   b. Models Available with Ethernet Communications:

1) Without RJ-45 10/100 Mbit; requires Modbus TCP Gateway; support for Modbus TCP protocol.
2) With RJ-45 10/100 Mbit; support for Modbus TCP, BACnet IP, and SNMP protocols.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of metering systems and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive meters.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Provide required support and attachment components in accordance with Section 260529.

D. Provide grounding and bonding in accordance with Section 260526.

E. Provide fuses complying with Section 262813 as required.

F. Identify meters and associated wiring in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

D. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.

E. Correct deficiencies and replace damaged or defective metering system components.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4 ADJUSTING

A. Program system parameters according to requirements of Owner.

3.5 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.6 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
   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.

3.7 PROTECTION

A. Protect installed system components from subsequent construction operations.

END OF SECTION

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SECTION 262726 - WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Fan speed controllers.

D. Receptacles.

E. Wall plates.

F. Floor box service fittings.

G. Poke-through assemblies.

H. Access floor boxes.

1.2 RELATED REQUIREMENTS

A. Section 096900 - Access Flooring.

B. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

C. Section 260526 - Grounding and Bonding for Electrical Systems.

D. Section 260533.16 - Boxes for Electrical Systems.

E. Section 260533.23 - Surface Raceways for Electrical Systems: Surface raceway systems, including multioutlet assemblies.

F. Section 260539 - Underfloor Raceways for Electrical Systems.

G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 260583 - Wiring Connections: Cords and plugs for equipment.

I. Section 260923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

J. Section 271000 - Structured Cabling: Voice and data jacks.

1.3 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).

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 1449 - Standard for Surge Protective Devices Current Edition, Including All Revisions.

M. UL 1472 - Solid-State Dimming Controls Current Edition, Including All Revisions.

1.4 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.
   5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
   6. Notify 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.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. 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.

C. Samples: One for each type and color of device and wall plate specified.

D. Certificates for Surge Protection Receptacles: Manufacturer's documentation of listing for compliance with UL 1449.

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.

G. 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.

H. Project Record Documents: Record actual installed locations of wiring devices.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
   3. Extra Keys for Locking Switches: Two of each type.
   4. Extra Surge Protection Receptacles: Two of each type.
   5. Extra Wall Plates: One of each style, size, and finish.
   6. Extra Flush Floor Service Fittings: Two of each type.
   7. Extra Poke-Through Core Hole Closure Plugs: Two for each core size.

1.6 QUALITY ASSURANCE

A. Conform to 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. 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.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.1 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.

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.

2.2 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. Wiring Devices Installed _____: White with white nylon wall plate.

G. Isolated Ground Convenience Receptacles: Orange.

H. Surge Protection Receptacles: Blue.

I. Wiring Devices Connected to Emergency Power: Red with red nylon 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. Flush Poke-Through Service Fittings: Gray wiring devices with aluminum cover and aluminum flange.

M. Access Floor Boxes: Gray wiring devices with gray steel cover with insert to match floor covering.

2.3 WALL SWITCHES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. 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 20and 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.

C. 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.

D. 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, three way, or four way as indicated on the drawings.

E. 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.

F. Locking Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever 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.

G. 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.

H. Locking Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V 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.

2.4 WALL DIMMERS

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.

2.5 RECEPTACLES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc; _____: www.leviton.com/#sle.
3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/#sle.
4. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
5. Substitutions: See Section 016000 - Product Requirements.
6. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. 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.
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.

C. 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 SE 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 SE 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.

D. 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.
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 SE 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 SE suitable for installation in damp or wet locations.

2.6 WALL PLATES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
3. Lutron Electronics Company, Inc: www.lutron.com/#sle.
4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. 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.

C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

E. Brass Wall Plates: Brushed satin finish, factory-coated to inhibit oxidation.

F. Aluminum Wall Plates: Smooth satin finish, clear anodized, factory-coated to inhibit oxidation.

G. Chrome Wall Plates: Smooth finish, chrome plated steel.

H. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

I. Premarked Wall Plates: Factory labeled as indicated; hot stamped for nylon wall plates and engraved for metal wall plates.

J. 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.

K. Weatherproof Covers for Wet 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.

2.7 FLOOR BOX SERVICE FITTINGS

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Thomas & Betts Corporation: www.tnb.com/#sle.
3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: Service fittings compatible with floor boxes provided under Section 260533.16 with components, adapters, and trims required for complete installation.

C. Above-Floor Service Fittings:
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.
   b. Voice and Data Jacks: As specified in Section 271000.
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.
      3) Voice and Data Jacks: As specified in Section 271000.
   b. Provide barrier to separate line and low voltage compartments.

D. 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.
   b. Configuration: _____.
   c. Voice and Data Jacks: As specified in Section 271000.
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).
      2) Communications:
      3) Voice and Data Jacks: As specified in Section 271000.
      4) Voice and Data Jacks: Provided by others.
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.

7. Products:
    a. Hubbell Incorporated: www.hubbell.com/#sle.

2.8 POKE-THROUGH ASSEMBLIES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Thomas & Betts Corporation: www.tnb.com/#sle.
3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

C. Above-Floor Service Fittings:
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.
    b. Voice and Data Jacks: As specified in Section 271000.
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.
        3) Voice and Data Jacks: As specified in Section 271000.
    b. Provide barrier to separate line and low voltage compartments.
5. Products:
    a. Hubbell Incorporated: www.hubbell.com/#sle.
    b. Substitutions: See Section 016000 - Product Requirements.

D. Flush Floor Service Fittings:
1. Single Service Flush Convenience Receptacles:
    a. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).
2. Single Service Flush Communications Outlets:
    a. Configuration: _____.
    b. Voice and Data Jacks: As specified in Section 271000.
3. Single Service Flush Furniture Feed:
    a. Configuration: One 2 inch by 1-1/4 inch combination threaded opening(s).
4. Dual Service Flush Combination Outlets:
    a. Cover: Hinged door(s).
    b. Configuration:

1) Power: One standard convenience duplex receptacle(s).
2) Communications:
3) Voice and Data Jacks: As specified in Section 271000.

5. Dual Service Flush Furniture Feed:
   a. Configuration:
      1) Power: One 3/4 inch threaded opening(s).
      2) Communications: Two 1/2 inch threaded opening(s).
6. Accessories:
   a. Closure Plugs: Size and fire rating as required to seal unused core hole and maintain fire rating of floor.

2.9 ACCESS FLOOR BOXES

A. Manufacturers - Access Floor Boxes:
   1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
   2. Thomas & Betts Corporation: www.tnb.com/#sle.
   3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Manufacturers - Access Floor Boxes with Pre-wired Connectors for Manufactured Wiring Systems:
   1. AFC Cable Systems Inc: www.afcweb.com/#sle.
   2. RELOC Wiring Solutions, a brand of Acuity Brands, Inc: www.relocwiring.com/#sle.
   3. Wiremold, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.
   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.

C. Description: Metallic multi-service box suitable for mounting in access floor system specified in Section 096900.

D. Access floor boxes with pre-wired connectors for manufactured wiring systems are permitted only where manufactured wiring systems are permitted as specified in Section 260519.

E. Configuration:
   1. Power: Two standard convenience duplex receptacle(s).
   2. Communications:
   3. Voice and Data Jacks: Provided by others.

PART 3 EXECUTION

3.1 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 core drilled holes for poke-through assemblies are in proper locations.

H. Verify that openings in access floor are in proper locations.

I. Verify that conditions are satisfactory for installation prior to starting work.

3.2 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.

3.3 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533.16 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.
      b. Wall Dimmers: 48 inches above finished floor.
      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 Architect to obtain direction prior to proceeding with work.
   5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. 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.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. 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.

I. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

J. 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.

K. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

L. Install wiring devices plumb and level with mounting yoke held rigidly in place.

M. Install wall switches with OFF position down.

N. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

O. Do not share neutral conductor on branch circuits utilizing wall dimmers.

P. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

Q. 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.

R. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

S. Identify wiring devices in accordance with Section 260553.

T. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Inspect each surge protection receptacle to verify surge protection is active.

G. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 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 Architect.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 262813 - FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.2 RELATED REQUIREMENTS

A. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

B. Section 262413 - Switchboards: Fusible switches.

C. Section 262416 - Panelboards: Fusible switches.

D. Section 262419 - Motor-Control Centers: Fusible switches.

E. Section 262513 - Low-Voltage Busways: Fusible switches.

F. Section 262816.16 - Enclosed Switches: Fusible switches.

G. Section 262913 - Enclosed Controllers: Fusible switches.

1.3 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.

H. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
      a. Fusible Switches for Switchboards: See Section 262413.
      b. Fusible Switches for Panelboards: See Section 262416.
      c. Fusible Switches for Motor Control Centers: See Section 262419.
      d. Fusible Switches for Busway: See Section 262501.
      e. Fusible Enclosed Switches: See Section 262816.16.
      f. Fusible Switches for Enclosed Motor Controllers: See Section 262913.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. 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.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Fuses: One set(s) of three for each type and size installed.
   3. Fuse Pullers: One set(s) compatible with each type and size installed.
   4. Spare Fuse Cabinet Keys: Two.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

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

2.1 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com/#sle.

B. Littelfuse, Inc: www.littelfuse.com/#sle.

C. Mersen: ep-us.mersen.com/#sle.

D. Substitutions: See Section 016000 - Product Requirements.

2.2 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.

2.3 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.

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.

H. Class L Fuses: Comply with UL 248-10.

I. Class CC Fuses: Comply with UL 248-4.

2.4 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.

PART 3 EXECUTION

3.1 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.

3.2 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 where indicated.

D. Identify spare fuse cabinet in accordance with Section 260553.

END OF SECTION

SECTION 262816.13 - ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed circuit breakers.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
   1. Includes requirements for the seismic qualification of equipment specified in this section.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.3 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. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

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. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.

J. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.

K. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within 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. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of circuit breaker upon request.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of enclosed circuit breakers 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.

D. Manufacturer's equipment seismic qualification certification.

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, installation, and starting of product.

G. Project Record Documents: Record actual installed locations of enclosed circuit breakers.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.6 QUALITY ASSURANCE

A. Conform to 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature between 23 degrees F and 104 degrees F during and after installation of enclosed circuit breakers.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

E. Substitutions: See Section 016000 - Product Requirements.

F. Source Limitations: Furnish enclosed circuit breakers and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Seismic Qualification: Provide enclosed circuit breakers and associated components suitable for application under the seismic design criteria specified in Section 260548 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 23 degrees F and 104 degrees F.

E. Short Circuit Current Rating:
   1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location indicated on the drawings.
   2. Provide enclosed circuit breakers 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 260573.
   3. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
   4. Label equipment utilizing series ratings as required by NFPA 70.

F. Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Provide thermal magnetic circuit breakers unless otherwise indicated.

I. Provide electronic trip circuit breakers where indicated.

J. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

K. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

L. 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. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
3. Provide surface-mounted enclosures unless otherwise indicated.

M. Provide externally operable handle with means for locking in the OFF position.

N. 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 circuit breakers 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.
   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.

O. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

2.3 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. Interrupting Capacity:
1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
   a. 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
   b. 14,000 rms symmetrical amperes at 480 VAC.
2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.

C. Conductor Terminations:
1. Provide compression lugs unless otherwise indicated.
2. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

D. 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.

1. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
2. Provide interchangeable trip units where indicated.

E. 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.
      c. Short time pickup and delay.
      d. Instantaneous pickup.
      e. Ground fault pickup and delay where ground fault protection is indicated.
   2. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
   3. Provide communication capability where indicated: Compatible with system indicated.

F. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

G. Provide the following circuit breaker types where indicated:
   1. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   2. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
   3. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

H. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.

I. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.

J. 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. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
   3. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
   4. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 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 260529.

E. Provide required seismic controls in accordance with Section 260548.

F. Install enclosed circuit breakers plumb.

G. Install flush-mounted enclosed circuit breakers so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

I. Provide grounding and bonding in accordance with Section 260526.

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 indicated.

L. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

M. Identify enclosed circuit breakers in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers used for service entrance and for circuit breakers larger than _____ amperes. Tests listed as optional are not required.

D. 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.

E. Test GFCI circuit breakers to verify proper operation.

F. Test shunt trips to verify proper operation.

G. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from circuit breaker enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 262816.16 - ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed safety switches.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260548 - Vibration and Seismic Controls for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262813 - Fuses.

F. Section 262913 - Enclosed Controllers: Manual motor controllers.

G. Section 263600 - Transfer Switches: Automatic and non-automatic switches listed for use as transfer switch equipment.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.

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. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within 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. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

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, installation, and starting of product.

G. Project Record Documents: Record actual locations of enclosed switches.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.6 QUALITY ASSURANCE

A. Conform to 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

B. General Electric Company: www.geindustrial.com/#sle.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

E. Substitutions: See Section 016000 - Product Requirements.

F. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 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 260548 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:
   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 indicated on the drawings.
   2. Minimum Ratings:
      a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
      b. General Duty Single Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.
      c. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
      d. 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.
   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 unless otherwise indicated.
      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. General Duty Switches:
   1. Conductor Terminations:
      a. Provide mechanical lugs.
      b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Provide externally operable handle with means for locking in the OFF position, capable of accepting two padlocks.

R. 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

3.1 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.

3.2 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 260529.

E. Install enclosed switches plumb.

F. 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.

G. Provide grounding and bonding in accordance with Section 260526.

H. Provide fuses complying with Section 262813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Identify enclosed switches in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 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

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SECTION 262913 - ENCLOSED CONTROLLERS

PART 2 PRODUCTS

1.1 ENCLOSED CONTROLLERS

A. Provide enclosed controller assemblies 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: Enclosed controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.

D. Service Conditions:
   1. Provide controllers and associated components suitable for operation under the following service conditions without derating:
      a. Altitude:
         1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet.
         2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet.
      b. Ambient Temperature: Between 32 degrees F and 104 degrees F.
   2. Provide controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

E. Short Circuit Current Rating:

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Enclosures:
   1. Comply with NEMA ICS 6.
   2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   3. Finish: Manufacturer's standard unless otherwise indicated.

H. Instrument Transformers:
   1. Comply with IEEE C57.13.
   2. Select suitable ratio, burden, and accuracy as required for connected devices.
   3. Current Transformers: Connect secondaries to shorting terminal blocks.
   4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

1.2 OVERCURRENT PROTECTIVE DEVICES

A. Overload Relays:
   1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
   2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
   3. Trip-free operation.
   4. Visible trip indication.
   5. Resettable.
      a. Employ manual reset unless otherwise indicated.
      b. Do not employ automatic reset with two-wire control.

END OF SECTION

SECTION 264300 - SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surge protective devices for service entrance locations.

B. Surge protective devices for distribution locations.

C. Surge protective devices for branch panelboard locations.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 262300 - Low-Voltage Switchgear.

C. Section 262413 - Switchboards.

D. Section 262416 - Panelboards.

E. Section 262419 - Motor-Control Centers.

F. Section 262513 - Low-Voltage Busways.

1.3 ABBREVIATIONS AND ACRONYMS

A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.

B. SPD: Surge Protective Device.

1.4 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 1283 - Standard for Electromagnetic Interference Filters Current Edition, Including All Revisions.

F. UL 1449 - Standard for Surge Protective Devices Current Edition, Including All Revisions.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.6 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:
   1. UL 1449.
   2. UL 1283 (for Type 2 SPDs).

E. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.

F. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

G. Project Record Documents: Record actual connections and locations of surge protective devices.

1.7 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.9 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

C. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Factory-installed, Internally Mounted Surge Protective Devices:
   1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.

B. Substitutions: See Section 016000 - Product Requirements.

C. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

2.2 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   1. Indoor clean, dry locations: Type 1.
   2. Outdoor locations: Type 3R.

C. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
   1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.
   2. Provide flush-mounted SPD where mounted in public areas or adjacent to flush-mounted equipment.

D. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.

2.3 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.

B. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

D. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.

E. Repetitive Surge Current Capacity: Not less than 5,000 impulses.

F. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

2.4 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.

B. List and label as complying with UL 1449, Type 1 or Type 2.

C. Distribution locations include SPDs connected to distribution panelboards, motor control centers, and busway.

D. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

E. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.

F. Repetitive Surge Current Capacity: Not less than 3,500 impulses.

G. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

2.5 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.

B. List and label as complying with UL 1449, Type 1 or Type 2.

C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

D. Surge Current Rating: Not less than 60 kA per mode/120 kA per phase.

E. Repetitive Surge Current Capacity: Not less than 2,000 impulses.

F. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.

D. Verify system grounding and bonding is in accordance with Section 260526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.

E. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.

F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 260526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Section 7.19.1.

D. 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.

3.4 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 265600 - EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior luminaires.

B. Poles and accessories.

C. Luminaire accessories.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260533.16 - Boxes for Electrical Systems.

E. Section 260548 - Vibration and Seismic Controls for Electrical Systems.

F. Section 260923 - Lighting Control Devices: Automatic controls for lighting including outdoor motion sensors, time switches, and outdoor photo controls.

G. Section 262726 - Wiring Devices: Receptacles for installation in poles.

H. Section 262813 - Fuses.

I. Section 265100 - Interior Lighting.

1.3 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices current edition.

B. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals 2013, with Editorial Revision (2022).

C. 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 2023.

D. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code) 1989 (Corrigendum 2019).

E. IEEE C2 - National Electrical Safety Code(R) (NESC(R)) 2023.

F. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).

G. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information 2019.

H. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products 2019.

I. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources 2021.

J. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

K. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems 2000 (Reaffirmed 2006).

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 1598 - Luminaires Current Edition, Including All Revisions.

O. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits Current Edition, Including All Revisions.

P. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
   2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. 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 upon request.
3. Provide structural calculations for each pole proposed for substitution.

C. 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. Lamps: Include rated life and initial and mean lumen output.
4. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

D. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.

E. Samples:
1. Provide one sample(s) of each specified luminaire where indicated.

F. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

G. Field Quality Control Reports.
1. Include test report indicating measured illumination levels.

H. 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 starting of product.

I. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.
3. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.
4. Extra Fuses: Five percent of total quantity installed for each type, but not less than two of each type.

5. Touch-Up Paint: 2 gallons, to match color of pole finish.

K. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.6 QUALITY ASSURANCE

A. Conform to 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 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.

1.8 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide three year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. 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.

E. 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.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. 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.

I. 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. Color Rendering Index (CRI): Not less than 90.

J. Exposed Hardware: Stainless steel.

2.3 LED DRIVERS

A. 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.

B. 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.

2.4 POLES

A. All Poles:
   1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
   2. Structural Design Criteria:
      a. Comply with AASHTO LTS.

b. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.

3. Material: Steel, unless otherwise indicated.
4. Shape: Square straight, unless otherwise indicated.
5. Finish: Match luminaire finish, unless otherwise indicated.
6. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
7. Unless otherwise indicated, provide with the following features/accessories:
   a. Top cap.
   b. Anchor bolts with leveling nuts or leveling shims.
   c. Anchor base cover.
   d. Provision for pole-mounted weatherproof GFI receptacle where indicated.
   e. Hinged base.

B. Metal Poles: Provide ground lug, accessible from handhole or transformer base.

2.5 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

3.1 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.

3.2 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.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533.16 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 260529.

F. Provide required seismic controls in accordance with Section 260548.

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:
   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. Foundation-Mounted Poles:
      a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 033000.
         1) Install anchor bolts plumb per template furnished by pole manufacturer.
         2) Position conduits to enter pole shaft.

b. Install foundations plumb.
c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
d. Tighten anchor bolt nuts to manufacturer's recommended torque.
e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
f. Install anchor base covers or anchor bolt covers as indicated.

3. Embedded Poles: Install poles plumb as indicated.
4. 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 260526 at each pole bonded to grounding system as indicated.
5. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
6. Install non-breakaway in-line fuse holders and fuses complying with Section 262813 in pole handhole or transformer base for each ungrounded conductor.
7. Install weather resistant GFI duplex receptacle with weatherproof cover as specified in Section 262726 in designated poles.

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.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

E. Measure illumination levels at night with calibrated meters to verify conformance with performance requirements. Record test results in written report to be included with submittals.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. 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 Architect.

3.6 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.

3.7 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

3.9 ATTACHMENTS

A. Luminaire schedule.

B. Luminaire cut sheets.

END OF SECTION

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SECTION 271000 - STRUCTURED CABLING SYSTEM

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes all final design, material, equipment, supplies, labor, testing, and accessories required to furnish and install a complete Structured Cabling System (SCS) as indicated on the drawings and as specified herein. The SCS shall be defined as all cables, equipment, products, etc, as indicated on the drawings, and mentioned in these specifications. (Please note, for this project, that the SCS encompasses more than just voice and data cabling.)

B. It is the intent of the Drawings and Specifications for the Contractor to provide and install a complete, fully operational, and tested system.

C. All miscellaneous system components including, but not limited to, cables, termination equipment, punch blocks, patch panels, ladder racks, backboards, equipment racks, and any other related items shall be furnished and installed complete under this section, such that the system shall perform all functions listed herein in compliance with all of the specified requirements.

D. Schedule is paramount to the project's success. With this, the structured cabling contractor will have to be a team player, continually working with the team to facilitate expeditious design, procurement, and construction processes. SCS Contractor shall be required to attend weekly construction meetings through the duration of the project.

E. This project will be performed in a phased construction format. Each phase of construction will be completely installed, labeled and tested, to the greatest extent physically possible, before moving to the next phase.

1.2 RELATED WORK, STANDARDS, DOCUMENTS AND PUBLICATIONS

A. Each agency's relative codes, standards, and recommended practices apply to the voice/data cabling systems and their components as specified herein:
   1. American National Standards Institute (ANSI)
      a. ANSI T1.336 Engineering requirements for a universal telecommunications frame
      b. ANSI T1.404 Network and customer installation interfaces – DS3 and metallic interface specification
   2. Building Industry Consulting Service International (BICSI)
      a. Telecommunications Distribution Methods Manual (TDMM) – latest edition.
      b. Customer – Owned Outside Plant Design Manual (CO-OSP) 2004.
   3. Comite Consultatif Internationale de Telegraphique et Telephonique (CCITT)
   4. Electronic Industries Alliance (EIA)

a. ANSI/TIA/EIA-455-as applicable for measurement and Testing of Fiber Optic Systems
b. ANSI/TIA/EIA-492-as applicable for specifications for Optical Fibers
c. ANSI/TIA/EIA-526 Standard Test Procedures for Fiber Optic Systems
d. ANSI/TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises
e. ANSI/TIA-568-C.1 Commercial Building Telecommunications Cabling Standard
f. ANSI/TIA-568-C.2 Balanced Twisted-Pair Telecommunications Cabling Components Standards
g. ANSI-TIA-568-C.3 Optical Fiber Cabling Components Standard
h. ANSI/TIA/EIA-606-A Administration Standard for Commercial Telecommunications Infrastructure 2002.
i. ANSI/TIA/EIA-J-STD-607-A or latest Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications 2002

5. Federal Communications Commission (FCC)
   a. FCC Part 68 Rule
6. American Society for Testing and Materials (ASTM)
   a. E814-02 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
7. Insulated Cable Engineers Association (ICEA)
   a. Communications Wire and Cable for Premises Wiring.
8. International Electrotechnical Commission (IEC)
   a. IEC 61935-01 Generic Cabling Systems - Specification for the testing of balanced communication cabling in accordance with ISO/IEC 11801 Part 1: Installed Cabling
   b. IEC 61935-02 Generic Cabling Systems - Specification for the testing of balanced communication cabling in accordance with ISO/IEC 11801 Part 2: Patch Cords and Work Area Cords
9. Institute of Electrical and Electronics Engineers (IEEE)
   a. IEEE 802 Specification for Local Area Networks
   b. ANSI/IEEE C62.41 – Guide on the Surge Environment in Low-Voltage (1000V or less) AC Power Circuits 2002
10. International Organization for Standardization (ISO)
    a. ISO/IEC 11801 Information Technology – Generic Cabling for Customer Premises 1995 plus Amendments 1 & 2.
11. National Fire Protection Association (NFPA)
    a. ANSI/NFPA-70 National Electric Code 2002(NEC)
    b. ANSI/NFPA-75 Standard for the protection of information technology equipment 2003
12. National Electrical Manufacturers Association (NEMA)
13. Occupational Safety and Health Administration (OSHA)
14. Telecommunications Industry Association (TIA)
    a. ANSI/TIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces 2003.
    b. ANSI/TIA-758-A Customer-Owned Outside Plant Telecommunications Cabling Standard 2004

c. ANSI/TIA-942 Telecommunications Infrastructure Standard for Data Centers 2005

15. Underwriters Laboratories Standards (UL)
16. Intetek Testing Services ETL SEMKO (ETL)
    a. The contractor shall be responsible for obtaining and utilizing the latest Structured Cabling, Architectural, and Electrical plans.

1.3 GENERAL REQUIREMENTS

A. Manufacturer: The term "manufacturer" shall be defined as the company, or group of companies, that actually produces the products meeting the requirements of Section 2 of this document. The manufacturer shall have a minimum of seven- (7) year's experience in manufacturing products of this type and shall be ISO 9001 Certified. The products, summarized in this specification, shall be supplied by a single manufacturer, with the exception of:
   1. Data racks and other hardware that is not defined as part of the channel test configuration by ANSI/TIA/EIA 568-C.
   2. Fiber Optic Cable and Outside plant (OSP) fiber cable.
   3. Channel solutions consisting of cabling and connectivity hardware independently tested by UL or ETL and that are listed in Section 2 of this document.
   4. Cables manufactured by another manufacturer specifically called out on the drawings.

B. Contractor: The term "contractor" shall be defined as the company, or group of companies, that actually installs the products per Section 3 of this document. The contractor selected to provide the installation of this system shall be certified by the manufacturer in all aspects of design, installation and testing of the products described herein.
   1. The contractor shall hold a valid State of California C-10 or C-7 license, shall have completed at least ten (10) projects of equal scope, shall have been in business of furnishing and installing systems of this scope and magnitude for at least five (5) years, and capable of being bonded to assure the Owner's Project Manager of performance and satisfactory service during the guarantee period.
   2. The contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work.
   3. All work shall be performed under the supervision of a company accredited by the manufacturer and such accreditation must be presented.
   4. The contractor shall be a manufacturer's authorized/certified installer and warranty station for the equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Contractor must be certified by the manufacturer a minimum of 180 days prior to bid opening.
   5. The contractor selected for this Project must adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning this Project.
   6. The contractor shall own and maintain tools and equipment necessary for successful installation and testing of fiber optic cable and Category 6 metallic premise distribution systems and have personnel who are adequately trained in the used of such tools and

equipment.

7. The contractor shall have the capability to produce the AutoCAD documentation as required elsewhere in this specification.

1.4 SUBSTITUTIONS

A. In order to maintain a high degree of quality assurance, the Contractor shall, without exception, use the parts and supplies as specified on the drawings and in this specification.

B. For any proposed product substitution or when the Contractor intends to include an "or equal" product in the bid pricing, provide a substitution request submittal to the Owner's Project Manager for review no later than fifteen (15) calendar days prior to Bid submittal. This report shall include:
   1. Description of how the proposed product(s) will impact meeting the project completion date, indicate item(s) with lead times and expected delivery date(s).
   2. Itemized cost comparisons between the proposed product(s) and the listed product(s).
   3. Detailed technical analysis of the electrical and mechanical specification differences between the proposed product(s) and the listed product(s).
   4. ETL "Verified" or UL "Verified" test lab documentation for the proposed product(s), component(s) and assemblies.
   5. Proposed product identification, manufacturer literature (specifications and cut sheets).
   6. Name, address and contact information of several similar projects where the proposed product(s) have been used.
   7. Name, address and contact information of the proposed product(s) manufacturer's local representative.
   8. Sample proposed product(s) manufacturer's warranty.

C. The Owner's Design Team/Project Manager must approve any proposed product(s) substitution item in writing. The Owner's Design Team/Project Manager reserves the right to require a complete sample of any proposed product(s) and may request a sample tested by an independent testing consultant to prove equality. The decision of the Owner's Design Team/Project Manager regarding equality of proposed product(s) items will be final.

D. If a proposed product(s) is given final acceptance by the Owner's Project Manager, the Contractor shall reimburse the Owner's Design Team/Project Manager for the costs to review the proposed product(s) substitution(s), and for any additional engineering charges, and shall pay all charges of other trades resulting from this product(s) use, at no cost to the Owner.

E. It is a mandatory requirement that a single Contractor perform the work described in this specification.

1.5 GENERAL SUBMITTAL REQUIREMENT

A. Submittals shall be presented and formatted per the guidelines in the Division 1 section of this RFP package.

B. All cut sheets shall represent the latest version, part number, and revision of the product. Where multiple products or part numbers appear on a page, a bold arrow or circle shall indicate which product or part numbers are to be used as part of the installation. The submittal shall include all descriptive pages associated with the product, not just the page showing the part number.

1.6 BID SUBMITTAL REQUIREMENTS

A. Pre-Qualification Certificates: Contractor shall submit current training certificates for design, engineering, installation and testing of the specified products.

B. Manufacturer Tests: Contractor shall submit all manufacturer test information. If equivalent product(s) are substituted, the equivalent product(s) must show demonstrated and documented equivalence to the product(s) specified.

C. Bid Forms: Contractor shall submit completed any detailed bid forms provided with this specification or elsewhere in the RFP Package. Quoted price shall be broken down and categorized per the bid forms. All unit prices and alternates shall be included. Responses with incomplete or omitted bid forms shall be rejected.

D. Material and System Installation Guarantees: The Contractor shall guarantee at the time of the bid that all Category 6 cabling and components meet or exceed specifications (including installation) of ANSI/TIA/EIA-568-C and 569-B.
   1. Complete documentation regarding the manufacturers warranty shall be submitted as part of the bid. This shall include, but is not limited to, a sample of the warranty that would be provided to the customer when the installation is complete and documentation of the support procedure for warranty issues.
   2. A systems application assurance manual documenting the vendor supported applications and application guidelines shall be provided as part of the submittals.

E. Project Narrative: Contractor shall submit a summary of the scope of work, in their own words, illustrating a complete and thorough understanding of the project. The narrative shall include, but not be limited to cable drop counts, riser and backbone cable type and quantity, project staffing and duration, quality assurance procedures and methodology, problem escalation procedures, and project schedule.

F. Hours: Provide the total number of estimated man-hours used to calculate the Base Bid.

G. Resume: A resume of qualification shall be submitted with the Contractor's bid indicating the following:
   1. A copy of their valid State of California C-7 Low-Voltage license.
   2. Summaries of at least ten (10) projects of equal scope completed within the last (5) years whereas at least one (1) shall be a warranted project from the manufacturer of the proposed solution. Project Summary to include a project description, number of cable drops, duration, date completed, and complete contact information for a representative of the customer familiar with the contractor’s work.

3. A signed letter from the contractor's bonding company indicating their maximum project bonding capability.
4. A technical resume of experience for the contractor's Project Manager who will be assigned to this project. This individual will remain as Project Manager for the duration of the project. The Contractor may change Project Managers only with the Owner's Project Manager's written approval.
5. A list of technical product installation training attended by the contractor's personnel within the past two (2) years that will install the SCS system shall be submitted with the response.
6. All of the above for any sub-contractor, who will assist the SCS contractor in performance of this work.

H. Manufacturer's Letter: The Contractor shall furnish a letter from the manufacturer, which certifies that the contractor is the Authorized/Certified Installer and that the equipment shall be installed according to manufacturer's recommendations.

I. Bill of Materials: The bill of materials shall contain a complete list of every component, part or device by part description, manufacturer and manufacturer's part number, quantity and unit of measure. See example format below:

Description	Part #	Quantity	Unit of Measure
CAT6 Station	Systimax	10 boxes	1000ft/box
Cable (blue)	#2071		

1. This information may be used by the Owner to evaluate the Contractor's general understanding of the project scope during the bid evaluation. Errors/Omissions from this bill of material do not relieve the contractor from providing all material, components, labor, etc., as outlined in this specification and on the drawings to provide a complete and useable structured cabling system.

J. Copies: Provide 3 copies of the above information at bid time.

1.7 PRE-INSTALLATION SUBMITTAL REQUIREMENTS

A. Within forty-five (45) calendar days after the date of award of the Contract, the Contractor shall submit the following:

B. Submittal Binder: Submit eight (8) copies of the complete Submittal Binder to the Owner for review. The binder shall consist of four major sections with each section separated by index tabs. Each page in the binder shall be numbered sequentially and shall be summarized in the index.
1. The first section shall be the "title sheet" which shall include the submittal date, project title and address, name of the contractor, and name of the Owner.
2. The second section shall contain an index including the page number, product Manufacturer, product part number, product description, and corresponding specification

section number or drawing sheet number where that product is referenced. Also listed in the index shall be each item of test equipment to be used to test the optical fiber and copper components. Include all patch cords and other specialized components.

3. The third section shall contain original manufacturer cut sheets for all of the materials that meet the requirements listed in Section 2 of this specification and all materials described on the construction drawings. Also include manufacturer's cut sheets for all testing equipment to be used for completion of the project. All pages shall be numbered sequentially corresponding to the index. On each cut-sheet, provide an indicating arrow next to each part number of proposed material.
4. The fourth section shall contain a Cabling Diagram. The diagram shall be based on the drawings included in the Construction Documents. It shall be updated to show quantities and part numbers for all components including patch panels, cable, conduit, cabinets and equipment racks, splices, splice cases and all other associated components.
5. Failure to comply with any of the requirements listed above may result in the rejection of the entire submittal package.

C. Component Samples and Mock-ups: Provide one full size installation sample mock-up of each of the following components for approval. All samples are to be fully labeled per these specifications.
   1. Optical Fiber Cable Samples: Provide a 24" length of each type of optical fiber cable being used as a part of this installation; each sample shall be complete with strength members, outer jacket, and all elements. The outer jacket shall be stripped back 12" from one end of the sample to allow the individual fiber sub-cable groups to be inspected for all cables. Each color-coded sub-cable jacket shall be stripped back 6" from the end of the cable to allow its individual elements to be inspected. Label each cable as detailed in this specification. The sample shall show all the cable markings, including part numbers, manufacturer, and lengths.
   2. Copper Cable Samples: Provide a 24" length of each type and color of copper cable being used as a part of this installation. The outer jacket shall be stripped back 6" from one end of the sample to allow the individual pairs to be inspected for all cables. Label each cable as detailed in this specification. The sample shall show all the cable markings, including part numbers, manufacturer, and lengths.
   3. Category 6 Patch Panel: Provide a Category 6 patch panel. This shall consist of the specified patch panel, fully loaded, complete with all associated components. The patch panel shall be fully loaded with the maximum number of cables dressed into the patch panel and terminated as described in this specification. All strain relief shall be provided as part of the sample. A 36" length of each cable shall be dressed and attached to the strain relief with "hook and loop" straps per these specifications. The unit shall be fully labeled as detailed in these specifications.
   4. Outlet Samples.
      a. Provide a mock-up of each communications outlet, as listed below. The sample is intended to represent a typical communications outlet and shall include all associated parts to make a complete sample. Provide bushings and strain relief for the

distribution cable jacket, demonstrating how the cable shall be secured. Label the outlet and each connector as detailed in this specification.

b. Provide samples of the following outlet configurations:
   1) Wall-mounted outlet - provide the faceplate, terminated communications outlets, the electrical backbox, and a 36" length of the relevant cable(s).
   2) Wall-mounted phone outlet - provide faceplate and jack insert only.
   3) Furniture outlet – provide faceplate, bezel, outlets, cable and labeling installed in a modular furniture baseboard or beltline raceway sample. The contractor shall obtain a sample of the modular furniture system baseboard or beltline raceway where the outlet will be installed from the furniture system vendor. If the modular furniture system has not been selected or finalized, the contractor shall proceed with all other tasks or phases of the project, but shall not place an order for furniture system faceplates, bezels, etc.. until furniture system samples are available and this mock-up has been accepted by the owner. The Owner shall not be held responsible for any re-stocking, re-ordering or other fees and charges resulting from ordering parts prior to mock-up acceptance.

5. Installation shall not proceed until the sample mock-ups meet the satisfaction of the Owner. Sample mock-ups are intended to represent the components that are to be installed as part of this project; therefore, they are to be provided with all associated components and labeling required for the final installation. Upon acceptance, the mock-ups will be used as the standards by which the quality of work on the project by the contractor shall be judged. Any installation that does not meet this standard shall be replaced or re-worked by the contractor as approved by the Owner at no additional cost. All samples will be retained by the Owner. The Owner shall not be held responsible for project delays resulting from delays in sample mock-up approval.

1.8 POST INSTALLATION SUBMITTAL REQUIREMENTS

A. Within fifteen (15) calendar days after the completion of work, the Contractor shall submit the following:

B. Record Documentation
   1. Final Test Results: Test results for each cable indicating tests performed, results obtained and values measured. Test results shall be provided in electronic format with the associated application (if required) for viewing.
   2. As-Built Drawings: Contractor shall provide a complete set of professionally drafted "E" size (30" x 42"), unless otherwise noted, reproducible bond as-built drawings, generated on AutoDesk AutoCAD 2004 or later.
      a. MDF, BDF and IDF Diagrams - Including:
         1) Cable routing.
         2) Position of all components and apparatus.
         3) Detailed layout of the wallfield(s).
         4) Labeling plan.

b. Work Area Floor Plans - Including:
   1) Detailed cable routes.
   2) Labeled workstation locations. Labels to match approved workstation faceplate labels.
c. Cross Connect Documentation - Including:
   1) Cross-connect records for all voice, and data devices.
d. Riser Distribution Plan.
e. Cable Tray, Conduit, and Raceway Plans (if applicable).
f. Campus Distribution Plan (if applicable).
g. Building Control Plans (if applicable).

C. As-Built Documentation Display in each MDF, BDF & IDF.

D. Contractor shall install a complete Contractor-provided, professionally drafted as-built floor plan in color in each MDF, BDF & IDF mounting frame. Each floor plan, generated on AutoDesk AutoCAD 2004 or later and printed in color, shall depict all jack locations in each modular furniture cubicle and all other areas. Also depicted shall be in-building antenna, reader board, CTV jack locations or any other communications outlet cables by the SCS contractor. All jack locations shall be color coordinated with the Owner's labeling scheme as described elsewhere in this specification.

E. Contractor shall provide to Owner one set of CD ROMs containing all post installation submittals.

F. Warranty Documentation:

G. Contractor shall present to Owner all warranty General and Specific Warranty Documents per Warranty Specifications Sections. Warranty shall commence after final acceptance of System by Owner.

1.9 GENERAL SYSTEM PRODUCT, INSTALLATION AND OVERALL SYSTEM WARRANTY

A. Prior to Owner acceptance, the contractor shall provide to the Owner's Project Manager, a manufacturers product and performance warranty. This will require a submittal of the required pre-job certification registration forms as well as the required project closing information. The Owner will only acknowledge acceptance upon submittal of a valid manufacturers warranty.

B. The warranty shall commence from the date of the Owners final written acceptance of the completed project.

C. All conditions for obtaining the manufacturers warranty shall be the sole responsibility of the contractor.

D. The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the Owner after the end of the guarantee period.

E. A typewritten notice shall be posted at the equipment rack that shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

1.10 SPECIFIC SYSTEM PRODUCT, INSTALLATION AND OVERALL SYSTEM WARRANTY

A. A twenty (20) year Extended Product Warranty and Application Assurance for the voice/data wiring system shall be provided as follows:
   1. 20 Year Extended Product Warranty
      a. The 20 Year Extended Product Warranty shall ensure against product defects, that all approved cabling components exceed the specifications of ANSI/TIA/EIA 568-C and ISO/IEC 11801, exceed the attenuation and NEXT requirements of ANSI/TIA/EIA 568-C and ISO/IEC 11801 for cabling channels, that the installation will exceed the loss and bandwidth requirements of ANSI/TIA/EIA 568-C and ISO/IEC 11801 for fiber channels, for a twenty (20) year period. The warranty shall apply to all passive SCS components.
      b. The 20 Year Extended Product Warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s) for a twenty (20) year period.
   2. 20 Year Application Assurance
      a. The 20 Year Application Assurance shall cover the failure of the wiring system to support the application which it was designed to support, as well as additional application(s) introduced in the future, up to 350Mbps parallel transmission schemes, by recognized standards or user forums that use the ANSI/TIA/EIA 568-C or ISO/IEC 11801 component and channel specifications for cabling, for a twenty (20) year period.
   3. System Certification
      a. Upon successful completion of the installation and subsequent inspection, the Owner's Project Manager shall be provided with a numbered certificate, from the manufacturing company, registering the installation.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. All equipment listed herein will be by:
   1. Structured Cabling System (SCS): "Commscope Uniprise UltraMedia" or equal
   2. Cabinets, Racks, and Ladder tray: Chatsworth, Cooper B-line.
   3. Horizontal and Vertical wire management: Chatsworth.
   4. Riser and OSP Fiber Cable: Systimax, Berktek, AMP.
   5. Riser and OSP Copper Cable: General, Superior Essex
   6. Protectors: Circa, Systimax, Porta Systems or Marconi

B. It is the responsibility of the bidder to insure that the proposed product meets or exceeds every standard set forth in these specifications and the equipment's technical data sheets.

C. The functions and features specified are vital to the operation of this facility. Therefore, inclusion of a component's manufacturer in the list of acceptable manufacturers does not release the contractor from strict compliance with the requirements of this specification.

2.2 OUTLETS

A. Faceplates
1. All Faceplates shall be available in single, duplex, triplex, quadplex, or sixplex arrangement in a single gang configuration.
2. Faceplates shall be available in eightplex arrangement in a dual gang box configuration.
3. Surface mount boxes shall be available in single, dual, quad, sixplex and twelveplex configuration.
4. Modular furniture faceplates shall be available in single, dual, triple and quad configuration for the Owner’s modular existing and/or new modular furniture. Faceplates shall be flush-mounted in the modular furniture. Surface mounted boxes/faceplates are unacceptable. The contractor is responsible for coordinating with the Owner’s modular furniture contractor to determine faceplate requirements. The contractor shall provide and install all parts/fittings necessary to meet the requirements of this section.
5. Wall mounted phone jack faceplates shall be single gang configuration, constructed of stainless steel and have two standard phone mounting posts located above and below the jack opening.

B. Communications outlets shall consist of one, two or three gang utility outlet boxes plates equipped with 8-pin modular (RJ-45) jacks utilizing T568B wiring. All outlet cabling shall terminate on termination blocks at their associated Main Distribution Frame (MDF)/Building Distribution Frame (BDF)/Intermediate Distribution Frame (IDF) Rooms, or as otherwise indicated on the drawings.

C. Unless otherwise noted on the floor plans, or within this document, all data wall outlets for 23 AWG copper cable shall be:
1. 8-position/8-conductor modular outlets for data or voice.
2. Insulation displacement.
3. Support Universal applications in a multi-vendor environment, accepting modular RJ-45 plugs for data or voice outlets.
4. Provide with blank module inserts for all unused module locations. Jack module arrangement is shown on the drawings. Provide color-coded inserts at each outlet, termination blocks, and at patch panels.

D. Category 6 Gigabit outlets
1. All Category 6 outlets shall meet or exceed Category 6 transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA 568-C Commercial Building

Telecommunications Cabling Standard and be part of the UL LAN Certification and Follow-up Program.

2. The Category 6 outlets shall be capable of being in a modular patching situation or as a modular telecommunication outlet (TO) supporting current 10Base-T, Token Ring, 100 Mbps TP-PMD, 155 Mbps ATM, 622 Mbps ATM using parallel transmission schemes and evolving high-speed, high-bandwidth applications, including Ethernet, 1000BASE-T and 1.2 Gbps ATM.
3. The Category 6 outlets shall be capable of being installed in any modular faceplate, modular patch panel, frame, or surface-mounted box without special couplings or adapters.
4. The Category 6 outlets shall have improved pair splitters and wider channel for enhanced conductor placement. The outlet shall also have a low-profile wire cap, which protects against contamination and secures the connection. Multicolored identification labels shall be available to assure accurate installation.
5. Product Specification: Uniprise (UNJ600-xx).

2.3 STATION CABLE

A. Category 6 unshielded twisted pair (UTP) cables shall extend between the station location and it's associated TC and consist of 4 pair, 23 gauge solid insulated wire, and shall terminate on 8 pin modular jacks at each outlet and patch panels.

B. Category 6 UTP, 4 Pair
1. The high-performance Category 6 UTP cable shall be of the traditional round design with mylar separator tape between pairs.
2. The cable jacket shall comply with Article 800 NEC for use as a plenum or non-plenum cable. The 4 pair UTP cable shall be UL Listed type CMP (plenum) or type CM/G (non-plenum).

C. All Category 6 high performance cables shall meet or exceed the following:

1. Electrical Characteristics:

Mutual Capacitance	56 nF/m at 1kHz
Characteristic Impedance	(± 3%) of 100 Ohms 1-550 MHz
DC Resistance Max	7.61 Ohms/100m)
Positive ACR	To 400 MHz-km

2. Physical specifications:

	Non – Plenum	Plenum
Conductor size	23AWG	23AWG
Diameter	<.25" nominal	<.24" nominal
Operating temperature	-4 F to 140 F	-4 F to 140 F

D. Product Specification: Commscope Uniprise UltraMedia Category 6 (7504/75N4) .

2.4 MODULAR PATCH PANEL SYSTEM

A. The termination block shall support the appropriate emerging high-bandwidth applications, including 1 Gbps Ethernet, potentially 1.2 Gbps ATM and 2.4 Gbps ATM, Multi-Tasked Split Screen Computing, Virtual Holographic Video Conferencing, Instant Access Telemedicine, 3D CAD/CAM Engineering, and Internet-Intranet Communications/ Commerce, as well as all 77 channels (550 MHz) of analog broad band video, and facilitate cross connection and inter connection using modular patch cords.

B. All Modular jack panels shall be wired to ANSI/TIA/EIA 568-C using T568B wiring.

C. The wiring block shall be able to accommodate 23 AWG cable conductors.

D. The Category 6 modular jack panels shall meet or exceed the Category 6 standards requirements in ISO/IEC 11801 and ANSI/TIA/EIA and shall be UL Listed.

E. A 110 IDC termination block shall provide for the termination of horizontal, equipment, or tie cables.

F. Product Specification: Uniprise (UNP610-xxP) Cat 6 patch panel.

2.5 CATEGORY 6 – PATCH/STATION CORDS

A. Provide Category 6 Modular Patch/Station cords for each assigned port on the patch panel and for each outlet in the station locations. All cords shall conform to the requirements of ANSI/TIA/EIA 568-C Standard, Horizontal Cabling Section. Cords shall be equipped with an 8 pin modular connector on each end and shall conform to the length(s) specified. All cords shall be wired to T568B standards. All cords shall be factory-built by the cabling manufacturer with a molded boot at both ends. Fabrication of cords in the field is prohibited.

B. All patch cords shall exceed ANSI/TIA/EIA and ISO/IEC Category 6/Class E specifications. Patch cords shall be available in stranded or solid conductor in lengths to 50 feet.

C. The patch cord shall have built-in exclusion features to prevent accidental polarity reversals and split pairs.

D. UL Verified for ANSI/TIA/EIA 568-C Electrical Performance

E. Miscellaneous:
   1. UL Listed for Fire Safety
   2. ISO 9001 Certified Manufacturer
   3. FCC Compliant

F. Quantities: Shown on drawings.

G. Product Specification: Uniprise (UNC6-xx-xF) Category 6 modular patch cord.

2.6 FIBER OPTIC CABLING

A. Fiber optic cabling shall be provided between facilities and furnished with the quantity of fibers as designated on the contract drawings.

B. All fiber in a cable run shall be from the same manufacturer and shall be the same type. A mix of fibers from different manufacturers may not be used.

C. Multimode Fiber Specifications:
1. All fiber optic cables within the premises shall use multimode, graded-index fibers with 50 micron cores only.
2. Fibers must comply with ANSI/TIA/EIA 492 specifications and ISO/IEC 11801 standards.
3. Fibers will have dual wavelength capability; transmitting at 850 and 1300nm ranges.
4. Shall be designed to support 10Gb/s applications for 300 meters.
5. Specifications Outside Plant Cables:
   a. Maximum attenuation @ 850/1300 nm 3.0/1.0 dB/km. The core shall be filled with a water-blocking compound and be suitable for underground conduit, direct burial or aerial applications.
6. Product Specification: Uniprise Multimode LazrCORE 300 or AMP XG 10G 50/125 micron fiber optic cable.

Core	50±2.5 µm
Performance	Laser optimized 10 Gigabit to 300 meters
Core/Cladding Concentricity Error:	<3.0 µm
Numerical Aperture:	0.200 ± 0.015
Cladding diameter:	125 µm ± 1 µm
Cladding Non-Circularity:	≤1.0%
Minimum Tensile Strength:	100,000 psi
Fiber Minimum Bending Radius:	.75 in. (1.91 cm)
Cable Minimum Bending Radius: During Installation: After Installation:	 20 times cable diameter 10 times cable diameter
Operating Temp. Range:	32°F to 122°F (0°C to 50°C)
Storage Temp. Range:	-40°F to 149°F (-40°C to 65°C)

Minimum Bandwidth:	2000 MHz at 850 NM 500 MHz at 1300 NM

7. Sheath Construction:
   a. Outside Plant Cables: Systimax Single mode Loose-tube Dielectric Sheath Cables with buffer/fan-out kits as required. Equal by Berk-Tek or Corning
8. Product Specification: Comscope Uniprise.

2.7 FIBER PATCH CORDS

A. Fiber patch Cords shall be available in either Singlemode or Multimode.

B. Construction shall be either 3.0 mm cordage or 1.6 mm cordage

C. Connectors shall be available in Duplex LC.

D. Use only factory manufactured patch cords. Field terminated patch cords are not acceptable.

E. Quantities: See drawings.

F. Product Specification: Uniprise.

2.8 FIBER DISTRIBUTION CENTER (FDC)/FIBER PATCH PANEL

A. Fiber Patch Panels - Combination Shelf: The Combination Shelf is a wall or frame mounted unit that terminates, provides cross connection, interconnection, splicing and fiber identification for up to 48 fibers. The shelf will provide protection from mechanical stress on the cable and fibers and from macro-bending losses.
   1. The shelf shall be wall or rack mountable depending on the location requirement. The units must fit into a 19” wide frame arrangement and have a jumper routing trough.
   2. When wall mounted the shelf shall consist of a modular enclosure with front access and can be fully administered from the front. When rack mounted the shelf shall consist of a modular enclosure with front and rear access and can be fully administered from the front and rear. The unit shall slide out to allow access from the top. Include splice organizers and fiber breakout kits as required.
   3. The shelf shall have a translucent, removable cover over the connector panels. The connector panels shall snap into the front of the shelf and accommodate ST, SC, or LC connectors as required.
   4. Miscellaneous:
      a. UL Listed for Fire Safety
      b. ISO 9001 Certified Manufacturer
   5. Product Specification: Uniprise RFE-FXD, RFE-FXG.

2.9 FIBER OPTIC CONNECTORS

A. Fiber Optic Connector Cassettes: All fiber optic cable shall be factory terminated 12-strand Duplex LC type connectors. Provide 12-fiber factory terminated cassettes with either LC duplex connection and splice pigtails.
   1. The connector must:
      a. Be capable of mounting on either 0.9 mm buffered fiber or on 3.0-mm cordage.
      b. Meet EIA and IEC standards for repeatability.
      c. Have a locking feature to the coupler and assure non-optical disconnect.
      d. Have an installed attenuation loss of less than .5dB.
      e. Miscellaneous:
         1) UL Listed for Fire Safety
         2) ISO 9001 Certified Manufacturer
   2. Product Specification: Uniprise

2.10 COPPER CABLING

A. Outside Plant Copper Cables
   1. All voice grade wire and cable placed in the outside environment shall be solid, twisted pair, and multi-conductor. The copper twisted pairs shall have a mutual capacitance at 1kHz of 15.7 nF/1,000 ft. The cable shall be resistant to mechanical damage, lightning or damage from wildlife.
   2. The aerial air core cable shall be a self-supporting or lashed cable consisting of plastic-insulated solid conductors covered by a plastic core wrap and surrounded by an inner polyethylene jacket, a corrugated aluminum shield, a corrugated steel wrap and a bonded polyethylene jacket (PASP).
   3. The buried or underground cable shall have an aluminum steel polyethylene (ASP) sheath and a core of solid-copper conductors, dual insulated with foam skin and plastic, surrounded by FLEXGEL III filling compound.

B. The multi-pair copper cables shall meet the following specifications:

   1. Physical Specifications:

Gauge	24 AWG
Pair Size	25 to 1,800

   2. Electrical Specifications:

DC Resistance	27.3Ω/1000 ft (8.96Ω/100m), maximum
Mutual Capacitance (@ 1kHz)	15.7 nF/1000 ft (5.15 nF/100m) (25 pair), maximum
Impedance	100 Ω (25 pair)

Buried/Underground Cable Attenuation (db/1,000 ft [305m]):	
at 772 kHz	5.6 (25 pair), maximum
at 1.0 MHz	6.4 (25 pair), maximum

Aerial Cable Attenuation (dB/1,000 ft [305m]):	
at 772 kHz	5.9 (25 pair), maximum
at 1.0 MHz	6.7 (25 pair), maximum

3. ISO 9001 Certified Manufacturer: Systimax or listed equal
   a. Buried/Underground: CSI ANMW
   b. Aerial: CSI BKMP (self support), CSI BKMA (lashed), CSI BKMH (lashed)
4. Copper Riser Cables: Shielded or unshielded 24 AWG multi-pair copper cables shall be used as the vertical riser cables. The cable shall support voice, data and building service applications. The bending radius and pulling strength requirements of all backbone cables shall be observed during handling and installation. The multi-pair copper cables shall be in plenum or riser rated form and placed in conduit as required.

C. Shielded: The shielded cable, 200 pair or more, shall consist of solid-copper conductors insulated with expanded polyethylene covered by a PVC skin, be conformance tested to meet ANSI/TIA/EIA 568-C for Category 3 cables, be UL and Listed as CMR. The core shall be overlaid with a corrugated aluminum sheath, which is adhesively bonded to an outer jacket of PVC plastic to form an ALVYN sheath. The copper riser cable shall meet or exceed the following electrical specifications listed below:

   a. Electrical Specifications:

Average DC Resistance	26.5Ω/1,000 ft (8.7Ω/100m), maximum
Average DC Resistance Unbalance	1.7%, maximum
Mutual Capacitance @ 1kHz	16 nF/1000 ft (5.25 nF/100 m), maximum
Capacitance Unbalance (pair to ground)	201pF/1,000 ft (65.94 pF/100m) maximum

   b. Attenuation (dB/100 m [328 ft.]:

Frequency	Attenuation (Max.)
1.00 MHz	2.3 dB

4.00 MHz	4.9 dB
10.00 MHz	8.5 dB
16.00 MHz	12 dB

c. Worst Pair Near-End Crosstalk (NEXT) dB/100 m [328 ft]:

	Pair-To-Pair NEXT (Max.)
1.0 MHz	13.8 dB
4.0 MHz	11.2 dB
10.0 MHz	10.2 dB
16.0 MHz	9.2 dB

d. The PVC sheath shall have improved frictional properties, allowing it to be pulled through conduit without the use of lubricants.
e. The cable shall be available in 25, 50, 100, 150, 200, 300, 400, 600, 900, 1200, 1500, and 1800 pair counts.
f. Miscellaneous:
   1) UL Listed for Fire Safety
   2) ISO 9001 Certified Manufacturer
g. Product Specification: ARMM type cable or listed equal.

2. Non-shielded: The non-shielded non-plenum cable shall consist of 24-AWG solid-copper conductors insulated with color coded PVC, 25 pair cable shall be UL Verified to ANSI/TIA/EIA 568-C for Category 5E, 25 or 50 pair shall be conformance tested to meet ANSI/TIA/EIA 568-C for Category 5E cables. The non-shielded cable shall be available in 25 and 50 pair.
   a. Miscellaneous:
      1) UL Listed for Fire Safety
      2) ISO 9001 Certified Manufacturer
   b. Product Specification: Commscope or AMP.

2.11 GROUNDING SYSTEM AND CONDUCTORS

A. The SCS Contractor shall utilize a Telecommunications Bonding Backbone (TBB) as provided by the Electrical contractor. The SCS contractor shall provide and terminate TBB cable(s) on

ground bars located at each MDF/BDF/IDF Room, or as otherwise indicated on the drawings. All communication system bonding and grounding shall be in accordance with the NEC and NFPA. Horizontal cables shall be grounded in compliance with ANSI/NFPA 70 and local requirements and practices. Horizontal equipment including cross connect frames, patch panels, cable trays, equipment racks, ladder trays, conduits, active telecommunication equipment, sleeves and test apparatus and equipment shall be bonded to the TBB ground bars utilizing a #6-AWG and two hole compression grounding lugs. The Contractor shall be responsible for providing an approved ground at all newly installed distribution frames, and/or insuring proper bonding to any existing facilities. The Contractor shall also be responsible for ensuring ground continuity by properly bonding all appropriate cabling, cable sheaths, circuit protectors, closures, cabinets, service boxes, and framework.

2.12 EQUIPMENT RACKS

A. When shown on drawings, communication closets shall be equipped with floor mounted equipment racks provided by the SCS Contractor to provide termination bays for the multiple cable types in addition to shelves, panels, power strips, etc. The racks shall be made of lightweight aluminum and include mounting hardware for mounting specified termination equipment to the frame. In addition, the mounting hardware must provide vertical and horizontal wireways for cross connect wire.

B. Equipment racks, ladder trays and rack mount accessories shall be Black in color unless otherwise noted.

C. Racks shall be mounted on an isolation pad and utilize non-conductive washers to secure the rack to the floor. Floor mounted open racks shall be secured from the bottom rail to prevent movement. All racks shall be individually grounded to the isolated ground bar within the equipment room using a standard ground lug and #6 jacketed green cable. Daisy chaining a ground wire between racks is not allowed. Racks mounted on raised floors shall be seismically braced to the structural floor below the raised floor to the satisfaction of the Local Authority having Jurisdiction and all local, state and federal requirements.

D. Product Specification: Chatsworth or listed equal.

2.13 TERMINAL BACKBOARDS

A. Where indicated on drawings, provide new plywood terminal backboards. Use Douglas Fir Plywood, exterior grade, finished one side and prime coat painted on all surfaces with a finish coat of fire retardant intumescent white enamel. On each plywood sheet leave one (1) Fire Marshal Stamp unpainted for inspection. Unless otherwise indicated, use 8’-0” high x length as shown on drawings x 3/4" thick plywood. See backboard elevations for more information.

2.14 UNSPECIFIED EQUIPMENT AND MATERIAL

A. Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide a complete and functional SCS installation shall be provided in a level of quality consistent with other specified items.

2.15 FIRE RATED PATHWAY

A. The firewall through-penetration shall be a manufactured, UL Classified, firestop device/ system designed to allow cables to penetrate fire-rated walls with a built-in fire sealing system that automatically adjusts to the amount of cables installed.

B. The firestopping device shall be capable of installation in new construction or retrofit in existing structures.

C. The device shall be UL Tested and Classified in accordance with ASTM E814 (UL 1479) and with ratings up to and including 2 hours.

D. Manufacturer: Specified Technologies Inc., EZ-Path® or equal by Wiremold.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION DESCRIPTION

A. The structured cabling system shall consist of any or all of the following subsystems:
1. Work Area Subsystem
2. Horizontal Subsystem
3. Administration Subsystem
4. Backbone Subsystem
5. Support Subsystem

B. Work Area Subsystem: The Work Area Subsystem provides the connection between the information outlet and the station equipment in the work area. The Work Area Subsystem includes:
1. Adapters
2. Faceplates

C. Horizontal Subsystem: The Horizontal Subsystem provides connections from the horizontal cross connect to the information outlets (IOs) in the work areas. It consists of the horizontal transmission media, the associated connecting hardware terminating this media, and IOs in the work area. The Horizontal Subsystem encompasses the active channel (See section on Testing). Each floor of a building shall be served by its own Horizontal Subsystem. The Horizontal Subsystem includes:
1. Horizontal Cabling
2. Jacks
3. Patch Panels
4. Patch Cords

5. Station Cords

D. Administration Subsystem: The Administration Subsystem links all of the subsystems together. It consists of labels, diagrams, drawings, manuals, and tools necessary to manage the Structured Cabling System after installation. The Administration Subsystem includes:
   1. Labels
   2. As-built drawings
   3. Operations manuals
   4. Record drawings
   5. Test results
   6. Warranty documents

E. Backbone Subsystem: The main cable route within a building is called the Backbone Subsystem. It links the main cross connect (MDF) in the equipment room to intermediate cross connects (IC) in the BDFs and/or IDFs. It consists of the backbone transmission media between these locations and the associated connecting hardware terminating this media. It is normally installed in a star topology with first-level backbone cables beginning at the main cross connect. If needed, a second-level backbone cables begin at intermediate cross connects.

F. A Backbone Subsystem in a single building will consist of a single MDF connected to one or more IDFs on a single floor or on multiple floors. The backbone will also connect the MDF to a Main Point of Entry (MPOE) which houses the incoming telecommunications services for the building.

G. A Backbone Subsystem in a multi-building campus will consist of a single MDF connected to more than one BDF (one per building). Each BDF will be connected to the IDFs of each respective building. The MDF will also connect to the campus MPOE. Additional MPOEs may connect to the campus backbone through the BDFs.

H. The Backbone Subsystem includes:
   1. OSP/Riser/Plenum rated fiber optic cable
   2. 25-pair to 2400-pair OSP/Riser/Plenum rated copper cable
   3. OSP/Riser/Plenum rated coax cable
   4. Patch panels
   5. Wall and rack mounted termination fields
   6. Patch cables
   7. Cross-connect wire

I. Support Subsystem: The Support Subsystem consists of hardware and equipment required to facilitate and sustain the Structured Cabling System. The Support Subsystem includes the cabling pathways, cabinets, and racks that hold the structured cabling in place. The Support Subsystem includes:
   1. Cable tray
   2. Ladder Rack

3. Fire Stop systems
4. Conduit
5. Data Equipment Racks
6. Cabinets
7. Vertical and Horizontal Wire Managers
8. Backboards

3.2 INSTALLATION REQUIREMENTS

A. The wiring of the system shall be executed in accordance with the drawings and the equipment manufacturer's wiring diagrams. Should any variations in these requirements occur, the contractor shall notify the Owner's Project Manager before making any changes. It shall be the responsibility of the manufacturer-authorized installer of the approved equipment to install the equipment and guarantee the system to operate as per plans and specifications.

B. All materials shall be new. No used or re-manufactured parts or components shall be accepted.

C. All communications cabling used throughout this project shall comply with the requirements as outlined in the NEC Articles 725, 760, 770, and 800 and the appropriate local codes. All copper cabling shall bear UL listed type CMP (Plenum Rated) and/or CM/G (General Purpose) and/or CMR (Riser Rated). All fiber optic cabling shall bear OFNP (Plenum Rated) and/or OFNR (Riser Rated) and/or OFN/G (General Purpose). The contractor is responsible for installing appropriately rated cable for the environment in which it is installed.

D. Cable Storage: The Contractor shall not roll or store cable reels without an appropriate underlay and the prior written approval of Owner's Project Manager.

E. All installation shall be done in conformance with ANSI/TIA/EIA 568-C standards and manufacturers installation guidelines. The Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines will require the Contractor to provide, in a timely fashion, any additional material and labor necessary to properly rectify the situation to the satisfaction and written approval of the Owner's Project Manager. This shall also apply to any and all damages sustained to the cables by the Contractor during the implementation.

F. The system must meet all local and other prevailing codes.

G. All cabling installations shall be performed by qualified technicians. The labor employed by the contractor shall be regularly employed in the installation and repair of communication systems and shall be acceptable to the Owner's Project Manager to engage in the installation and service of this system.

H. Special Equipment and Tools: In order to ensure the least amount of cable untwisting, it is required that all cables shall be stripped using a cable manufacturer's recognized special tool. It

shall be the responsibility of the Contractor to furnish any special installation equipment or tools necessary to properly complete the System. This may include, but is not limited to, tools for terminating cables, testing and splicing equipment for copper/fiber cables, communication devices, jack stands for cable reels, or cable winches.

I. Under no circumstance are "channel locks" or other pliers to be used.

J. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.

K. No cable is to be pulled through a conduit "L-bend" (condulets).

L. Conduit runs shall not exceed 100 feet or contain more than two 90 degree bends without utilizing appropriately sized pull boxes. Pull boxes are not to be used in lieu of a bend. It is the contractor's responsibility to report any unusable or inadequate conduit runs to the owner prior to pulling any cable.

M. Reinstate all pull-wires in conduits and ducts after use to facilitate future addition of cables.

N. Cable raceways and conduits shall not be filled greater than the BISCI recommended fill for the particular raceway or conduit size.

O. The use of lubricants (i.e. Yellow 77, Polywater) to facilitate the installation of cables in conduits is highly discouraged. If such a lubricant must be used, the contractor shall use a lubricant specifically designed for the environment and type of cable being installed. (E.G. the use of outside plant, low temperature cable lubricants shall not be acceptable in an indoor plenum environment.) Under no circumstances shall cable pulling lubricant be allowed to accumulate on walls, floors, backboards, or other surfaces outside the conduit.

P. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor before final acceptance at no cost to the Owner.

Q. Each station cable shall have 1 meter of service slack configured in an "S" shape via J-hooks at rack or wall field end and 2 meters of service loop at station outlet end. Service slack shall be located within 15' of the MDF/BDF/IDF as required to maintain a neat and "workmanship like" installation.

R. The length of each individual run of horizontal cable from the administration subsystem to the information outlet shall not exceed 295-ft (90 m).

S. Each run of cable between the termination block and the information outlet shall be continuous without any joints or splices.

T. All station cable shall be placed in the interior of walls unless otherwise noted or obstructed.

U. Provide bushings, grommets and strain-relief for cables terminating at wall-mounted outlets and patch panels to ensure durable and robust connections. The bushings and grommets are

intended to protect the cables from any sharp edges that present a risk to the cables. Ensure that all sharp edges are covered to protect the cables from damage.

V. All cable bundles exiting floor or wall penetrations and running into furniture or casework shall be wrapped in spiral wrap or split-loom tubing to protect the cabling and provide a neat installation.

W. Power Separation: The Contractor shall not place any distribution cabling alongside power lines, or share the same conduit, channel or sleeve with electrical apparatus. At no point shall the communications cables be tied to power cables or other building services. Station cables and tie cables installed within ceiling spaces shall be routed through these spaces at right angles to electrical power circuits.

X. Avoid electromagnetic interference (EMI) by maintaining adequate physical separation between telecommunications cabling and possible sources such as, but not limited to, electric motors, electric pencil sharpeners, transformers, fluorescent lights that share distribution space with telecommunications cabling, copiers that share work area space with line cords and terminals, large fax machines and power cords that supports such equipment.

Y. All cable or innerduct shall run parallel or at right angles to building wall structures.

Z. In suspended ceiling and raised floor areas where duct, cable trays or conduit are not available, cable bundles shall be supported via "J" hooks attached to the building structure and framework at a maximum of five (5) foot intervals. Minimum 1” wide J-hooks shall be appropriately sized to allow a minimum of 50% spare capacity for future cable installation. The contractor shall include all costs in base bid for any additional supports/seismic bracing required by the Local Authority having Jurisdiction.

AA. The Contractor shall bundle, in bundles of 48 or less, station or other cabling with half inch hook and loop strips tight enough to hold the bundle together in a cylindrical shape, but not so tight as to deform the cable geometry. It shall be possible to completely rotate all cable ties around all cable bundles. Plenum rated hook and loop ties will be used in all plenum areas. In areas where 2 or more bundles are traveling in close proximity, utilize a Chatsworth Rapidtrak Cable support system.

BB. Cables or J hooks shall not be attached to lift out ceiling grid supports or laid directly on the ceiling grid.

CC. Cables or J hooks shall not be attached to or supported by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling air space.

DD. Where additional conduit(s)/sleeve(s) are required, but not provided by the electrical contractor, the SCS cabling contractor shall be responsible to provide such conduit(s)/sleeve(s). Conduit(s) and sleeve(s) shall be of suitable material, sized, installed, fire-stopped, and grounded as required by the NEC, ANSI/TIA/EIA standards and all other applicable codes and standards.

Any conduit(s) and sleeve(s) added by the SCS contractor shall be approved by the Owner's Project Manager prior to rough-in.

EE. In the event Contractor is required to remove ceiling tiles, such work shall not break or disturb grid. Removal of the ceiling grid must be coordinated with the Owner's Project Manager. All insulation shall be replaced in its original location.

FF. Cabling and Termination Identifications: A numbering and marking scheme must be used to identify all cable and cabling terminations. All cables, regardless of length, shall be marked and/or numbered at both ends. Marking codes and methodologies shall correspond to the instructions in this specification.

GG. Ensure that all waste materials are disposed of in a safe manner. Pay particular attention to waste materials produced during the termination of optical fiber cabling. Ensure that all used components and fiber cut-offs are collected in purpose-made containers and disposed of properly. The contractor shall remove all debris and rubbish created in the course of this project. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.

HH. Equipment Racks and Cabinets: All equipment racks and cabinets shall be bolted to the floor by the contractor in the location shown on drawings.

II. Ladder tray mounting brackets shall be screwed to studs or to the properly mounted plywood wall field, not to drywall.

JJ. Seismic Requirements: Contractor will install all equipment racks, equipment cabinet enclosures, cable runways, etc. according to the local, state and/or federal code. Contractor will notify Owner's Project Manager of such requirements and shall provide such bracing as required.

KK. Miscellaneous Equipment: The Contractor shall provide any necessary screws, anchors, clamps, distribution rings, wire molding (MC/MDF & TC/IDF locations), miscellaneous grounding and support hardware, etc., necessary to facilitate the installation of the System.

LL. The cables within the rack or cabinets shall be numbered for identification.

MM. Cable bundles within the MDF/BDF/IDF shall be dressed into bundles of no more than 48 cables. Maintain each bundle with half inch, hook and loop strips every 18 inches. On completion of installation, neatly run and re-tie all cable bundles in the Closet.

NN. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc.

OO. The contractor shall install all patch cords as required per drawings and specifications at the direction of the Owner's project manager in a neat and systematic fashion. Prior to installing all patch cords, the contractor shall install patch cords in a single rack to demonstrate work practices to the Owner's project manager. Only after any corrections/modification to the installation as directed by the Owner's project manager, may the contractor continue installing the patch cords in the remaining racks.

PP. Conduits: All backbone cabling will run through dedicated conduits. All new conduits will be supplied with a pull string. Existing conduits shall be proven to be clear prior to pulling of cables. Contractor shall supply pull string and pull rope for the installation of all cables in existing conduits. For all conduits left with available capacity, Contractor shall replace pull strings with ¼-inch pull rope during the course of his work. Contractor must seal all conduits with an approved sealing compound.

QQ. Use purpose-built pulling grips during cable installation. Do not pull cables by attaching pull wires to cable jackets, elements or reinforcement. The cable pulling tension shall be applied smoothly without jerks. Use strain gauges or equivalent measures to ensure that the maximum manufacturer recommended tensile load rating of the cables is not exceeded during installation.

RR. The number of cables in each conduit shall be controlled to allow for future cable installation and to stay within the manufacturers maximum allowable cable pulling tension. Conduit fill ratios shall not exceed the current requirements of the NEC.

SS. Provide expansion plugs in all ducts/conduits entering the building. Seal all unused ducts/conduits with plugs that allow the pull-string to be tied off on the inside.

TT. All cabling shall be splice free unless otherwise noted on drawings.

UU. The Contractor shall be responsible for providing an approved ground at all distribution frames. The Contractor shall also be responsible for ensuring ground continuity by properly bonding all appropriate cabling, closures, cabinets, service boxes, and framework. All grounds shall consist of #6 AWG copper wire and shall be supplied from an approved building ground and bonded to the main electrical ground. All cable sheaths and splice cases shall be grounded to a Telecommunications Ground Bus. Grounding must be in accordance with the NEC, NFPA, ANSI-J-STD-607-A and all local codes and practices. Bond all metallic sheath communications cables entering the building per manufacturer specifications and NEC 770-33, 800-33 and 800-40.

VV. Each equipment cabinet and rack requires its own dedicated grounding connection to the grounding infrastructure. Grounding infrastructure can consist of either an "aisle ground" conductor placed at the ladder tray above each rack/cabinet, or by providing every rack/cabinet with its own dedicated #6 AWG (min.) green conductor back to the TMGB/TGB. All ground conductor attachments to the TMGB/TGB shall utilize 2-hole compression lugs.

WW. In raised-floor environments, the ground conductor shall attach to the lowest holes on the

front rail of each rack/cabinet.

XX. Attachment to every rack and cabinet shall be made by one of the following methods:
1. Direct connection to the rack- Attach ground conductor's 2-hole compression lug to the front rail's top holes of the rack/cabinet using either two (2) tri-lobular thread-forming screws (self-tapping or sheet metal screws produce metal shavings and are not acceptable) or by using two (2) standard bolts with two (2) "Type B" internal-external tooth lock washers per bolt. If thread-forming screws are not used, remove paint at the connection point and use an approved anti-oxidant prior to attaching the ground conductor.
2. Rack ground bus- Install a dedicated copper ground strip at the top of the rear rail. Attach ground conductor's 2-hole compression lug to this ground strip using either tri-lobular thread-forming screws (self-tapping or sheet metal screws produce metal shavings and are not acceptable) or by using two (2) standard bolts with two (2) "Type B" internal-external tooth lock washers per bolt.

YY. Rack mounted equipment shall be grounded via the chassis, in accordance with manufacturer's instructions. The equipment chassis shall be bonded to the rack/cabinet using one of the following methods:
1. If the equipment has a separate grounding hole or stud, use a #6AWG ground wire from the chassis ground hole/stud to the rack grounding bus.
2. If the manufacturer suggests grounding via the chassis mounting flanges, use tri-lobular thread-forming screws (not self-tapping or sheet metal screws) to attach the equipment to the rack/cabinet rails. If the equipment mounting flanges are painted, remove the paint and apply an anti-oxidant, or use tri-lobular thread-forming screws and two (2) "Type B" internal-external tooth lock washers to safely ground equipment to the rack.

ZZ. Bonding of ladder tray sections- Attach bonding straps to each ladder tray section by utilizing either two (2) tri-lobular thread-forming screws (not self-tapping or sheet metal screws) or by using two (2) standard bolts with two (2) "Type B" internal-external tooth lock washers per bolt. If thread-forming screws are not used, remove paint at each connection point and use an approved antioxidant prior to attaching the bonding strap.

3.3 PENETRATIONS OF WALLS FLOORS AND CEILINGS

A. Unless specifically shown on the drawings, the Contractor shall make no penetration of floors, walls or ceiling without the prior written approval of the Owner's Project Manager.

B. Any penetrations through acoustical walls or other walls for cable pathways shall be sleeved by the Contractor. Sleeves shall consist of metallic conduit deburred and grommetted on both ends, with flanges or other means to prevent the sleeve from slipping or falling out of the partition. Sleeves shall extend a minimum of 6" on both sides of the partition. Outside perimeter of sleeves shall be sealed against sound, air, heat, or as required by partition design. Inside of sleeve shall be sealed similarly after installation of all cabling. Cables shall be independently supported on either side of the sleeve. Sleeves shall not be used as cable supports. Additional requirements in compliance with applicable code shall apply.

C. Replace all moisture and fire barrier material in ducts, conduits and other penetrations disturbed during installation of communications cabling.

D. Any penetrations through fire-rated walls for cable pathways / cables shall be sealed by use of a non-permanent fire blanket or other method in compliance with the current edition of NFPA and the NEC or other prevailing code and must be an approved UL Listed system. The contractor must not use concrete or other non-removable substance for fire stopping on cable trays, wireways or conduits. Contractors who use this method will be required to replace all cables affected and provide the original specified access to each effected area. This requirement also applies to maintaining fire ratings of all floors penetrated by conduits or devices designated for use by voice and data cabling.

E. Sealing of openings between floors or through rated walls, whether existing or created by the contractor for placement of cable shall be the responsibility of the contractor. Sealing material and application shall be an approved UL Listed system and shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the contractor. Any openings created by or for the contractor and left unused shall also be sealed as part of this work.

1. Firestopping work shall be performed by a single contractor to maintain consistency and accountability on the project.
2. The Contractor shall install penetration firestop seal materials in accordance with design requirements, and manufacturer's instructions.
3. The Contractor's installer shall be certified, licensed or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements.
4. All installed through penetration firestops shall be identified via label, or stencil. Label shall state that the fill material around the penetrating item is a firestop, and that it shall not be disturbed unless by an authorized contractor. The label shall include the firestop brand name, and the classified system number for which it was installed.
   a. Sample Label:

      MANUFACTURER'S NAME: _____
      ATTENTION
      Fire Rated Assembly
      For Any Changes To This System, Please Refer To UL System Listed Below
      PRODUCT: _____
      HOUR RATING: _____
      UL SYSTEM: _____
      INSTALLATION DATE: _____
      INSTALLED BY: _____
      LICENSE NUMBER: _____
      PHONE: _____
      FAX: _____

3.4 LABELING REQUIREMENTS

A. Labeling: The Contractor shall be responsible for printed labels for all cables and cords, distribution frames, and outlet locations, according to the specifications. No labels are to be written by hand.

B. Numbers must be assigned to each outlet location using a logical designation convention. Blueprints with the outlet placement and configuration information have been furnished to the Contractor. Contractor will provide the equipment as necessary to generate Panduit PAN-CODE (or Equal) laser printer generated self-laminating labels using the numbering convention shown below and as specified herein. Before any permanent labels are installed on blocks, face plates or cables, a sample label of each various type listed below must be submitted to Owner's Project Manager for written approval to ensure compliance with the labeling scheme, legibility, etc.

C. Station Faceplate Labeling. The following is illustrative of the number convention to be used:
   1. Example: 21.001
      a. 21: IDF location where cable originates (i.e., IDF room "#2-1").
      b. 001: Station Number

D. Station Outlet Labeling. The following is illustrative of the number convention to be used:
   1. Example: DATA A
      a. Data A 1st Data Jack
      b. Example: Voice 1
      c. Voice 1 1st Voice Jack

E. Station Cable Jacket Labeling. All station cables (Voice and Data) will be labeled within six inches of each termination end (e.g., at both ends, outlet end and BDF/IDF end) using "P-Touch" type, self-laminating cable markers.
   1. Example: 21.001A
      a. 21: IDF location where cable originates (i.e., IDF room "#1").
      b. 001: Station Number
      c. A: Cable Identification ("A" for data cable #1, "B" for data cable #2, and "V" for the voice cable.)

F. Riser Cable Labeling. All riser cables will be labeled to reflect the origin and destination abbreviation for the cable and pair counts on large font (16 pitch) self-laminating labels, which shall be located within 18 inches of each end of the cable. Labels shall be placed on the cable to be visible without relocating surrounding cables.
   1. Example #1: IDF22/IDF31/CP100/01
      a. IDF22: Cable Origination
      b. DF31: Cable Destination

c. CP100: Cable Type & Pair or Strand Count (ex. 100 – pair Copper Cable. Other possibilities include HB for hybrid fiber cable, MM for multimode cable, and SM for singlemode cable.)
d. 01: Cable identification number (ex. cable 01, there may be more than one copper riser cable with the same origin, destination and pair count)

G. Voice Station Cable Termination Block Labels. All voice station cables will be labeled using appropriate terminal-block label strip with label holders.
1. Example: 001
a. 001: Station Number

H. Voice Riser Cable Termination Block Labels. All voice riser blocks shall be labeled using appropriate terminal-block label strip with label holders and shall follow Station Outlet Faceplate Labeling scheme outlined above. Building interconnect voice cable termination block labels shall be per ANSI/TIA/EIA-606-A.

I. Patch Panel Labels, Horizontal. All patch panels will be labeled using self-laminating laser patch panel label markers.
1. Example: 001A
a. 001: Station Number
b. A: Cable Identification (“A” for data cable #1, “B” for data cable #2)
2. Data cable #1 shall be terminated adjacent to data cable #2 moving left to right and top to bottom.
3. Fiber Patch Panel Labels. All fiber patch panels will be labeled using self-laminating laser patch panel label markers. The scheme shall indicate: destination of connected cables on the patch panel followed by a slash (/), origination of connected cables on the patch panel followed by a slash (/), and the port number adjacent to the port
a. Example: MDF/IDF2/01
1) MDF: Destination Patch Panel Location Designation
2) IDF22: Origination Patch Panel Location Designation
3) 01: Indicates port number on both origin and destination patch panels.

J. Equipment Rack Labeling: All equipment racks shall be labeled according to their room identifier and a two-digit number. The labels will be engraved plastic plates, with 1”-high white letters on black background. The labels will be attached to the crossmember at the top front of each frame or rack with appropriately-sized sheet metal screws. Self-adhesive strips, glues, etc. are unacceptable.
1. Example: MDF-01
a. MDF: Room Designation
b. 01: Rack Identifier

K. Tube Cable and Fiber Cable Warning Labeling. The Contractor shall provide and install tags of stamped plastic for tube cable and innerduct. The labeling convention described above within Paragraph H shall apply. Additionally, the Contractor will also install fiber optic warning tags

(Osburn Associates Part Number F04002) every eight feet on all exposed fiber optic cable as well as on innerduct containing fiber optic cable installed within the building.

L. MDF/BDF/IDF Floor Plan Mounting Frame: Provide wall mountable floor plan mounting frame with removable Plexiglas front cover in each MDF/BDF/IDF. Frame and cover shall be sized to house 30”x42” floor plan drawing. Coordinate location of frame with Owner’s Project Manager prior to installation.

3.5 TESTING/WARRANTY

A. The testing is to show that there are no errors, damaged or incorrectly installed components, that the installation is correctly labeled and that all the installed components meet or exceed the criteria detailed in these specifications. Any test that does not show that a component is satisfactorily installed, as per these specifications, shall be repeated. If a test procedure needs to be modified to satisfactorily test some components, the modification shall be submitted for approval of the Owner’s Project Manger prior to the tests being conducted.

B. All outlets, cables, patch panels and associated components shall be fully assembled and labeled prior to testing. Any testing performed on incomplete systems shall be redone on completion of the work.

C. Provide the Owners' Project Manager with the opportunity to witness all testing. On reasonable request, the installer shall demonstrate that the test procedure competently identifies the fault conditions being tested for.

D. Complete all of the tests identified in these specifications.

E. Ensure that all test equipment is in calibration before delivery to site and throughout the testing period. The Installer shall be responsible for ensuring that any necessary tests and rework to maintain equipment's calibration status is carried out. Any tests performed on uncalibrated test equipment shall be repeated at the Installer’s cost.

F. The test documentation shall be available for inspection by the Owners' Project Manager during the installation period and copies shall be submitted to the Owners' Project Manager within fourteen days of completion of tests on cables in each area. The Installer shall retain a copy to aid preparation of Record Documents information. See Records Documents details under submittals section.

G. If on submittal of the Record documentation there are any missing test results or incorrectly named files, the test shall be repeated at the Installer’s expense.

H. The Contractor shall provide competent, factory-trained engineers and/or technicians, authorized by the manufacturer of the cabling system, to technically supervise and participate during all tests for the systems. Personnel shall be competent in and qualified by experience or

training for comprehensive TDR and OTDR operation and troubleshooting, for both copper and optical fiber testing.

I. The Contractor shall test and certify the cabling system to minimum standards as set forth in the ANSI/TIA/EIA-568-C specifications for 100BaseTX Ethernet and for Category 6E cable, token ring, and 1000baseT signals.

J. All cables and termination hardware shall be 100% tested for defects in installation and to verify cable performance under installed conditions. All conductors of each installed cable shall be verified usable by the contractor before system acceptance. Any defect in the cable system installation including but not limited to cable, connectors, feed-through couplers, patch panels, splices, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

K. Each cable shall be tested for continuity on all pairs and/or conductors. Twisted-pair voice cables shall be tested for continuity, pair reversals, shorts, transpositions, presence of A.C. voltage and opens using a “green light” type test set. Twisted-pair horizontal cables shall be tested for the all of the above requirements, plus tests that indicate installed cable performance. These cables shall be tested using a 568-B.2-2 Level III / IEC 61935 Level III or better ETL certified cable tester/analyzer.

L. Each installed cable shall be tested for installed length using a Time Domain Reflectometer (TDR) device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA -568-C Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.

M. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be collocated in the binder. Correction of all damaged cables shall include replacing damaged cables with new cables in complete runs, replacing damaged connectors or remaking poor terminations. In-line cable joints, splices or distribution points will not be acceptable except where specified in this document. All damaged cables shall be removed from site.

N. Manufacturer Warranty: Contractor shall provide a twenty (20) year Extended Product Warranty and System Assurance Warranty for this cabling system per Submittals Section and Records Document.

O. Enhanced Category 6 data cable shall be performance verified using an automated test set. This test set shall be capable of testing for the continuity and length parameters defined above, and provide results for the following tests:

P. Attenuation (Insertion Loss).
   1. Return Loss (RL).

2. Near End Crosstalk (NEXT) – measured at both ends of each cable pair.
3. Attenuation to Crosstalk Ratio (ACR).
4. Power Sum Near End Crosstalk (PSNEXT).
5. Power Sum Attenuation to Crosstalk Ratio (PSACR).
6. Far End Crosstalk (FEXT).
7. Equal Level Far End Crosstalk (ELFEXT).
8. Power Sum Equal Level Far End Crosstalk (PSELFEXT).

Q. Optical Fiber Cable Testing: All fiber testing shall be performed on all fibers in the completed end to end system. There shall be no splices unless otherwise shown on drawings or in this specification. Testing shall consist of a bi-directional end to end OTDR trace performed per ANSI/TIA/EIA 455-61 & ANSI/TIA/EIA 526 and a bi-directional end to end power meter test performed per ANSI/TIA/EIA 455-53A. The system loss measurements shall be provided at 850 and 1300 nanometers for multimode fibers and 1310 and 1550 for single mode fibers.
1. Graphical printouts shall be taken of OTDR tests for each element. These printouts shall be stapled or otherwise attached to 11" x 8.5" size sheets. They shall be printed at an appropriate scale, such as 0.5 dB per division for the attenuation axis. Provide diskette copies of the OTDR traces to the owner on completion of the testing. Provide a copy of the emulation software and the appropriate license to the client.
2. Pre-installation cable testing: The Contractor shall test all fiber cable prior to the installation of the cable. The Contractor shall assume all liability for the replacement of the cable should it be found defective during the warranty period.
3. Loss Budget: Fiber links shall have a maximum loss of: (allowable cable loss per km)*(km of fiber in link) + (.4dB)*(number of connectors) = maximum allowable loss.
4. Any link not meeting the requirements of the standard shall be brought into compliance by the contractor, at no charge to Owner.

3.6 MISCELLANEOUS PROJECT REQUIREMENTS

A. Single Point of Contact: Contractor will provide an English proficient, single point of contact, i.e., Project Manager, to speak for the Contractor and to provide the following functions:
1. Initiate and coordinate tasks with Owner’s Project Manager, and others as specified by Owner’s Project Manager.
2. Provide day-to-day direction and on-site supervision of Contractor personnel.
3. Ensure conformance with all Contract provisions.
4. Participate in weekly site project meetings.
5. This individual will remain as Project Manager for the duration of the project. The Contractor may change Project Managers only with the Owner’s Project Manager’s written approval.

B. Planning meetings and schedule: Within thirty (30) calendar days after the date of award of the Contract, an initial planning meeting will be held with the successful bidder to clarify all requirements (systems, services, distribution methods, etc.), identify responsibilities, and

schedule the events that will transpire during the implementation of the project. Within one (1) week of this initial meeting, the contractor shall provide a written report and project schedule to clearly document the events and responsibilities associated with the project.

C. Site Cleaning: Throughout the progress of the plant construction, the contractor shall keep the working area free from debris of all types and remove from the premises all rubbish resulting from any work done by Contractor. On a daily basis and at the completion of its work, the Contractor shall, to the extent possible, leave the premises in a clean and finished condition.

D. Safety Requirements: Contractor will utilize appropriate personnel and display warning signs, signals, flags and/or barricades at the work site to ensure adherence to safety regulations and as prudence requires.

E. Specification/Drawing Status: All specifications and drawings related to this project will be "frozen" after shop drawing approval. The Owner reserves the right to negotiate any future changes with the Contractor at any time.

F. Upon approval of shop drawings, Contractor shall immediately place orders for all required materials, components, and supplies. In addition, Contractor shall secure and forward written confirmations (including orders and shipping dates) direct from each manufacturer/vendor to the Owner's Project Manager.

G. Contractor shall expedite shipment of all materials, components and supplies, as necessary to ensure the successful completion of the Project by the date required. All costs for expediting shall be included within Contractor's pricing as provided below.

H. The system/network cost herein shall include administration/ maintenance training for at least ten Owner's representatives with a minimum allotment of sixteen hours. All training shall include written and/or video materials that shall remain the property of Owner. If materials are written, they shall be provided in quantities sufficient for each person trained; if materials are video, one copy of each will be required. The administration/maintenance training shall include, but not be limited to, the following:
   1. Review of as-built documentation, including a site demonstration.
   2. All warranty information.

I. Minimum standards for maintenance purposes shall include optional access to service on a 24 hour-a-day, 365 day-a-year basis. In addition, Contractor shall, upon notification, respond as follows:
   1. Emergency Response: Contractor must respond by utilizing remote diagnostics capabilities (as applicable) within thirty minutes of notification. If necessary, Contractor must dispatch at least one certified technician for arrival on-site within two hours of notification.
   2. Non-Emergency Response: Contractor shall respond by utilizing remote diagnostics capabilities and or cause dispatch of at least one certified technician for arrival on-site within one business day of notification.

3. Definition of "Emergency": For maintenance purposes, "emergency" shall be defined as one or more of the following conditions:
   a. Defects of any riser pairs and/or components involving at least ten percent (10%) of any riser cable's capacity.
   b. Defects of station cable pairs and/or components involving at least ten percent (10%) of any department or group of voice and/or data stations.
   c. Defects significantly impairing any single attendant console.
   d. Defects of any fiber optic cable and/or components involving at least ten percent (10%) of any department's or group's fiber-based systems and/or stations.
   e. Any pre-defined failure as submitted by Owner and agreed to be Contractor.

3.7 DAMAGES

A. The Contractor will be held responsible for any and all damages to portions of the building caused by it, its employees or subcontractors; including but not limited to:
   1. Damage to any portion of the building caused by the movement of tools, materials or equipment.
   2. Damage to any component of the construction of spaces.
   3. Damage to the electrical distribution system.
   4. Damage to the electrical, mechanical and/or life safety or other systems caused by inappropriate operation or connections made by the Contractor or other actions of Contractor.
   5. Damage to the materials, tools and / or equipment of the Owner, its consultants, agents and tenants.

3.8 INSPECTIONS

A. On-going inspections shall be performed during construction by the Owner's Project Manager. All work shall be performed in a high quality manner and the overall appearance shall be clean, neat and orderly. The following points will be examined and must be satisfactorily complied with:
   1. Are all cables properly labeled, from end-to-end?
   2. Have all terminated cables been properly tested in accordance with the specifications for the specific category as well as tested for opens, shorts, polarity reversals, transposition and presence of AC and/or DC voltage?
   3. Have the pathway guidelines been followed? Are all cable penetrations installed properly and fire stopped according to code?
   4. Have the Contractors avoided excessive cable bending?
   5. Is Cable Fill Correct?
   6. Are hanging supports within 1.5 meters (5 feet)?
   7. Does hanging cable exhibit some sag?
   8. Are telecommunications closet terminations compatible with applications equipment?
   9. Have Patch Panel instructions been followed?

a. Jacket removal point?
b. Termination positions?
c. All pair terminations tight with minimal pair distortions?
d. Twists maintained up to Index Strip?

10. Have Modular Panel instructions been followed?
    a. Cable dressing first?
    b. Jackets remain up to the Connecting Block?
    c. All pair terminations tight and undistorted?
    d. Twists maintained up to the Connecting Block?
11. Are connectors properly turned right side up in the Jack Panels or faceplates without cables wrapped or twisted around the Mounting Collars?
12. Are the correct outlet connectors used (T568A or T568B)?
13. Is the jacket maintained right up to the termination?
14. Are identification markings uniform, permanent and readable?

3.9 COMPLETION OF WORK

A. At the completion of the System, the Contractor shall restore to its former condition, all aspects of the project site and on a daily basis, shall remove all waste and excess materials, rubbish debris, tools and equipment resulting from or used in the services provided under this Contract. All clean up, restoration, and removal noted above will be by the Contractor and at no cost to Owner. If the Contractor fails in its duties under this paragraph, Owner may upon notice to the Contractor perform the necessary clean up and deduct the costs thereof from any amounts due or to become due to the Contractor. It shall be the Contractor's responsibility to remove trash from the areas it is working in and bring trash and debris to the Contractor provided dumpster.

B. Final Punch Walk: The contractor and owner shall complete a final inspection to determinate if all conditions of the scope of work are completed to the owner’s satisfaction. A “punch list” will be formulated within (2) days of the punch walk and be presented to the contractor for completion prior to final project sign-off by the owner. If an item is missed during the punch walk or not included on the “punch list” for any reason, it does not release the contractor from completing the scope of work as defined in the specification or drawings.

C. Contractor shall submit complete Record Documentation as outlined in submittals section prior to project sign-off by owner.

3.10 SYSTEM AND/OR NETWORK TESTING

A. Upon completion of installation, Contractor shall execute all of the required tests as summarized in this specification. When all such tests have been completed to Owner’s satisfaction and Manufacturer’s specifications, Contractor shall give the Owner written notice thereof.

B. Contractor must assume responsibility of assuring that the system and/or network installed operates properly, including any required coordination with other suppliers.

END OF SECTION

SECTION 282000 - CLOSED CIRCUIT TELEVISION SYSTEM

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes all final design, all labor, material, equipment, supplies, labor, testing, and accessories required to furnish and install a complete Closed Circuit Television System as indicated on the drawings and as specified herein.

B. It is the intent of the Drawings and Specifications, which are presented in a "design- build" format, for the Contractor to design, provide and install a complete, fully operational, and tested system.

C. All miscellaneous system components including, but not limited to, cables, termination equipment, punch blocks, patch panels, backboards, and any other related items shall be furnished and installed complete under this section, such that the system shall perform all functions listed herein in compliance with all of the specified requirements.

D. The CCTV System shall include, but not limited to, the following subsystems/ products:
   1. See Products Section.

1.2 RELATED WORK

A. Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and sections of Divisions 1 and 26 of these specifications.

B. All applicable portions of Section 26000 shall apply to this section as though written herein completely.

1.3 GENERAL REQUIREMENTS

A. The contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work.

B. All work shall be performed under the supervision of a company accredited by the basic equipment manufacturer and such accreditation must be presented.

C. The installing contractor shall be a factory authorized distributor and warrantee station for the brand of equipment offered (Genetec) and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The installing contractor shall maintain a spare set of all major parts for the system at all times. All circuit boards, amplifiers and control sub systems shall be 100% backed up with stock at contractors shop.

D. All of the equipment in this specification shall be furnished and installed by the Authorized Factory Distributor of the equipment. The Contractor shall furnish a letter from the

manufacturer of all major equipment, which certifies that the installing contractor is the Authorized Distributor and that the equipment has been installed according to factory intended practices. The Contractor shall also furnish a written guarantee from the manufacturer that they will have a service representative assigned to this area for the life of the equipment.

E. All communication systems supplied shall be listed by Underwriter's Laboratories under UL Standard 1459. A copy of the UL listing card for the proposed system shall be included with the contractor's submittal.

F. All of the equipment in this specification shall be furnished and installed by the Authorized Factory Distributor of the equipment with the most current software package available at the time of installation. At the time of Owner Acceptance of the installation, all equipment shall include any and all updated software revisions. In addition, when the software is available in disk format, a backup copy of the most up to date revision, in disk format, shall be handed to the Owner at the completion of the project.

G. The contractor shall pay all charges (including travel, lodging, meals, etc.) required to provide factory certification, equal to that of a Factory Authorized Distributor of the substituted item, for two (2) selected Owners representatives. This training shall occur at the primary factory of the substituted item in question and shall allow the selected Owners representatives to provide any and all Factory/Manufacturer Approved repairs, services, software upgrades, etc. without affecting any available or applicable Manufacturer Warranties.

1.4 QUALITY ASSURANCE

A. In order to maintain a high degree of quality assurance, the contractor shall, without exception, use the parts and supplies as specified in this specification.

B. For any proposed substitution, a complete descriptive, technical and cost comparison, and test report package shall be submitted to the Owner for review. Final approval of the substitution item shall be at the option of the Owner, and written notice of the status of the proposed alternative will be supplied to all bidders prior to the final bid date. The Owner or its representative must approve any proposed substitution item in writing. The Owner reserves the right to require a complete sample of any proposed equal item and may, if necessary, request a sample tested by an independent testing consultant to prove equality. The decision of the Owner regarding equality of proposed equal items will be final.

C. It is the intent of these specifications to establish a standard of quality for labor and material to be installed. The Base Bid shall include materials as specified - without exception. Proposed substitutions, if approved in writing by the Owner, shall be listed on the bid form in addition to the specified materials.

D. Approved equal status does not imply final acceptance. Final acceptance of a substitution item shall be made by the Owner prior to the award of bid to the successful contractor, after reviewing the bid information.

E. If a substitution item is given final acceptance by the Owner, the Contractor shall reimburse the Architect for any additional engineering charges and shall pay all charges of other trades resulting from the substitution, at no cost to the Owner.

F. If a substitution item is given final acceptance by the Owner, the contractor shall pay all charges (including travel, lodging, meals, etc.) required to provide factory certification, equal to that of a Factory Authorized Distributor of the substituted item, for two (2) selected Owners representatives. This training shall occur at the primary factory of the substituted item in question and shall allow the selected Owners representatives to provide any and all Factory/Manufacturer Approved repairs, services, software upgrades, etc. without affecting any available or applicable Manufacturer Warranties.

1.5 GENERAL SUBMITTAL REQUIREMENT

A. Submittals shall be presented and formatted per the guidelines in the Division 1 section of this RFP package.

B. Submittal shall be furnished in an 8 ½" x 11" format in 3-ring loose-leaf binders. The cover and the title page shall bear the project name, capital project number, specification number, name of contractor and date. The document shall have a table of contents and page numbers on each of the pages including brochures and drawings.

C. Drawings shall be no larger than 34" x 22". Drawings larger than 8 ½" x 11" shall be folded to 8 ½" x 11" so that the drawing's name and page number are visible and can be unfolded without being removed.

D. Reproduced material shall not be subject to fading by light or heat and shall have high contrast for easy reading.

E. All cut sheets shall represent the latest version, part number, and revision of the product. Where multiple products or part numbers appear on a page, a bold arrow or circle shall indicate which product or part numbers are to be used as part of the installation. The submittal shall include all descriptive pages associated with the product, not just the page showing the part number.

1.6 PRE-INSTALLATION SUBMITTAL REQUIREMENTS

A. Within thirty (30) calendar days after the date of award of the Contract, the Contractor shall submit the following:
   1. Submittal Binder: Submit electronic copies of the complete Submittal Binder to the Owner for review. The binder shall consist of five major sections with each section separated by index tabs. Each page in the binder shall be numbered sequentially and shall be summarized in the index.
      a. The first section shall be the "title sheet" which shall include the submittal date, project title and address, name of the contractor, and name of the Owner.
      b. The second section shall contain proposed material list including manufacturer's name, model number and technical data for all equipment the contractor proposes to

install. Items shall be identified by specification section and paragraph number. The technical data shall consist of copies of factory issued catalog sheets or brochures, which give ratings and specifications for the proposed items. Include statement describing exceptions being taken, if any, to the specifications wherein the submitted equipment or design varies from that originally specified.

c. The third section shall contain original manufacturer cut sheets for all of the materials that meet the requirements listed in Section 2 of this specification and all materials described on the construction drawings. Also include manufacturer's cut sheets for all testing equipment to be used for completion of the project. All pages shall be numbered sequentially corresponding to the index.
d. The fourth section shall contain Single line system diagram identifying and showing interrelationships between equipment items and how they are interconnected. The diagram shall be based on the drawings included in the Construction Documents. It shall be updated to show quantities and part numbers for all components including patch panels, cable, conduit, cabinets and equipment racks, splices, splice cases and all other associated components.
e. The fifth section shall contain shop drawings showing details of fabricated items, rack elevation drawings, console arrangements and schematics of custom designed items.
f. For any exceptions that are not approved by City, contractor shall resubmit the information in complete compliance with the specifications and drawings.
g. Failure to comply with any of the requirements listed above may result in the rejection of the entire submittal package.

1.7 POST INSTALLATION SUBMITTAL REQUIREMENTS

A. Within fifteen (15) calendar days after the completion of work, the Contractor shall submit the following:
   1. Record Documentation:
      a. Record drawings shall be made on separate clean blue line prints of the electrical drawings issued by the City or Architect and shall be reserved for the purpose of showing work as actually installed, including accurately dimensioned locations of all conduit stub-outs and pull boxes, routing of all conduits extending from or between buildings and locations of all telecommunications equipment not installed according to drawings.
      b. Drawings shall be kept up to date with neat and legible annotations made thereon daily as work proceeds, showing work as actually installed. Additional sheets may be attached to show greater detail. Drawings shall be available at all times for inspection and shall be kept on the job at a location designated by City.
   2. Contractor at his option may use an additional set of drawings for daily field annotations. This set of drawings shall be kept at the site.
   3. Final record drawings shall be submitted with floor numbers, room numbers, panel directories and all other identification necessary to conform to number designations for occupancy rather than to construction numbers. All buried conduit and/or underground conduits stubs intended for future extension shall be accurately shown as to depth and exact measurement from a permanently established landmark, such as building or

structural features.

4. On completion, record drawings shall be signed, dated and returned to the City for inspection and approval before acceptance of any work.
5. Provide three (3) sets of drawings to City Telecommunications Systems Engineer.

B. Final Submittal

1. Three (3) complete sets of the Final Submittal including a full set of the drawings on vellum shall be delivered to City Telecommunications Systems Engineer prior to acceptance tests and as a condition for final payment for the project to the contractor. It shall include all the information necessary to maintain each system, and shall consist of the following:
   a. Operators Instructions (as applicable).
   b. Factory-issued Service Manuals for each piece of equipment installed. The manuals shall contain complete parts lists, detailed schematics, circuit descriptions, maintenance procedures and trouble-shooting methods. In the event such manuals are not available from the factory, it shall be the responsibility of the contractor to compile and submit the required information.
   c. A System Manual for each system furnished. This manual shall complement the above service manuals with all necessary additional information unique to the system that is not otherwise provided, such as a list of applicable service manuals, options selected, jumper or strapping choices, modifications, and detailed wiring information. All manuals shall be bound in a 3-ring binder with tabs identifying each system.
   d. Record Drawings (see Paragraph 1.07-A-5).
   e. Two (2) electronic copies of all drawings in AutoCAD 2000 format or as specified by the City Telecommunications System Engineer, shall be provided. One copy to the Library Capital Project Section and one copy to the City Telecommunications Systems Engineer.

1.8 GENERAL SYSTEM PRODUCT, INSTALLATION AND OVERALL SYSTEM WARRANTY

A. Prior to Owner acceptance, the contractor shall provide to Owner, a manufacturers product and performance warranty. This will require a submittal of the required pre- job certification registration forms as well as the required project closing information.

1.9 THE OWNER WILL ONLY ACKNOWLEDGE ACCEPTANCE UPON SUBMITTAL OF A VALID MANUFACTURER'S WARRANTY.

A. The warranty shall commence from the date of final written acceptance by the Owner.

B. All conditions for obtaining the manufacturer's warranty shall be the sole responsibility of the contractor.

C. The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the owner after the end of the guarantee period.

D. A typewritten notice shall be posted at the equipment rack that shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

1.10 SPECIFIC SYSTEM PRODUCT, INSTALLATION AND OVERALL SYSTEM WARRANTY

A. The entire system shall be warranted free of mechanical or electrical defects for a period of one (1) year after final acceptance of the installation. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the Owner. The warranty shall be transferable to any person/persons at the discretion of the Owner

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Material, Equipment and Software shall be products of a single manufacturer. All material, equipment and software shall be the latest technology and currently in production. Each major component of equipment shall have the manufacturer's model and serial number in a conspicuous place. Acceptable manufacturers include:
   1. By City
   2. Axis (Cameras)

B. The equipment shall be available through Authorized, factory-trained and certified Business Partners or Dealers.

C. Hardware Manufacturer Experience: All system hardware and firmware shall be produced by manufacturers regularly engaged in the production of electronic security management systems and application software for at least 5 years.

D. Software Manufacturer Experience: All system and application software shall be produced by manufacturers regularly engaged in the production of electronic security management systems and application software for at least 5 years.

E. System Installer Experience: The system shall be installed by a factory-trained contractor who has been regularly engaged in the installation of electronic security management system equipment for at least 5 years.

F. System Component Design: Electronic security management system components shall be designed for continuous operation. Electronic components shall be of SMT manufactured process. All connections to the intelligent system controllers, intelligent reader controllers, and intelligent control modules shall be protected by SMT type TVS (Transient Voltage Suppressors).
   1. Modularity: The contractor shall provide equipment designed for increase of system capability and capacity. System components shall be designed to facilitate easy maintenance and replacement of components and devices. The system shall auto-configure new and replacement controllers for address, baud rate and communication type. Systems

using controller hardware with rotary switches, dipswitches and jumpers for address, baud rate and communication type are not acceptable.

2. Maintainability: Components shall be designed to be maintained using commercially available tools and equipment. Components shall be arranged and assembled so they are accessible to maintenance personnel. There shall be no degradation in tamper protection, structural integrity, EMI/RFI attenuation, or line supervision capability after maintenance when it is performed in accordance with manufacturer's instructions.

G. It is the responsibility of the bidder to ensure that the proposed product meets or exceeds every standard set forth in these specifications and the equipment's technical data sheets.

H. The functions and features specified are vital to the operation of this facility. Therefore, inclusion of a component's manufacturer in the list of acceptable manufacturers does not release the contractor from strict compliance with the requirements of this specification.

I. The communication contractor shall furnish and install a Closed Circuit Television (CCTV) system. The CCTV system shall consist of fixed cameras, monitors, power supply, cabling, distribution amplifier, and associated equipment. The CCTV System shall be monitored and recorded on the VMS located in the Owner's Server Room.

J. CCTV Contractor shall furnish and install a complete and fully functional CCTV system. CCTV Contractor shall furnish and install any and all materials whether or not specified to provide a complete and fully functional CCTV system. CCTV Contractor shall configure all settings and programming of the equipment including but not limited to camera titles, presets, recording schedules, and frame rates. CCTV Contractor shall coordinate with the Owner's IT Project Manager in the system settings and configuration.

K. CCTV Contractor shall meet or exceed all Federal, State, and local building codes including but not limited to the National Electric Code and Fire Codes. CCTV Contractor shall install all materials in accordance with manufacturer's instructions and specifications. CCTV Contractor shall install all materials in accordance with professional standards including EIA/TIA standards.

L. CCTV Contractor and its subcontractors shall be an authorized manufacturer dealer/reseller and manufacturer's certified installer of the CCTV system and VMS equipment. The Contractor and subcontractors shall submit manufacturer's certification documentation at the time of bid submittal.

M. Cabling – CCTV Contractor shall furnish and install all cabling for the CCTV system. CCTV Contractor shall furnish and install all cabling supports as per NEC and EIA/TIA requirements. Cable support shall be independent from ceiling and other equipment supports.

N. Cabling installed in the interior of the building shall be plenum rated. Any cabling installed exterior to the building shall be installed in and protected with weatherproof and watertight conduit and enclosures.

O. Cameras - The camera locations are shown on the plans. CCTV Contractor shall verify camera locations at the site. CCTV Contractor shall furnish and install cameras and mounts. CCTV contractor shall furnish and install appropriate mounting backboxes for the cameras. CCTV contractor shall secure and earthquake brace camera backboxes. CCTV contractor shall verify which appropriate camera back box to use with the camera manufacturer. CCTV contractor shall cut ceiling tiles in a neat and clean manner as necessary to install the camera backboxes and cameras. CCTV contractor shall ensure that no gaps are visible in the ceiling when the cameras are installed. CCTV Contractor shall adjust the camera lenses and settings to obtain the required views. CCTV Contractor shall coordinate with the Owner's project manager and end user to determine camera view. CCTV Contractor shall readjust the camera lenses and settings as necessary to obtain alternate views as requested by Owner's Project Manager. CCTV Contractor shall connect the cameras to the video inputs of the respective monitor.

P. Camera power supplies – Cameras shall be powered by POE network switches or POE injectors. Exterior camera heaters may require additional AC or DC power. Provide power supplies and cable as required.

Q. Power supplies. All cameras will be PoE.

R. Contractor shall install an IP Video Management System (VMS) consists of software, Patch panels, Category 6 cabling, patch cables, fiber transceivers, servers, disk storage, network switches as required for a complete and operable system. VMS software is existing by owner. Provide all upgrades as necessary.

S. Monitors – CCTV Contractor shall furnish and install two desktop mounted LCD monitors at the circulation desk and one desktop mounted monitor at the reference desk. The circulation desk monitors will display the cameras viewing the public and family restrooms. The reference desk monitor will display the camera view the family restroom.

T. CCTV Contractor shall configure all settings of the CCTV system including all parameters of the cameras and monitors. CCTV Contractor shall coordinate with the general contractor and Owner's project manager for the installation schedule and to deliver a fully functional system.

U. The installation shall comply with ALL applicable National Electric Codes, Building, and Fire Codes. The CCTV Contractor shall apply section 271000 – Structured Cabling System (SCS) for all cabling infrastructure associated with the CCTV system.

2.2 VMS:

A. Connect to existing City VMS – provide upgrades as required to accommodate all additional cameras.
   1. Video Storage Array:
      a. Include all costs in bid to provide additional storage as required.
         1) 10 FPS, H.264 compression, 50% motion
         2) Record single index frame per second

3) 25% Overhead

2. The contractor shall provide additional camera licenses as required for all new cameras

2.3 HARDWARE

A. Cameras
   1. Outdoor 2MP, Fixed Dome, Axis P3265

B. Camera Mounting
   1. Camera Mounting Hardware – Ancillary hardware shall be provided by the contractor, if required, and shall be compatible and comparable in strength to other attached hardware. Contractor is responsible to securely mount all cameras and camera enclosures with appropriate fasteners required for the mounting surface. Follow all manufacturer recommended installation guidelines. See camera schedules on plans for desired mount.
   2. Camera Mounts and Enclosures – Axis. Mounts and enclosures shall be appropriate for environment where camera is mounted. See drawings.
   3. VMS Administration Client (Existing – provide upgrades as necessary to accommodate additional cameras)
   4. Client Computer (existing) – Contractor shall use their own equipment for testing and configuration of equipment.

C. Cabling
   1. Category 6 cabling system. The following is project approved system. Provide Category 6 cabling system with 20 year Manufacturer's Warranty per specification section 271000. All cabling used throughout this project shall comply with the requirements as outlined in the National Electric Code (NEC Articles 725, 760, 770, and 800 and the appropriate local codes. All copper cabling shall bear CMP (Plenum Rated), CM/CMR (Riser Rated), OSP (Outside Plant) and/or appropriate markings for the environment in which they are installed.

D. Miscellaneous Connectors – as required.

E. Miscellaneous materials – All materials necessary to furnish and install a complete and fully functional system.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. The wiring of the system shall be executed in accordance with the drawings and the equipment manufacturer's wiring diagrams. Should any variations in these requirements occur, the contractor shall notify the Architect before making any changes. It shall be the responsibility of the factory-authorized distributor of the approved equipment to install the equipment and guarantee the system to operate as per plans and specifications.

B. Furnish all conduit, junction boxes, conductors, equipment plugs, terminal strips, etc., and labor to install a complete and operable system.

C. The cables within the rack or cabinets shall be carefully cabled and laced with Velcro. All cables shall be numbered for identification.

D. Splices of conductors in underground pull boxes are not permitted.

E. The labor employed by the contractor shall be regularly employed in the installation and repair of communication systems and shall be acceptable to the owner and architect to engage in the installation and service of this system.

F. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc., the Contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., Caused by the performance of this work.

G. The system must meet all local and other prevailing codes.

H. All cabling installations shall be performed by qualified technicians.

I. All cabling shall be splice free.

J. In order to ensure the least amount of cable untwisting, it is required that all cables shall be stripped using a special tool.

K. The use of lubricants (i.e. Yellow 77) to facilitate the installation of cables in conduits is highly discouraged. If such a lubricant must be used, the contractor shall verify the acceptability of the lubricant to be used with the cable manufacturer, prior to using such a lubricant.

L. Under no circumstance are "channel locks" or other pliers to be used.

M. Plenum rated cable may be run exposed above ceilings, provided the cabling is supported independent of other utilities such as conduits, pipes, and the ceiling support systems. The cables shall not be laid directly on the ceiling panels. The use of cable ties shall be done in accordance with the cable manufacturer's requirements. The cable jacket composition must meet local and all other prevailing fire and safety codes.

N. All firewalls penetrated by CCTV contractor shall be sealed by use a non- permanent fire blanket or other method in compliance with the current edition of National Fire Protection Association (NFPA) and the National Electric Code (NEC) or other prevailing code and must be a system listed by Underwriter’s Laboratory (U.L.). The contractor must not use concrete or other non-removable substance for fire stopping on cable trays, wire ways or conduits. Contractors who use this method will be required to replace all cables affected and provide the original specified access to each effected area.

O. The contractor shall bolt all equipment racks to the floor/wall once the Owner determines the exact location for each rack. The earthquake mounting brackets that come with each relay rack

kit shall be screwed to studs, not drywall. All equipment shall be serviceable in the racks final location – the need to unbolt racking equipment to access or service equipment is not acceptable.

P. In suspended ceiling areas and raised floor areas (if shown on drawings) where walker duct, cable trays or conduit are not available, the Contractor shall bundle station wiring with approved ties at distances not more than 6’ intervals The cable bundling shall be supported via "J" hooks attached to the existing building structure and framework. Plenum cable will be used in all appropriate areas.

Q. Clearly mark security cable at 10’ intervals with color-coded tags to differentiate it from surrounding cables.

R. All cable, wires, wiring forms, terminal blocks and terminals shall be identified by labels, tags or other markings. The markings shall clearly indicate the function, source, or destination of all cablings, wiring and terminals. The wire marking format contained in the shop drawings shall be utilized for all conductors installed on the project. All cables and wires shall be identified, utilizing heat shrink, machine printed, polyolefin wire markers (Brady Type B-321, WMS-#17-321 or equal). Handwritten tags are not acceptable. All cabinets and panels shall be provided with permanently attached lamicoid labels with 1” high white lettering on black background. Labels must contain the text name and alphanumeric identifier as called out on the single line.

3.2 SPECIFIC SYSTEM INSTALLATION REQUIREMENTS

A. The installer shall, upon completion of the system installation, adjust all controls, etc., to provide a system operating at maximum capability.

B. Submit block diagram and shop drawing of equipment.

3.3 GENERAL TESTING REQUIREMENTS

A. Provide all instruments for testing and demonstrating in the presence of the owner's inspector that the frequency response is as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds.

3.4 SPECIFIC SYSTEM TESTING REQUIREMENTS

A. System shall be complete and properly operating prior to calling for the test. The inspector, contractor and engineer shall walk test system at Owner’s option and contractor shall make minor satisfactory adjustments to the system in the presence of the inspector. Contractor shall coordinate the time of test with the Owner’s inspector. This test shall be performed during a time when there are no other persons on the site. The testing shall include:
   1. Demonstrate acceptable picture quality and camera views on each camera.
   2. Demonstrate acceptable picture quality on each video monitor.
   3. Demonstrate switching, recording and playback functions of the VMS.

B. The Owner or Owner's representative may visit the site during the installation of the system to ensure that correct installation practices are being followed.

C. The Owner or Owner's representative will conduct a final job review once the contractor has finished the job. This review will take place within one week after the contractor notifies the owner.

D. Two copies of all certification data and drawings for all identifications shall be provided to the Owner before the owner's review.

E. The Owner or Owner's representative will review the installation and certification data prior to the system acceptance.

F. The Owner or Owner's representative may test some of the systems features to ensure that the certification data is correct. If a substantial discrepancy is found, the Owner reserves the right to have an independent consultant perform a certification of the entire system. If such a procedure is undertaken, the cost of the testing will be billed back to the contractor.

G. In the event that repairs or adjustments are necessary, the contractor shall make these repairs at his own expense. All repairs shall be completed within 10 days from the time they are discovered.

H. The contractor shall provide not less than eight (8) hours for site instruction of personnel in the operation and maintenance of the installed systems. This instruction time shall be divided as directed by the Owner.

I. The contractor shall hand to the owner a copy of any applicable installation specific software configurations in CD format.

END OF SECTION

SECTION 311000 - SITE CLEARING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Clearing and protection of vegetation.

B. Removal of existing debris.

1.2 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 011000 - Summary: Sequencing and staging requirements.

C. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 015713 - Temporary Erosion and Sediment Control.

E. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.

F. Section 017419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

G. Section 024100 - Demolition: Removal of built elements and utilities.

H. Section 312323 - Fill: Filling holes, pits, and excavations generated as a result of removal operations.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fill Material: As specified in Section 312323 - Fill and Backfill

PART 3 EXECUTION

3.1 SITE CLEARING

A. Comply with other requirements specified in Section 017000.

B. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

3.2 EXISTING UTILITIES AND BUILT ELEMENTS

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Protect existing structures and other elements that are not to be removed.

3.3 VEGETATION

A. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by building structure, paving, playing fields, lawns, and planting beds.

B. Do not begin clearing until vegetation to be relocated has been removed.

C. Preservation of existing vegetation: The construction schedule shall consider the amount and duration of soil exposed to erosion by wind, rainfall, and vehicle tracking and seek to minimize distrurbed soil during the rainy season. A schedule shall be prepared that shows the sequencing of construction activities with installation of maintenance of soil stabilization and sedment control BMPs.

D. Do not remove or damage vegetation beyond the limits indicated on drawings.
   1. Exception: Specific trees and vegetation indicated on drawings to be removed.
   2. Exception: Selective thinning of undergrowth specified elsewhere.

E. Install substantial, highly visible fences at least 4 feet high to prevent inadvertent damage to vegetation to remain:
   1. Around trees to remain within vegetation removal limits; locate no closer to tree than at the drip line.
   2. Around other vegetation to remain within vegetation removal limits.
   3. See Section 015000 for fence construction requirements.

F. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.

G. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
   1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.
   2. Trees: Sell if marketable; if not, treat as specified for other vegetation removed; remove stumps and roots to depth of 36 inches.
   3. Existing Stumps: Treat as specified for other vegetation removed; remove stumps and roots to depth of 36 inches.
   4. Fill holes left by removal of stumps and roots, using suitable fill material, with top surface neat in appearance and smooth enough not to constitute a hazard to pedestrians.

H. Dead Wood: Remove all dead trees (standing or down), limbs, and dry brush on entire site; treat as specified for vegetation removed.

I. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.4 DEBRIS

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

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SECTION 312200 - GRADING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Removal of topsoil.

B. Rough grading the site for site structures.

C. Finish grading.

1.2 RELATED REQUIREMENTS

A. Section 311000 - Site Clearing.

B. Section 312316 - Excavation.

C. Section 312316.13 - Trenching: Trenching and backfilling for utilities.

D. Section 312323 - Fill: Filling and compaction.

1.3 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with the Standards Specifications for Public Works Construction (Greenbook); current edition.

B. Perform work in accordance with Project's Geotechnical Report - "Geotechnical Exploration City of Rancho Cucamonga Fire Station 178, APN 1077-422-58" prepared by Leighton Consulting, Inc. dated November 6, 2020.

PART 2 PRODUCTS

2.1 MATERIALS

A. Topsoil: See Section 312323.

B. Other Fill Materials: See Section 312323.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

B. Verify the absence of standing or ponding water.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Protect from damage above- and below-grade utilities to remain.

D. Provide temporary means and methods to remove all standing or ponding water from areas prior to grading.

E. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.

F. Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside this line.

G. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

3.3 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
   1. Remove sod, grass, and any other vegetation before stripping top soil.
   2. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
   3. Strip topsoil in a manner to prevent intermingling with underlying subsoil or other waste materials.
   4. Strip topsoil to depth indicated on drawings.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil , unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. See Section 312323 for filling procedures.

G. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.

H. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

I. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack surface water control.

3.4 SOIL REMOVAL

A. Stockpile topsoil to be re-used on site; remove remainder from site.
   1. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water and other erosion control measures.
      a. Limit height of topsoil stockpiles to 72 inches.
      b. Do not stockpile topsoil within plant protection zones.
      c. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or resued.

B. Stockpile subsoil to be re-used on site; remove remainder from site.

3.5 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 2 inch in size. Remove soil contaminated with petroleum products.

C. Where topsoil is to be placed, scarify surface to depth of 6 inches.

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 12 inches.

E. Place topsoil in areas indicated.

F. Place topsoil during dry weather.

G. Remove roots, weeds, rocks, and foreign material while spreading.

H. Near plants spread topsoil manually to prevent damage.

I. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

J. Lightly compact placed topsoil.

K. Maintain stability of topsoil during inclement weather. Replace topsoil in areas where surface water has eroded thickness below specifications.

3.6 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.

B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).

3.7 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

B. Trees to Remain: If damaged due to this work, trim broken branches and repair bark wounds; if root damage has occurred, obtain instructions from Architect as to remedy.

C. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.8 FIELD QUALITY CONTROL

A. See Section 312323 for compaction density testing.

3.9 CLEANING

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 312316.13 - TRENCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Backfilling and compacting for utilities outside the building to utility main connections.

1.2 RELATED REQUIREMENTS

A. Document "Geotechnical Exploration City of Rancho Cucamonga Fire Station 178, APN 1077-422-58" prepared by Leighton Consulting Inc., dated August 4, 2021: Geotechnical report; bore hole locations and findings of subsurface materials.

B. Section 312200 - Grading: Site grading.

C. Section 312316 - Excavation: Building and foundation excavating.

D. Section 312323 - Fill: Backfilling at building and foundations.

1.3 DEFINITIONS

A. Finish Grade (FG) Elevations: Indicated on drawings.

B. Finish Surface (FS) Elevations: Indicated on drawings.

1.4 REFERENCE STANDARDS

A. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop 2022, with Errata .

B. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates 2019.

C. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)) 2012 (Reapproved 2021).

D. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method 2015, with Editorial Revision (2016).

E. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)) 2012 (Reapproved 2021).

F. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method 2015.

G. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) 2017, with Editorial Revision (2020).

H. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils 2017, with Editorial Revision (2018).

I. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) 2023.

J. Standard Specifications for Public Works Construction (Greenbook); current edition.

K. Local Water Agency: Cucamonga Valley Water District

L. Project's Geotechnical Report - Geotechnical Exploration City of Rancho Cucamonga Fire Station 178, APN 1077-422-58 prepared by Leighton Consulting Inc. dated November 6, 2020.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Samples: 10 pound sample of each type of fill; submit in air-tight containers to testing laboratory.

C. Materials Sources: Submit name of imported materials source.

D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

E. Compaction Density Test Reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where allowed by owner.
   1. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. General Fill: Subsoil excavated on-site.
   1. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.

B. Engineered Fill: Conforming to Greenbook Section 200-1.4, and recommendations as stated in the Project's Geotechnical Report.

C. Concrete for Fill: Lean concrete conforming to Greenbook Section 200-4, and recommendations as stated in the Project's Geotechnical Report.

D. Granular Fill: Crushed rock, conforming to Greenbook Section 200-1.2, _____and recommendations as stated in the Project's Geotechnical Report. Gravel use is acceptable only when used in conjunction with filter fabric.

E. Sand: Conforming to Greenbook Section 200-1.5, and recommendations as stated in the Project's Geotechnical Report.and recommendations as stated in the Project's Geotechnical Report.

2.2 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, woven Mirafi ; 140N manufactured by Mirafi.

B. Trace Wire and Detectable Warning Tape: Install detectable warning tape during the installation of proposed utilities on contract drawings. Acid- and alakli-resistant, polyethylene film warning tape manufactured for making and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 5 mils (0.1mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep, colored as follows:
1. Red: Electric and cathodic protection.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone, fiber optic, and other communications.
4. Blue: Potable water and fire protection service systems.
5. Green: Sewer and storm drainage systems.
6. Purple: Non-potable reclaimed water.

2.3 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, testing of samples for compliance will be provided before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Locate, identify, and protect utilities that remain and protect from damage.

C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

D. Protect plants, lawns, rock outcroppings, and other features to remain.

E. Grade top perimeter of trenching area to prevent surface water from draining into trench. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by the Architect.

3.3 TRENCHING

A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Cut trenches wide enough to allow inspection of installed utilities.

E. Hand trim excavations. Remove loose matter.

F. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

G. Remove excavated material that is unsuitable for re-use from site.

H. Stockpile excavated material to be re-used in area designated in Section 312200.

I. Remove excess excavated material from site.

J. Provide temporary means and methods, as required, to remove all water from trenching until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

K. Determine the prevailing groundwater level prior to trenching. If the proposed trench extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the Architect.

3.4 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.

3.5 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. Correct areas that are over-excavated.
   1. Thrust bearing surfaces: Fill with concrete.
   2. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.

G. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
   2. At Landscaped areas: 90 percent of maximum dry density.

H. Reshape and re-compact fills subjected to vehicular traffic.

3.6 BEDDING AND FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Utility Piping and Conduits:
   1. Bedding: Use clean sands in accordance with Greenbook requirements to a depth of at least 1 foot over the pipe.
   2. Cover with general fill.
   3. Fill up to subgrade elevation.
   4. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.

3.7 TOLERANCES

A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.8 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for field inspection and testing.

B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.

C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 ("modified Proctor"), AASHTO T 180, or ASTM D698 ("standard Proctor").

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Frequency of Tests: as directed by geotechnical engineer.

3.9 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 312316 - EXCAVATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Excavating for building volume below grade, footings, pile caps, slabs-on-grade, paving, site structures, and utilities within the building.

B. Trenching for utilities outside the building to utility main connections.

1.2 RELATED REQUIREMENTS

A. Document "Geotechnical Exploration City of Rancho Cucamonga Fire station 178 APN 1077-422-58", prepared by Leighton Consulting, Inc. dated August 4, 2021: Geotechnical report; bore hole locations and findings of subsurface materials.

B. Section 015713 - Temporary Erosion and Sediment Control: Slope protection and erosion control.

C. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring. General requirements for dewatering of excavations and water control.

D. Section 312200 - Grading: Grading.

E. Section 312316.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

F. Section 312323 - Fill: Fill materials, backfilling, and compacting.

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that survey bench mark and intended elevations for the work are as indicated.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Locate, identify, and protect utilities that remain and protect from damage.

C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

D. Protect plants, lawns, rock outcroppings, and other features to remain.

E. Grade top perimeter of excavation to prevent surface water from draining into excavation. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by Architect.

3.3 EXCAVATING

A. Excavate to accommodate new structures and construction operations.

B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Provide temporary means and methods, as required, to remove all water from excavations until directed by Architect. Remove and replace soils deemed suitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for field inspection and testing.

B. Provide for visual inspection of load-bearing excavated surfaces by Architect before placement of foundations.

3.5 CLEANING

A. Remove excavated material that is unsuitable for re-use from site.

3.6 PROTECTION

A. Divert surface flow from rains or water discharges from the excavation.

B. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

C. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition.

D. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

E. Keep excavations free of standing water and completely free of water during concrete placement.

END OF SECTION

SECTION 312323 - FILL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Filling, backfilling, and compacting for building volume below grade, slabs-on-grade, paving, and site structures.

B. Backfilling and compacting for utilities outside the building to utility main connections.

C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.2 RELATED REQUIREMENTS

A. Document "Geotechnical Exploration City of Rancho Cucamonga Fire station 178 APN 1077-422-58", prepared by Leighton Consulting, Inc. dated August 4, 2021: Geotechnical report; bore hole locations and findings of subsurface materials.

B. Section 015713 - Temporary Erosion and Sediment Control: Slope protection and erosion control.

C. Section 033000 - Cast-in-Place Concrete.

D. Section 312200 - Grading: Site grading.

E. Section 312316 - Excavation: Removal and handling of soil to be re-used.

F. Section 312316.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

1.3 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Indicated on drawings.

1.4 REFERENCE STANDARDS

A. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop 2022, with Errata .

B. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates 2019.

C. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)) 2012 (Reapproved 2021).

D. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method 2015, with Editorial Revision (2016).

E. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)) 2012 (Reapproved 2021).

F. Standard Specifications for Public Works Construction (Greenbook); current edition.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Materials Sources: Submit name of imported materials source.

C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used, including manufactured fill.

D. Compaction Density Test Reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. When fill materials need to be stored on site, locate stockpiles where designated.
   1. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. General Fill: Subsoil excavated on-site.
   1. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.

B. Engineered Fill: Conforming to Greenbook Section 200-1.4, and recommendations as stated in the Project's Geotechnical Report.

C. Concrete for Fill: Lean concrete conforming to Greenbook Section 200-4, and recommendations as stated in the Project's Geotechnical Report.

D. Granular Fill: Crushed rock, conforming to Greenbook Section 200-1.2, and recommendations as stated in the Project's Geotechnical Report. Gravel use is acceptable only when used in conjunction with filter fabric.

E. Sand: Conforming to Greenbook Section 200-1.5, and recommendations as stated in the Project's Geotechnical Report.

2.2 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, woven Mirafi ; 140N manufactured by Mirafi.

B. Vapor Retarder: 10 mil thick, polyethylene.

C. Impermeable Liner: 30 mil thick, polyethylene

2.3 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, testing of samples for compliance will be provided before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that survey bench marks and intended elevations for the Work are as indicated.

B. Identify required lines, levels, contours, and datum locations.

C. See Section 312200 for additional requirements.

D. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

E. Verify structural ability of unsupported walls to support imposed loads by the fill.

F. Verify areas to be filled are not compromised with surface or ground water.

3.2 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.3 FILLING

A. Fill 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. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

G. Correct areas that are over-excavated.
   1. Load-bearing foundation surfaces: Use structural fill, flush to required elevation, compacted to 100 percent of maximum dry density.
   2. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.

H. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
   2. At landscaped areas: 90 percent of maximum dry density.

I. Reshape and re-compact fills subjected to vehicular traffic.

J. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.4 FILL AT SPECIFIC LOCATIONS

A. Over Buried Utility Piping and Conduits
   1. Refer to Section 312316.13.

3.5 TOLERANCES

A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.

B. Top Surface of Filling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.6 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for field inspection and testing.

B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 ("modified Proctor").

C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

D. Frequency of Tests: as directed by the geotechnical engineer.

E. Proof roll compacted fill at surfaces that will be under slabs-on-grade.

3.7 CLEANING

A. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

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.

END OF SECTION

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SECTION 313219 - LIGHTWEIGHT GEO-SYNTHETIC FILL

PART 1 GENERAL

1.1 DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND DIVISION 01 SPECIFICATIONS SECTIONS, APPLY TO THIS SECTION.

1.2 **SECTION INCLUDES**

A. Lightweight, Geo-Synthetic Fill.

1.3 **RELATED REQUIREMENTS**

A. Section 03 1000 - Concrete Forming and Accessories

B. Section 03 3000 - Cast-in-Place Concrete.

1.4 **REFERENCE STANDARDS**

A. ASTM D6817 - Standard Specification for Rigid, Cellular Polystyrene Geofoam.

B. ASTM D7180 - Standard Specification for Use of Expanded Polystyrene Geofoam in Geotechnical Projects

C. ASTM D7557 - Standard Guide for Sampling of Expanded Polystyrene Geofoam Specimens

1.5 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Shop Drawings: Showing the following:
      a. Profile and section view of the proposed embankment.
      b. Size, type, location and orientation of all Geofoam blocks.
      c. Location and type of connectors.
      d. Ballasting or guying techniques.
      e. Placement sequence and methods.
   5. Verification Samples: For each product specified, two samples, minimum size 4 inches (102 mm) square, representing actual product.
   6. Manufacturer's Certificates: Certify products meet or exceed the following:
      a. Manufacturer's test reports showing the physical properties and standards for the products specified as tested in accordance with ASTM D 7557.
      b. Manufacturer's Certificate of Compliance for the first 100 yd (376 m3) and for every 1500 yd3 (1147 m3) thereafter of Geofoam before product is delivered to the site.

c. Computer generated stress-strain data and the accompanying curves from compressive testing. Curves and/or data shall clearly indicate the stress at 1 percent strain and the modulus of elasticity.
d. Each delivery shall have the compression test data for each lot attached with the delivery paperwork.
e. Certificate of Compliance shall include current inspection reports showing that the Geofoam manufacturer is in compliance with a UL follow-up service program for both flame and physical properties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with a minimum of 5 years documented experience in the manufacture of lightweight, geo-synthetic fill.
1. Manufacturer must also have a UL classification in category BRYX. Manufacturer must also maintain a UL classification in category QORW that ensures physical properties in accordance with ASTM D 6817. Third-party certifications that only include ASTM C 578 physical properties will not be considered as an alternative equal and will be rejected.
2. Sequencing: Ensure that placement drawings and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

1.7 DELIVERY, STORAGE & HANDLING

A. Handle and store products in accordance the manufacturer's recommendations until ready for installation.

B. Prevent damage to the Geofoam blocks during delivery, storage, and construction.

C. Geo-Synthetic Fill that is anticipated to be exposed to sunlight for more than six months shall be covered with an opaque material to prevent ultraviolet light degradation. Remove material that is exposed for excessive period beyond six months.

D. Protect the Geo-Synthetic Fill from: organic solvents such as acetone, benzene, and paint thinner; petroleum based solvents such as gasoline and diesel fuel; and open flames.

E. Geo-Synthetic Fill should be considered combustible and should not be exposed to open flame or any source of ignition.

1.8 WARRANTY

A. Manufacturer’s 10-year warranty covering the long-term physical property of expanded polystyrene Geofoam.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Insulfoam LLC, which is located at: 5635 Schaefer Avenue ; Chino, CA 91710; Tel: 909-591-7425; Email: request info (info@insulfoam.com) ; Web: www.insulfoam.com

2.2 MATERIALS

A. Geo-Synthetic Fill: InsulFoam GF shall conform to ASTM D 6817 and may be fabricated using material with recycled content. Blocks shall have a height of at least 36 inches (.91 m), a width of at least 48 inches (1.22 m), and length of at least 96 inches (2.44 m). Blocks shall be within tolerances of 0.5 percent of respective height, width and length dimensions. Additional field and/or shop trimming and cutting shall be required as necessitated by the geometry of the fill being constructed.
   1. Type EPS22: Physical Properties when tested in accordance with ASTM D 6817 shall be:
      a. Density shall be a minimum of 1.35 lb/ft3 (21.6 kg/m3) when tested in accordance with ASTM D 1622.
      b. Compressive Resistance shall be a minimum of 7.3 psi (50 kPa) at 1 percent deformation when tested in accordance with ASTM D 1621.
      c. Flexural Strength shall be a minimum of 40.0 psi (276 kPa) when tested in accordance with ASTM C 203.
      d. Elastic Modulus shall be a minimum of 730 psi (5000 kPA) when tested in accordance with ASTM C 203.
      e. Oxygen Index shall have a minimum volume of 24.0 percent when tested in accordance with ASTM C 2863.
   2. Connectors: Connectors shall be galvanized steel multi-barbed connectors or a urethane adhesive as recommended by the manufacturer. Each connector shall have a lateral holding strength of at least 60 lbs (27.22 kg) when tested with an EPS22 Geofoam.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared as required by manufacturer.

B. Verify that the on which the Geofoam fill will be placed is to the elevations indicated on the Drawings and that is smooth and free from holes and protruding objects.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces for uniform bearing using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Geo-Synthetic Fill shall be placed to the lines and grades required to meet the maximum earth fill allowed below the finish grade elevations shown in the Drawings and as directed by the Engineer. The surface of a layer of Geo-Synthetic Fill blocks to receive additional Geo-Synthetic Fill blocks shall be constructed with a variation in surface tolerance of no more than 0.05 feet (15 mm) in any 10 foot (3 m) interval.

C. All blocks shall accurately fit relative to adjacent blocks. No gaps greater than 0.07 feet (20 mm) will be allowed on vertical joints.

D. Finished surfaces of the Geo-Synthetic Fill immediately beneath pavement or concrete sections shall be constructed to within the tolerance of zero to minus 60 mm (0.20 ft) of the indicated grade.

E. Finished surfaces of the Geo-Synthetic Fill on side slopes that receive soil cover shall be constructed to within a tolerance of plus 0.30 feet (90 mm) to minus 0.30 feet (90 mm) of the indicated grade.

F. Blocks placed in a row in a particular layer shall be offset 2.0 feet (0.6 m) relative to blocks placed in adjacent rows of the same layer as shown on the Drawing. In order to avoid continuous joints, each subsequent layer of blocks shall be rotated on the horizontal plane 90 degrees from the direction of placement of the previous layer placed

G. When needed to prevent blocks sliding during embankment construction, InsulGrip galvanized steel multi-barbed connector plates from Insulfoam or urethane adhesive should be placed between horizontal layers of blocks. Install a minimum of 2 connectors for each 4 feet (1.22 m) by 8 feet (2.44 m) section of Geofoam material or as shown on plans or directed by the Engineer. Press firmly into the rigid foam until the connector is flush with the surface. Position the next foam block as specified and seat firmly before placing subsequent blocks.

H. Blocks shall be cut using a hot wire.

I. Because of the light unit-weight of the geofoam fill, provide temporary weighting and/or guying as necessary until all the blocks are built into a homogeneous mass, and the section as well as any soil cover are in place.

J. Embankment over the side slopes of Geo-Synthetic fills shall be placed starting at the bottom of the slope in such a manner to prevent damage to the fill. Finished Geo-Synthetic Fill on side slopes shall have a minimum of 2 feet (0.61 m) embankment cover.

K. Embankment material, in areas beyond the lateral distances necessary to protect Geo-Synthetic Fill from damage, shall be compacted.

L. During placement of the load distribution slab over the top surface of the Geo-Synthetic Fill, it is permissible to use rebar supports to support the reinforcing steel during concrete placement.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Repair or replace damaged products before Substantial Completion.

END OF SECTION 313219

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SECTION 320190 - LANDSCAPE MAINTENANCE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish all labor, material, equipment and services required to maintain landscape in a healthy growing condition and in a neat and attractive appearance throughout the maintenance period.

1.2 RELATED REQUIREMENTS

A. Division 32 Section Landscape Irrigation

B. Division 32 Section Landscape Work

1.3 QUALITY ASSURANCE

A. The Maintenance Contractor shall be experienced in horticulture and landscape maintenance, practices and techniques, and shall provide sufficient number of workers with adequate equipment to perform the work during the maintenance period.

1.4 MAINTENANCE PERIOD

A. Continuously maintain the entire project area during the progress of the work and during the ninety (90) calendar-day maintenance period until final acceptance of the project by the Landscape Architect,
   1. Maintenance Period begins following "Final Completion" of the Project and after all punchlist or corrective items have been accepted by the Landscape Architect and owner.

B. Maintenance period shall not start until final completion, when all elements of construction, planting and irrigation for the entire project are in accordance with Plans and Specifications. A prime requirement is that all lawn and landscape areas shall be planted and that all lawn areas shall show an even, healthy stand of grass seedlings which shall have been mown twice. If such criteria are met to the satisfaction of the Landscape Architect, a written notification shall be issued to establish the effective beginning date of maintenance period.

C. Any day of improper maintenance, as determined by the Landscape Architect, shall not be credited as an acceptable maintenance period day. The maintenance period shall be extended on a daily basis if the work is not in accordance to the Plans and Specifications. Project shall not be segmented into maintenance areas or phases, unless authorization of the Landscape Architect is obtained.

D. Maintenance shall continue beyond the ninety (90) day maintenance period, as required, until final acceptance is given by the Landscape Architect.

E. Contractor shall provide protection to the project site during the maintenance period.

F. A phased maintenance period will not be accepted.

1.5 GUARANTEE AND REPLACEMENT

A. Guarantee: All plant material and other materials installed under the Contract shall be guaranteed against any and all poor, inadequate or inferior materials and/or workmanship or improper maintenance, as determined by the Landscape Architect, and shall be replaced by the Contractor at his expense. Warranty periods are as follows:
   1. Trees, vines, and shrubs: One Year
   2. Groundcover and Turf: One year.

B. Replacement: Any materials found to be dead, missing, declining or not in a satisfactory or healthy condition during the maintenance period shall be replaced immediately. The Landscape Architect shall be sole judge as to the condition of material. Material to be replaced within the guarantee period shall be replaced by the Contractor within five (5) days of written notification by the Landscape Architect or owner. All replacement materials and installations shall comply with the Plans and Specifications. Any plant missing due to suspected theft shall be replaced by the Contractor. If the Contractor suspects that theft may be a problem, the Contractor shall provide written documentation to the owner that security on this site needs to be intensified.

C. The Contractor may relieve himself of theft responsibility if after the security notice, with no result, a written notice to the owner shall be given that plant material will not be replaced for theft or vandalism due to lack of site security being maintained. This procedure may take place only during the Landscape Maintenance Period.

1.6 OBSERVATION SCHEDULE

A. Normal progress observations shall be requested by the Contractor from the Landscape Architect as per observations listed in specifications Division 32 Section "Landscape Work."

1.7 FINAL ACCEPTANCE OF THE PROJECT

A. Upon completion of all project work, including maintenance period, the Landscape Architect will, upon proper written request, make an observation to determine final project acceptability. Provide minimum a 14 business day notice for final observation.

B. Where observed work does not comply with the Plans and Specifications, replace rejected work and continue specified maintenance period until reinspected by the Landscape Architect and determined to be acceptable. All replacement materials and installations shall be in accordance with the Plans and Specifications. Remove rejected work and materials immediately from project. Prior to the date of final observation, Contractor shall provide the Landscape Architect with all Record Drawings and close out documents in accordance with the Plans and Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials used shall either conform to Specifications in other sections or shall otherwise be acceptable to the Landscape Architect. The Landscape Architect shall be given a monthly record of all herbicides, insecticides and disease control chemicals used and irrigation scheduled. The amendments listed herein are for Bidding purposes only. The final amendment types and rates shall be determined by the Agronomic Soils Test.

B. Turf maintenance fertilizer: shall be "Best Turf Supreme 16-6-8":
   1. 16% nitrogen
   2. 6% phosphoric acid
   3. 8% potash

C. Slow Release maintenance fertilizer: shall be "Best Superturf 25-5-5 with Polyon" and shall consist of the following percents by weight:
   1. 25% nitrogen
   2. 5% phosphoric acid
   3. 5% potash

PART 3 - EXECUTION

3.1 GENERAL MAINTENANCE

A. General: Proper maintenance, including watering, weeding, mowing, edging, fertilization, rolling of turf, replacement and infill of mulch replacement of jute mesh, infill of settled areas, repairing and protection shall be required until entire project is finally accepted, but in any event for a period of not less than the specified maintenance period after planting.

B. Watering: Thoroughly water to insure vigorous and healthy growth until work is accepted. Water in a manner to prevent erosion due to application of excessive quantities of water. When hand watering use a water wand to break the water force. Supplemental hand water as required to maintain and encourage the proper growth of new and existing plant material.

C. Weeding:
   1. Keep plant basins, turf areas and areas between plants free of weeds. Control weeds with pre-emergent herbicides. If weeds develop, use legally approved herbicides and hand remove. Avoid frequent soil cultivation that destroys shallow roots. Weeding also shall be included in all paved areas including public or private sidewalks.
   2. Hand weed as required in addition to the application of weed control herbicides and pre-emergent to maintain all areas free of weeds including turf species other than the specified species. Periodic or predetermined weeding schedules may not be adequate and should be supplemented.
   3. Apply a final application of pre-emergent herbicide at the end of the maintenance period, just prior to final acceptance.

D. Tree basins in turf areas: Remove turf from around each tree to create a 4'- 0" diameter basin depending on tree size.

E. Pruning
   1. Trees: Prune trees to select and develop permanent scaffold branches; to eliminate narrow V-shaped branch forks that lack strength; to reduce toppling and wind damage by thinning out crowns; to maintain a natural appearance and to balance crown with roots. All trees shall be maintained and pruned in accordance with the accepted practices of the American Society of Consulting Arborists (ASCA). Prune only as directed by the Registered Consulting Arborists and Landscape Architect.
   2. Shrubs: Same objectives as for trees. Shrubs shall not be clipped into balled or boxed forms unless such is required by the landscape plans. All pruning cuts shall be made to lateral branches, buds or flush with the trunk. Stubbing and heading shall not be permitted.
   3. Only skilled workers shall perform pruning work in accordance with standard horticultural pruning practices. Remove from the project all pruned branches and material. Remove and replace any plant material excessively pruned or malformed resulting from improper pruning practices at no additional costs to the owner.
   4. Improperly pruned plant material as determined by the Landscape Architect is to be replaced at no cost to the owner.

F. Staking and Guys: Stakes and guys shall remain in place through the guarantee period and shall be inspected and adjusted to prevent rubbing that causes bark wounds. Remove nursery stake from all trees that are staked with lodgepole stakes per specifications. Provide supplemental staking or guying as required during high wind events to prevent damage to trees. Any damaged tree caused by high winds must be replaced by the contractor at no cost to the owner.

G. Insect, Animal, Rodent and Disease Control: Maintain proper control with legally approved materials as required as part of the Contract.

H. Protection: The Contractor shall maintain protection of the planted areas. Damaged areas shall be repaired or replaced at the Contractor's expense.

I. Trash: Remove trash weekly in all planted areas, pedestrian walkways and parking areas. Maintain all areas free of trash, clippings, and debris at all times.

J. Replacement: As per Guarantee and Replacement Specifications of this Section.

K. Fertilization: Fertilize all planting areas, during and just prior to end of maintenance period with the slow release maintenance fertilizer as indicated in the agronomic soils report.

L. Watering: Planting areas shall be watered at such frequency as weather conditions require to replenish soil moisture below root zone and to establish healthy plant material.
   1. Contractor is responsible for water audits and payment of any local penalties by local water districts at no additional cost to the Owner.

3.2 LAWN AND TURF MAINTENANCE

A. Mowing and Edging
   1. Initial mowing of turf will commence when the grass has reached a height of two and one-half (2-1/2) inches. The height of cut will be two (2) inches. After initial establishment maintain Bermuda and creeping grasses at 1½" and fescues or rye grass at 2". Mowing will be at least every 4-6 days for the second through fifth cuttings, and at least once per week after that for fescue. Bermuda grass is to be mowed minimum twice a week. Bent grass is to be mowed daily. Turf must be well established and free of bare spots and weeds to the satisfaction of the Landscape Architect prior to final acceptance.
   2. Excess grass clippings shall be picked up and removed from the site and premises. Let turf areas dry out enough so that mower wheels do not skid, tear or mark the lawn. Edges shall be trimmed at 90 degrees to pavement, at least weekly or as needed for neat appearance. Clippings shall be removed from paved and planting areas, etc. and disposed of from the site.

B. Watering: Lawns shall be watered at such frequency as weather conditions require to replenish soil moisture below root zone and to establish healthy strands of grass.
   1. Contractor is responsible for water audits and payment of any local penalties by local water districts at no additional cost to the Owner.

C. Disease control: Control turf diseases throughout the maintenance period with legally approved fungicides and herbicides. Replace any damaged or infected grass.

D. Weed Control:
   1. Control broad leaf weeds with selective, legally approved herbicides throughout maintenance period.
   2. A final application of selective herbicide shall be applied at the end of the landscape maintenance period, acceptance, just prior to final acceptance.
   3. Hand weed as required in addition to the application of weed control herbicides and pre-emergent to maintain all areas free of weeds including turf species other than the specified species. Periodic or predetermined weeding schedules may not be adequate and should be supplemented.

E. Fertilization:
   1. During maintenance period an application of turf maintenance fertilizer, as specified, shall be made at thirty (30) day intervals from the date of maintenance period start at a rate of five (5) pounds per 1,000 square feet, and as required by the agronomic soils report.
   2. Final application (just prior to final acceptance) shall be made with the slow-release maintenance fertilizer as required by the agronomic soils report.
   3. Replacement: At conclusion of maintenance period a final observation of lawn and turf areas shall be made. Remove diseased areas and unhealthy strands of grass from the site; do not bury into the soil. Replant areas with material and in a manner as specified on the Plans and Specifications at no additional cost to the Owner. All grass is to be fully grown with 100% coverage with a suitable thatch layer prior to turnover and final acceptance.

F. Arborist: Provide a written report and recommendations as required by the landscape architect if any plant material is in the sole opinion of the landscape architect, declining, stressed, infested, or otherwise not growing at the anticipated growth rate. The report is to include Agronomic Soils Test Data and recommendations and be provided at no cost to the owner.

3.3 IRRIGATION SYSTEM

A. System Observation: The Contractor shall check all systems for proper operation. Lateral lines shall be flushed out after removing the last sprinkler head or two at each end of the lateral. All heads are to be adjusted as necessary for unimpeded head to head coverage.

B. Valves: Contractor shall set, and verify that all pressure regulating valves to the operating pressure specified on the drawings.

C. Controllers: Set and program automatic controllers for seasonal water requirements. Give the Owner's Representative instructions on how to turn off system in case of emergency.

D. If the irrigation system is designed and specified to be operable from a central irrigation computer controller located off site, or a standard controller on site. The contractor shall demonstrate to Landscape Architect, Owner's Representative and future maintenance contractor that the central irrigation system is fully installed and operational from this off site control system as described and specified. Contractor shall make all adjustments as necessary to insure this operation prior to final acceptance.

E. Contractor shall set up and coordinate training for the Maintenance Contractor (Provider) on the irrigation controller, and pump with the manufactures representative. Maintenance period shall not end, and the project will not be accepted until this training has been completed.

F. Repairs: Repair all damages to irrigation system at the Contractor's expense. Repairs shall be made within twenty-four (24) hours or sooner to prevent damage to site improvements.

3.4 CLEANING

A. During maintenance work, keep pavements clean and work area in an orderly condition. Haul away and remove all debris from landscape areas, and do not leave any clippings, fertilizer, amendments and / or other material from landscape planting and/or maintenance period.

B. Powerwash all pavement and flatwork as necessary to remove all staining and tire marks on surfaces caused by maintenance or construction vehicles, prior to final acceptance.

END OF SECTION

SECTION 321123 - AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aggregate base course.

1.2 RELATED REQUIREMENTS

A. Section 312200 - Grading: Preparation of site for base course.

B. Section 312316.13 - Trenching: Compacted fill over utility trenches under base course.

C. Section 312323 - Fill: Compacted fill under base course.

D. Section 321216 - Asphalt Paving: Finish and binder asphalt courses.

E. Section 321313 - Concrete Paving: Finish concrete surface course.

1.3 REFERENCE STANDARDS

A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil–Aggregate Subbase, Base, and Surface Courses 2017 (Reapproved 2021).

B. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop 2022, with Errata .

C. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates 2019.

D. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)) 2012 (Reapproved 2021).

E. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method 2015, with Editorial Revision (2016).

F. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)) 2012 (Reapproved 2021).

G. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method 2015.

H. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) 2017, with Editorial Revision (2020).

I. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) 2023.

J. Standard Specifications for Public Works Construction (Greenbook); current edition.

K. Project's Geotechnical Report - "Geotechnical Exploration City of Rancho Cucamonga Fire Station 178 APN 1077-422-58" prepared by Leighton Consulting Inc. dated November 6, 2020.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Materials Sources: Submit name of imported materials source.

C. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

D. Compaction Density Test Reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Aggregate Storage, General:
1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
2. Prevent contamination.
3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aggregate Base [<>]: Crushed aggregate base, conforming to Greenbook, Section 200-2.2 ____.

B. Herbicide: Commercial chemical for weed control, registered by the EPA.

2.2 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.

B. Where aggregate materials are specified using ASTM D2487 classification, testing of samples for compliance will be provided before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.3 INSTALLATION

A. Spread aggregate over prepared substrate to a total compacted thickness as indicated on plans.

B. Place aggregate in maximum 4 inch layers and roller compact to specified density.

C. Level and contour surfaces to elevations and gradients indicated.

D. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

G. Apply herbicide per manufacturer requirements.

3.4 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch.

C. Variation From Design Elevation: Within 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for field inspection and testing.

B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.

C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with AASHTO T 180, ASTM D698 ("standard Proctor"), or ASTM D1557 ("modified Proctor").

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Frequency of Tests: as directed by Geotechnical Engineer.

F. Proof roll compacted aggregate at surfaces that will be under slabs-on-grade.

3.6 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 321216 - ASPHALT PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single course bituminous concrete paving.

B. Double course bituminous concrete paving.

C. Surface sealer.

1.2 RELATED REQUIREMENTS

A. Section 312200 - Grading: Preparation of site for paving and base.

B. Section 312323 - Fill: Compacted subgrade for paving.

C. Section 321123 - Aggregate Base Courses: Aggregate base course.

D. Section 321723.13 - Painted Pavement Markings: Concrete bumpers.

E. Section 330561 - Concrete Manholes: Manholes, including frames; gutter drainage grilles, covers, and frames for placement by this section.

1.3 REFERENCE STANDARDS

A. AI MS-2 - Asphalt Mix Design Methods 2015.

B. AI MS-19 - Basic Asphalt Emulsion Manual 2008.

C. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction 2009a.

D. Standard Specifications for Public Works Construction (Greenbook); current edition.

E. Project's Geotechnical Report - "Geotechnical Exploration City of Rancho Cucamonga Fire Station 178 APN 1077-422-58" prepared by Leighton Consulting, Inc. dated August 4, 2021.

1.4 QUALITY ASSURANCE

A. Obtain materials from same source throughout.

1.5 **SUBMITTALS**

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1.6 FIELD CONDITIONS

A. Do not place asphalt when ambient air or base surface temperature is less than 50 degrees F, or surface is wet or frozen.

B. Place bitumen mixture when temperature is not more than 15 F degrees below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 PRODUCTS

2.1 MATERIALS

A. Asphalt Concrete: Greenbook, Section 203-6.

B. Aggregate Base Course: Section 321123.

C. Tack Coat: Emulsified asphalt.

D. Seal Coat: per Greenbook, Section 203-9

2.2 ASPHALT PAVING MIXES AND MIX DESIGN

A. Base Course: B-PG 64-10-RAP per Greenbook Table 203-6.4.3 (A).

B. Wearing Course: D2-PG 64-10-RAP per Greenbook Table 203-6.4.3 (A).

C. Provide mixes complying with composition, grading, and tolerance requirements in ASTM D 3515 for the following nominal, maximum aggregate sizes:
   1. Base Course: 1 inch.
   2. Surface Course: 1/2 inch.
   3. Surface Course for Playgrounds and Similar Areas: 1/4 inch.

D. Submit proposed mix design of each class of mix for review prior to beginning of work.

2.3 SOURCE QUALITY CONTROL

A. Test mix design and samples in accordance with ASTM D 2172 California Test Method 382 or ASTM D 4125.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.2 BASE COURSE

A. See Section 321123.

3.3 PREPARATION - TACK COAT

A. Apply tack coat in accordance with Greenbook, Section 302-5.4.

B. Apply tack coat to contact surfaces of curbs, gutters and pavement joints.

3.4 PLACING ASPHALT PAVEMENT - SINGLE COURSE

A. Install Work in accordance with Greenbook.

B. Place asphalt within 24 hours of applying primer or tack coat.

C. Place to a maximum thickness of 4 inches.

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.

3.5 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

A. Place asphalt base course within 24 hours of applying primer or tack coat.

B. No pavement course shall be less than 1 1/2 inches in compacted thickness. If finish pavement thickness is 3 inches or less it shall be laid as single course.

C. No pavment course shall be more than 4 inches in compacted thickness.

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.

3.6 SEAL COAT

A. Apply seal coat to surface course and asphalt curbs in accordance with Greenbook Section 302-8.

3.7 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Compacted Thickness: Within 1/4 inch of specified or indicated thickness.

C. Variation from True Elevation: Within 1/4 inch.

3.8 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for quality control.

B. Provide field inspection and testing. Take samples and perform tests in accordance with California Test Method 308.

3.9 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for 2 days or until surface temperature is less than 140 degrees F.

END OF SECTION

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Driveways.

B. Roadways.

C. Parking lots.

D. Curbs and gutters.

E. Walks.

F. Stairs and ramps.

G. Mow strips.

H. Wheel stops.

I. Detectable warnings.

1.2 RELATED REQUIREMENTS

A. Division 03 Section Cast-in-Place Concrete

B. Division 05 Section Pipe and Tube Railings.

C. Division 31 Section Earthwork

D. Division 32 Section Architectural Site Concrete

E. Division 32 Section Concrete Paving Joint Sealants

1.3 DEFINITIONS

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

1.4 PREINSTALLATION CONFERENCE

A. Conduct conference at Project site two weeks prior to start of work of this section. Required attendance of all affected installers.
   1. Review methods and procedures related to concrete paving, including but not limited to, the following:

2. Concrete mixture design
3. Testing and inspection procedures.
4. Concrete finishes and finishing.
5. Cold- and hot-weather concreting procedures.
6. Curing procedures.
7. Construction joints.
8. Forms and form-removal limitations.
9. Reinforcement accessory installation.
10. Concrete repair procedures.
11. Protection of cast-in-place architectural site concrete.
12. Review special testing and inspection procedures.
13. Placement sequence and schedule.
14. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
    a. Contractor's superintendent.
    b. Ready-mix concrete manufacturer.
    c. Concrete paving subcontractor.
    d. District's or Client's Representative
    e. Architect's Representative
    f. Inspector of Record
    g. Provide meeting minutes for pre-installation conference

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Proprietary admixtures, pigments, curing compounds, hardeners, sealers, form-release agents, etc.: Indicate compatibility with other materials used.
   2. Stenciling material

B. Design Mixtures: Submit proposed mix designs and test data for each class of concrete and for each method of placement.
   1. Prepare mix designs on the basis of field experience (preferred) and/or trial mixes, in compliance with California Building Code (CBC), Section 1905A.3.
   2. Prepare mix designs on the basis of field experience (preferred) and/or trial mixes, in compliance with California Building Code (CBC), Section 1905.3.
   3. Mix designs shall be prepared, stamped and signed by a structural or civil engineer registered in the State of California.
      a. Mix designs shall be reviewed by the Architect (AOR) and Structural Engineer of Record (SEOR).
   4. Identify for each mix design submitted the method by which proportions have been selected.
      a. For mix designs based on trial mixtures, include trial mix proportions, test results, graphical analysis and show required average compressive strength f'c results. Provide gross weight and yield per cubic yard of trial mixes.
      b. Indicate quantity of each ingredient per cubic yard of concrete and percentages.

c. Indicate type and quantity of admixtures proposed or required.
d. Indicate water to cement ratio by weight.
e. Measured slump.
f. Measured air content.
g. Provide shrinkage test results.

5. Multiple mix designs or multiple manufacturers shall not be permitted for the same application.

C. Mix designs should contain no fly ash.

D. Submit proposed alternate design mixtures for review by the Architect and SEOR when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

E. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Shop drawings should include details such as reveals, recessed lights, handrails, or other elements requiring steel coordination.
1. Coordinate with and identify the details of the Contract Drawings on the shop drawings.
2. Comply with ACI 315, part B and CRSI requirements.

F. Construction Joint Layout: Indicate proposed construction joints required to construct the structure. Submit dimensioned drawing indicating layout of construction joints, contraction (control) joints, dowelled joints, decorative scoring and placement sequence of concrete if different than layout indicated on plans.
1. Location of construction joints are subject to approval of the Architect.
2. All form seams are to align with construction joints or reveals.

G. Placement Schedule: Submit concrete placement schedule before start of placement operations. Include locations of all joints including construction joints.

H. Pavement-Marking Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

I. Qualification Data: For qualified ready-mix concrete manufacturer (batch plant) and installer of detectable warnings.

J. Welding Certificates: Submit certifications signed by AWS Certified Welding Inspector of prequalified welding procedures, qualifications of welding procedures unless prequalified, qualifications of welding operators and qualifications of welders.

K. Material Certificates: For the following, submit manufacturer data, test results, and technical information for aggregate, sand and cement, submit ½ cubic foot physical sample. For sealant submit manufacturer color standard and custom palette together with physical samples:
1. Cementitious materials.

2. Aggregates and sand.
3. Steel reinforcement and reinforcement accessories.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent and epoxy adhesives.
8. Joint fillers.
9. Sealer
10. Sealant.

L. Material Test Reports: For each of the following:
1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

M. Detectable Warning Device Warranty: Submit copies of manufacture's five year warranty for each of these products and manufacturer custom and standard color palette.

N. Field quality-control reports.
1. Submit copies of delivery tickets complying with ASTM C 94 for each load of concrete delivered to the site. Tickets shall include all information required by the referenced standard.

O. Minutes of pre-installation conference.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with CBC Chapter 19A.
1. Chemical products field-applied to concrete shall comply with the air quality requirements of authorities having jurisdiction.
2. Comply with requirements of local, State and other authorities having jurisdiction for work performed within public right-of ways.

B. Regulatory Requirements: Comply with CBC Chapter 19.

C. Chemical products field-applied to concrete shall comply with the air quality requirements of authorities having jurisdiction.

D. Comply with requirements of local, State and other authorities having jurisdiction for work performed within public right-of ways.

E. Industry Standards: Comply with the following unless modified by requirements in the Contract Documents.(Plans and specifications)
1. ACI 301, "Specifications for Structural Concrete".
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials".
3. ACI 302.1R, "Guide for Concrete Floor and Slab Construction".
4. ACI 304R, "Guide for Measuring, Mixing, Transporting, and Placing Concrete".
5. ACI 305R, "Hot Weather Concreting".

6. ACI 306.1, "Standard Specification for Cold Weather Concreting".
7. ACI 318, "Building Code Requirements for Structural Concrete".
8. ACI 347, "Guide to Formwork for Concrete".
9. ACI SP-66, "ACI Detailing Manual".
10. CRSI, "Manual of Standard Practice".
11. CRSI, "Placing Reinforcing Bars".

F. Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of cast-in-place, surface-applied unit-paver-type detectable truncated dome products.

G. 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.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

H. Source Limitations for Concrete Paving: Obtain each color, size, type, and variety of concrete material and concrete mixture from single manufacturer with resources to provide concrete of consistent quality in appearance and physical properties. Secure all material required for the duration of the project as needed to ensure consistent quality in appearance.

I. Welding Qualifications: Comply with CBC Chapter 17A.
1. Qualify welding procedures and welding personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel" prior to performing any welding.
2. Qualify welding inspection personnel according to AWS QC1, "Standard for AWS Certification of Welding Inspectors."

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

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

L. ACI Publications: Comply with ACI 301 unless otherwise indicated.

M. Mockups: Before casting concrete paving, build mockups to verify selections made under Sample submittals and to fully demonstrate typical joints (including expansion and saw cut joints), surface finish, texture, color tolerances, standard of workmanship and completed product. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
a. Paving Modules: Construct at least one 8 ft. x 8 ft. mockup of each color, finish, and mix design of special paving module, including stenciled areas, banding and curbs

b. Retarder Finishes: Mock ups shall clearly demonstrate an even finish. No blotchy or light areas.
c. Stairs: Construct minimum 2 risers and treads X 4’ long with nosing grooves and stained color within groves for each color and finish specified.
d. Mow Strip: minimum 6’ long for each specified width and color.
e. Truncated Domes: minimum 3’X6’ long set in concrete with concrete base and grout.

2. Build mockups full-size, matching site concrete components indicated on the Drawings. Mock-ups shall be complete in every detail, including joints, reveals, edges, chamfers, etc. Include complex joinery conditions where necessary to integrate to other Project components as indicated including multiple pour conditions. Mockups should be provided for each finish, color, joint and detail specified.
3. Maintain accurate records of variables associated with each mockup to facilitate the matching of accepted mockups during actual construction.
4. Demonstrate curing, cleaning, and protecting of cast-in-place concrete paving, finishes, and contraction and expansion joints, as applicable.
5. Mockup Acceptance: Obtain Architect's approval of mockups before casting architectural site concrete and paving.
   a. The Architect may reject mockups that, in the Architect's sole judgment, do not demonstrate an acceptable completed product, including, but not limited to, color, joint work, surface finish, texture, tolerances, and standard of workmanship
   b. The Architect may require modifications to mockups to obtain acceptable results.
   c. The Architect may require modifications to mockup repairs to obtain acceptable results.
   d. The Architect may require removal and reconstruction of mockups to obtain acceptable results. Multiple mock ups maybe required.
   e. Contractor shall provide additional mockups as required to obtain results acceptable to the Architect at no additional cost to the Owner.
6. Mockup Disposition: Accepted mockups shall not become part of the completed Project. Maintain mockup onsite for the duration of construction and until all work has been accepted. Remove and legally dispose mockups after acceptance of final installed work. prior to Project Completion. If sufficient permanent concrete paving work has been completed, Contractor may submit a written request to Architect to transfer quality control for concrete paving from the accepted mockups to one or more designated portions of the permanent work.
7. Provide written meeting minutes for each mock up review indicating items reviewed, approvals, rejections, connections, or other action items.

1.7 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending, damage, and rust.
   1. Label bundles with durable identification tags. Maintain reinforcement identification after bundles are broken.
   2. Store reinforcement to avoid excessive rusting or fouling with grease, oil, dirt or other bond-weakening contaminants.
   3. Avoid damaging applied coatings, if any, on steel reinforcement.

PART 2 - PRODUCTS

2.1 FORMS

A. Formwork: / Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth surfaces.
   1. Set forms to alignment, grade and required dimensions. Formwork shall not deviate more than 1/4 inch from required vertical positions and 1/4 inch from required horizontal positions. Exposed Surfaces: Provide faced plywood panels complying with, or equivalent to, DOC PS 1, Structural I. Provide minimum 7-ply plywood and provide balance sheets for panels coated one-side only. Furnish in largest practicable sizes to minimize number of joints. Provide Medium-Density Overlay (MDO) panels or high density overlay (HDO) panels, with mill-applied release agent and edge sealant. Provide one of the following panels, or comparable substituted product:
      a. Olympic Panel Products, "B-Matte 333 MDO Concrete Form." Overlay Color: Brown.
      b. Pacific Laminate Products, "ProFace MDO." Overlay Color: Black.
      c. Sylvan Products, LLC, "Armor Ply MDO" Overlay Color: Brown.
   2. Hold forms rigidly in place by stakes, clamps, spreaders, and braces at 3 feet on centers, and where required to ensure rigidity.
   3. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.
   4. Place joint filler or backer rod on vertical surfaces in contact with concrete paving.
   5. Benders or thin plank forms may be used on curves, grade changes, or curb returns. Back forms for curb returns may be made of ½-inch thick benders cleated together for full depth of the curb.
   6. Keep forms in place until concrete is sufficiently hard to prevent damage to concrete.
   7. Reuse of Forms:
      a. Do not reuse forms if there is any evidence of surface wear or defect which would impair quality of surface or edge.
      b. Thoroughly clean and properly coat forms before reuse.
      c. Do not use forms from previous projects.
   8. Provide new forms specifically purchased for this project. Reuse of forms from past projects or contractors stock will not be accepted.

B. Curved Work: Kerf back of plywood form-facing panels, or use accepted flexible or curved forms for curved work with a radius of 100 feet or less.

C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.
   1. Obtain written acceptance of form release agent from integral colored concrete pigment manufacturer.
   2. Form-release agents shall be non-staining and can cause no visual effect to the finish.
   3. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.2 STEEL REINFORCEMENT

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

B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

D. Low-Alloy-Steel Reinforcing Bars (for Welding): ASTM A 706/A 706M, Grade 60, deformed, unless otherwise indicated.

E. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.
   1. Provide two-component "Speed Dowel System" manufactured by Greenstreak.

F. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

G. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

H. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
   1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

I. Zinc Repair Material: ASTM A 780.

2.3 CONCRETE MATERIALS

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

1. Portland Cement: ASTM C 150, Type II/V, gray, unless white cement is required to achieve colors indicated.
    a. Fly Ash: none accepted.

B. Normal-Weight Aggregates: ASTM C 33, complying with building code. Provide aggregates from a single source. All aggregates shall be free of materials with deleterious reactivity to alkali in cement when tested in accordance with ASTM C 289.
1. Comply with CBC section 1903A.3.
2. Comply with CBC section 1903.3.
3. Service Class, based on CBC Figure 1904A.2., "Weathering Probability Map":
    a. Negligible: Class 2N.
4. Service Class, based on CBC Figure 1904.2., "Weathering Probability Map":
    a. Negligible: Class 2N.
5. Maximum Coarse-Aggregate Size: 3/8 inch nominal.
    a. Source: Reliance, Vulcan, San Gabriel, or Carrol Canyon
    b. Hard rock mix; no pea gravel will be accepted.
6. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
    a. Source: Reliance, Foster, Corona
    b. Color to be white to light no dark material.

C. Water: Potable and complying with ASTM C 94/C 94M.

D. Shrinkage-Reducing Admixture: Commercially formulated, shrinkage inhibitor capable of reducing initial shrinkage by 80% and long-term shrinkage by 50%. Provide product suitable for use with either air-entrained or non-air-entrained concrete as appropriate to structural member and project location.
1. Products: Subject to compliance with requirements, provide one of the following(as required):
    a. Euclid Chemical Company (The), an RPM company; EUCON SRA, SRA+.
    b. Grace Construction Products, W. R. Grace & Co.; Eclipse Floor, Eclipse Plus.
    c. Sika Corporation; Control 40.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete. Provide products with not more than 100g/L volatile organic content.
1. Products: Subject to compliance with requirements, provide one of the following:
    a. BASF Construction Chemicals, LLC; Confirm.

b. Conspec by Dayton Superior; Aquafilm.
c. Nox-Crete Products Group; MONOFILM.

E. Clear, Waterborne, Membrane-Forming Curing Compound (Colored Concrete): Provide products that are acceptable to concrete color pigment manufacturer complying with ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of sealers with no glossy finish and compatible with specified sealer. Provide products with not more than 100g/L volatile organic content.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Sinak Corporation; The Cure WCE or Lithium Cure 1000.
b. L. M. Scofield; Cureseal-W.
c. Butterfield Color; Clear Guard H2O.

F. All curing materials should be dissipating without leaving a shiny, cloudy, or glossy finish. Curing material does not substitute requirement of a sealer.

2.5 HARDENERS AND SEALERS

A. Penetrating Liquid Floor and Horizontal Surface Treatment (Sealer): Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate water-based lithium quartz materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces. Materials hsall be compatible with concrete admixtures and shall be recommended by manufacturer for intended use. Provide product with 0g/L volatile organic content.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Sinak Corporation; Concrete Sealer HLQ 125.

2.6 RELATED MATERIALS

A. Joint Fillers:
1. Ceramar by W.R. Meadows. A closed cell isomeric polymer synthetic foam ASTM D 5249, Type 2 .
2. Deck-O-Foam polyethylene by W.R. Meadows. A closed cell expansion joint fille ASTM D 4819
3. 1/4" thickness.

B. Bonding Agent: ASTM C 1059, Type II, non-re-emulsifiable. Provide proprietary products composed of latex polymers.
1. Products: Subject to compliance with requirements, provide one of the following:
a. W. R. Meadows, Inc.; “Acry-Lok”.
b. Grace Construction Products, W. R. Grace & Co.; "Daraweld C".
c. Larsen Products Corp., "Weld-Crete".

C. Epoxy Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete, and for anchoring dowels to hardened concrete.

D. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of reveal specified.
   1. Provide W. R. Grace "Top-Cast".

2.7 DETECTABLE WARNING MATERIALS

A. General: All detectable warning systems shall comply with Americans with Disabilities Act (28 CFR Part 36 ADA Standards for Accessible Design, Appendix A, Section 4.29.2 Detectable Warnings on Walking Surfaces), and CBC requirements (Section 11B-24, 11B-705 and others). All detectable warning materials shall have raised truncated domes with a base diameter of nominal 0.90 inch (22.9 mm), tapering to a top diameter of 0.45 inch (11.4 mm),a height of nominal 0.20 inch (5.08 mm), and a center-to-center spacing of 2.35 inches (59.7 mm) nominal. The orientation of the dome pattern for all panels shall be parallel with the panel edges. Detectable warning materials shall visually contrast with surrounding areas.
   1. California Compliance Warranty: All detectable warning systems shall be approved by DSA-AC. If not approved, DSA will accept a written five (5) year product warranty provided by the manufacturer of detectable warning products and directional surfaces. Such warranty shall indicate compliance with architectural standards as published in the current edition of the California Building Standards Code, and also include durability criteria which indicate that the shape, color fastness, confirmation, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly for at least five (5) years after initial installation. As defined by the State, "not degrade significantly" means that the product maintains at least 90 percent of its approved design characteristics, as determined by the enforcing agency.

B. Concrete Paver Detectable Dome Warning System: Provide standard size precast architectural concrete paving units for installation in sand or mortar beds.
   1. Basis-of Design Product: Provide the following, or comparable substitute product:
      a. Wausau Tile - ADA-2 Truncated dome pavers.
         1) 12 inches by 12 inches nominal(actual 11.8 inches X 11.8 inches) by 2 3/8 inches
         2) Color A-40 Yellow (Federal Yellow No. 33538)

2.8 WHEEL STOPS

A. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 5-1/2 to 6 inches high by 7 inches wide by 48 inches long at singles stalls and 72 inches long at shared stalls. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
   1. Dowels: Galvanized steel or rebar, 1/2 inch in diameter, 18-inch minimum length.

2.9 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
   1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
   2. Proportioning:
      a. The proportioning of ingredients shall be such that the concrete can be readily worked into forms and around reinforcement under the conditions of placement to be used, without segregation or excessive bleeding.
      b. When proportioning by weight of loose, dry material, 94 pounds of cement shall be considered 1 cubic foot.
         1) Float/Broom Finish: Coarse aggregate 50 percent-50 percent fine aggregate.
         2) Retarder finish: Coarse aggregate 40 percent, fine aggregate 60 percent.
      c. Total water content shall not exceed 35 gallons per cubic yard of concrete.
      d. Weighing equipment shall be accurate within 1 pound and shall be adjustable for varying aggregate moisture content.
      e. A beam auxiliary shall register any part of the last 100 pounds of each aggregate. The aggregate hopper shall have a volume adjustment.
   3. Prepare compressive strength data for both 7-day and 28-day strengths.
      a. The 7-day compressive strength shall be at least 60 percent of the required 28- day strength.
      b. The 28-day compressive strength shall be as indicated.
      c. Provide drying shrinkage test data at 28 days, from not less than 3 test specimens.

B. Proportion mixtures to provide normal-weight concrete with the following properties:
   1. Typical Compressive Strength (28 Days): Provide the following minimum compressive strength (28 days) for concrete paving unless otherwise indicated: 3000 psi.
   2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50-0.60.
   3. Slump Limit: 4 inches, plus or minus 1 inch, unless indicated otherwise.
      a. Slump Limit (High-Range Water-reducing Admixture): 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture, plus or minus 1 inch, unless indicated otherwise.

C. Air Content, Exterior Exposed Concrete: Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having the following air entrainment for all exposed concrete with a weathering probability of severe or moderate per CBC Figure 1904.2.2/1904A.2.2:
   1. Provide air entrainment of 6.0 percent, plus or minus 1.5 percent at point of delivery for 1-inch and 3/4-inch nominal maximum aggregate size, if required unless indicated otherwise.

D. Limit "drying shrinkage" after 28 days of curing hardened concrete to 0.045 percent of the original concrete volume.

E. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

F. Chemical Admixtures: Admixtures may only be used if they are incorporated into the accepted concrete mix designs. Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   2. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
   3. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
   1. When air temperature is between 85 and 90 deg. F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg. F (32 deg. C), reduce mixing and delivery time to 60 minutes.

B. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
   1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
   2. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Division 31 Section "Earth Moving."

C. Proceed with concrete paving installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

C. Slope stair and step treads at not less than 1.0 percent and not more than 2.0 percent cross slope to drain.

3.4 STEEL REINFORCEMENT

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

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

A. General: Form construction, isolation or expansion joint, and saw cut / contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
   1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Isolation (Expansion) Expansion Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
   1. Locate expansion joints at intervals of 20 feet maximum unless otherwise indicated.
   2. Extend joint fillers full width and depth of joint and recess 1 inch from finish surface where no joint sealant is indicated.
   3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
   4. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   5. Break steel at expansion joints.
   6. Dowels- provide prefabricated ‘speed dowel’ assemblies.

C. Saw Cut (Control) Joints: Form weakened-plane saw cut joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth plus 1/4 inch of the concrete thickness, as follows, and to match jointing of existing adjacent concrete paving:
   1. Continue steel reinforcement across sawcut joints unless otherwise indicated.

D. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/8-inch radius unless otherwise noted. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in. Notify other trades as necessary to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
   1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, and side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
1. When air temperature has fallen to or is expected to fall below 40 deg. F (4.4 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.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

M. Hot-Weather Placement: Comply with ACI 305R (ACI 305R M) and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg. F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

N. Provide sand and base materials as indicated.

3.7 **FLOAT/BROOM FINISHING**

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture. Required to meet slip coefficient requirement.
3. Portland cement concrete paving shall be stable, firm, and slip resistant and shall comply with **CBCSections 11B-302** and **11B-403**.

3.8 **RETARDER FINISHING(FINE AGGREGATE)**

A. Protect all surrounds from overspray of liquid materials, including, but not limited to, adjacent horizontal surfaces, windows, roofs, walkways, drives, and landscaping.
   1. Apply surface protectant and /or plastic sheeting, sufficently taped in place.

B. Ensure to screed surface of concrete evenly to designated slope shown on approved civil grading plans.

C. Prepare concrete for retarder finish as recommended by retarder manufacturer.
   1. Consider using rolling tamper, jitterbug or rolling jitterbug to create a denser surface paste with no obstruction due to the appearance of course aggregate, allowing for a uniform sand texture.
   2. Screed or strike off the surface in two (2) directions using a wooden or metal straight edge to achieve the proper elevation in a sawing motion back and forth.
   3. Allow the bleed water to evaporate from the surface.
   4. Float concrete using a wooden hand/bull float.
   5. Float to a uniform appearance.
   6. Hand trowel or Fresno steel frowel to create tight dense smooth surface.(This could require 2 - 3 passes depending on mix design and/or desired finish to be achieved)
   7. Do not burnish the surface or allow the exposed sand surface to premanturely dry prior to the application of the surface retarder.

D. Mix surface retarder thoroughly prior to each use.

E. Apply surface retarder per manufacturers recommendations.

F. Remove retarder per manufactures recommendations.

3.9 ABRASIVE BLAST FINISHING

A. General: Perform abrasive blasting after compressive strength of concrete exceeds 2000 psi, and is at least 28 days old Coordinate with formwork removal to ensure that surfaces to be abrasive blasted are treated at same age for uniform results.
   1. Surface Continuity: Perform abrasive-blast finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work. Maintain required patterns or variances in depths of blast to match design reference sample or mockup.
   2. Abrasive Blasting: Abrasive blast corners and edges of patterns carefully, using backup boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle pressure, and blasting techniques required to match design reference sample or mockup.
   3. Depth of Cut: Use an abrasive grit of proper type and gradation to expose aggregate and surrounding matrix surfaces to match design reference sample or mockup, as follows and as required by Architect:
      a. Retain degree of abrasive-blast cut in "Brush," "Light," "Medium," or "Heavy" subparagraphs below to suit Project.

b. Brush: Remove cement matrix to dull surface sheen and expose face of fine aggregate; with no significant reveal.
c. Light to Medium: Expose fine aggregate with occasional exposure of coarse aggregate and uniform color; with maximum reveal of 1/16 inch.
d. Medium: Generally expose coarse aggregate; with slight reveal, a maximum of 1/8 inch.
e. Heavy: Expose and reveal coarse aggregate to a maximum projection of one-third its diameter; with reveal range of 1/4 to 5/16 inch.
f. Portland cement concrete paving shall have a medium sandblast finish equal to medium broom finish on all surfaces sloped less than 6% and slip resistant (heavy sandblast finish equal to heavy broom finish) on all surfaces sloped greater than 6%.
g. Portland cement concrete paving shall be stable, firm and slip resistant and shall comply with **CBC Sections 11B-302 and 11B-403.**

4. Abrasive Blasting: Abrasive blast corners and edges of patterns carefully, using backup boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle pressure, and blasting techniques required to match design reference sample or mockup.
5. Insert specific abrasive materials or processes if required for Project.

3.10 DETECTABLE WARNINGS

A. Detectable Warnings, General: Install detectable warnings as part of the concrete paving placement sequence. Set true to line and elevation. Comply with maximum slope and cross-slope requirements for accessible walkways.
   1. Blockouts: Form blockouts in concrete and asphalt pavements for installation of detectable paving units.
      a. Tolerance for Opening Size: Plus 1/4 inch, no minus.

B. Detectable warnings surfaces shall comply with **CBC Section 11B-705.1.**

C. Detectable warning surfaces shall be yellow conforming to **FS 33538 of Federal Standard 595C,** except for locations at curb ramps, islands, or cut through medians where color used shall contrast visually with that of adjacent walking surfaces, either light-on-dark or dark-on-light. **CBC Sections 11B-705.1.1.3 and 11B-705.1.1.5.**

D. Detectable warning surfaces shall differ from adjoining surfaces in resiliency or sound-on-cane contact. **CBC Section 11B-705.1.1.4.**

E. Provide 5 year minimum warranty per **DSA Bulletin 10/31/02, revised 04/09/08.**

F. Precast Detectable Warning Tiles: Comply with approved plans and details along with manufacturer's written instructions.

3.11 CONCRETE PROTECTION, CURING AND SEALING:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:
   1. 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, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or 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 that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

F. Seal Concrete: Apply specified sealer in accordance with manufacturer’s recommendations.
   1. Apply full strength in two coats with airless sprayer at the manufacturer’s recommended rate.
   2. After the first coat is completely dry, apply second coat at right angles to the first coat.

3.12 PAVING TOLERANCES

A. Comply with tolerances in ACI 117, the Americans with Disabilities Act, the CBC and as follows:
   1. Elevation: 1/8 inch.
   2. Thickness: Plus 3/8 inch, minus 1/4 inch.
   3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/8 inch. Surface must properly drain.
   4. Surface Discontinuities: Maximum 1/4 inch, subject to further limitations of accessible routes.
   5. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
   6. Lateral Alignment and Spacing of Dowels: 1/4 inch.

7. Vertical Alignment of Dowels: 1/8 inch.
8. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/8 inch per 12 inches of dowel.
9. Joint Spacing: 3 inches, except joint position shall be within 1/4 inch of objects in alignment with joint such as benches, light poles, pull boxes, etc.
10. Sawcut Joint Depth: Plus 1/4 inch, no minus.
11. Joint Width: Plus 1/16 inch, no minus.

B. Stair Treads: Stair treads within a run shall be constructed equally and shall shed water away from the path of travel. Maximum tread slope down from riser to nosing in direction of travel: 1.0 percent, plus or minus 0.5 percent. Maximum tread cross-slope perpendicular to direction of travel: 1.8 percent, plus 0.2 percent, minus 1.0 percent or as required to shed water.

C. Ramps: Ramps shall shed water away from the path of travel. Maximum ramp slope in direction of travel: 8.33 percent. Maximum ramp cross-slope perpendicular to direction of travel: 1.8 percent, plus 0.2 percent, minus 1.0 percent or as required to shed water.

3.13 WHEEL STOPS

A. Securely attach wheel stops to paving with not less than two #4 galvanized steel dowels or rebar, minimum 18 inches long, located at one-quarter to one-third points. Install dowels in drilled holes in the paving and bond dowels to wheel stop. Recess head of dowel beneath top of wheel stop.

B. Install preformed speed [bumps] [humps] [cushions] in bed of adhesive applied as recommended by manufacturer for heavy traffic.

C. Securely attach preformed speed [bumps] [humps] [cushions] to paving with hardware spaced as recommended by manufacturer for heavy traffic. Recess head of hardware beneath top surface.

3.14 FIELD QUALITY CONTROL

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

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 20 cu. Yd., or fraction thereof of each concrete mixture placed each day.
    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg. F and below and when it is 80 deg. F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Owner, Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.15 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, cracked, chipped, stained or defective or that does not comply with requirements in this Section as determined by Landscape Architect. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with Portland cement

concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude all but pedestrian traffic from paving for at least 28 days after placement. When construction traffic is permitted, maintain paving as clean as possible by providing adequate surface protection and by removing surface stains and spillage of materials as they occur.
   1. Rubber tire marks are unacceptable in the completed construction.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Project Completion inspections.

E. Repair of damaged, defective or rejected concrete is not permitted. Remove all concrete from expansion joint to expansion joint or greater as required to provide a constant continuous finish.

3.16 FINAL CLEANING

A. Remove all excess concrete, form materials, over pours, waste, etc., and legally dispose off-site.

B. Provide a final acid and power wash for all concrete paving surfaces. Do not use any material that will affect the appearance of the concrete.

C. All over pours in planting areas should be removed prior to landscape operations.

D. Clean concrete paving to remove stains, markings, dust, and debris.

END OF SECTION

SECTION 321373 - PAVEMENT JOINT SEALERS

PART 1 - GENERAL

1.1 SECTION INCLUDES: RELATED DOCUMENTS

A. Exterior joint sealant for non-traffic surfaces.

1.2 RELATED REQUIREMENTS

A. Division 32 Section Concrete Paving.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch- (13-mm-), and 1/4-inch (6.4-mm) wide joints formed between two 6-inch-(150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

D. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

B. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

C. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

D. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.

E. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

F. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

B. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C).

C. When joint substrates are wet or covered with frost.

D. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

E. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Landscape Architect from manufacturer's full range.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Multicomponent Pourable Urethane Sealant (Sealant #1):
   1. Available Products:
      a. Sonneborn, Division of ChemRex Inc.; SL 2.
   2. Type and Grade: M (multicomponent) and P (pourable).
   3. Class: 25.
   4. Use Related to Exposure: T (traffic).
   5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

D. Multicomponent Nonsag Urethane (Sealant #2):
   1. Available Products:
      a. Pecora Corporation; Dynatred.
   2. Type and Grade: M (multicomponent) and NS (nonsag).
   3. Class: 25.
   4. Use Related to Exposure: T (traffic).
   5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.5 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of backer materials.
   2. Do not stretch, twist, puncture, or tear backer materials.
   3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses provided for each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

F. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

3.6 SCHEDULE

A. Horizontal Joints, less than 5 percent slope; Sealant No. 1.

B. Horizontal Joints, grades steeper than 5 percent; Sealant No. 2

C. Vertical Joints; Sealant No. 2

END OF SECTION

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SECTION 321500 - DECOMPOSED GRANITE SURFACING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Edging materials

1.2 RELATED REQUIREMENTS

A. Division 31 Section Earthwork

B. Division 32 Section Landscape Work

1.3 DEFINITIONS

A. Decomposed Granite (DG): compacted decomposed granite composite utilizing resin emulsion and specified aggregate.

B. Resin emulsion: Liquid binding agent for Decomposed Granite (DG).

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Manufacturer's product sheets, including installation specifications.

B. Test reports:
   1. Marshall Stability test results using pre-approved specified aggregate.
   2. Final compaction report.

C. Mix Design:
   1. Source, color and weight of aggregate.
   2. Quantity of water for pre-wetting.
   3. Quantity of resin emulsion.
   4. Written certification from approved mix manufacturer that all deliveries of mix meet specifications.
   5. Weight tickets or weigh-master tickets for each load of mix.

1.5 QUALITY ASSURANCE

A. Pre-installation Meeting:
   1. The Contractor shall coordinate, schedule and conduct a meeting to review the installation requirements with the mix supplier and Architect.

B. Mockup:
   1. Contractor shall form and install a 4-foot square sample of DG duplicating a small section of actual work to be done for each type, size and color of surfacing material.

C. Installer Qualifications: Installer to provide evidence to indicate successful experience in providing decomposed granite or crushed 3/8" or 1/4" minus aggregate paving containing stabilizer binder additive.
   1. Installer shall be a certified by the manufacturer or blender of the resin product.

1.6 SITE CONDITIONS

A. Weather and site requirements:
   1. Aggregate base or sub-base is to be dry.
   2. Do not install DG mix, or apply seal coat if the possibility of rain is forecast within four days following installation.
   3. Resin emulsion is diluted with water: protect newly installed pavement and seal coat from water until curing is complete.
   4. Install DG mix and seal coat when ambient temperature is above 60 degrees Fahrenheit and overnight temperature is above 32 degrees F.

1.7 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Warranty Period: Contractor shall provide warranty for performance of product. Contractor shall warranty installation of product for the time of one year from completion.

C. Contractor shall provide, for a period of sixty days, unconditional maintenance and repairs as required.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Aggregate: Furnish one five pound bag for each type, color, and size of material installed.
   2. Resin emulsion: Furnish one 40 pound bag of stabilizer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 AGGREGATE MATERIALS

A. Suppliers: Subject to compliance with requirements, provide material to be incorporated into the Work, but are not limited to, the following suppliers:
   1. Southwest Boulder and Stone, Indio, CA. 760-342-5522

B. Nominal maximum size of aggregate:
   1. Sieve Metric% Passing
   2. 9.5 mm 95 -100
   3. 4.5 mm 87 -100
   4. 2.36 mm 73 - 93
   5. 600 um 34 - 54
   6. 300 um 20 - 40
   7. 75 um min 11 - 23

2.3 STABILIZING AGENT

A. Basis of Design: Design is based on "Stabilizer" manufactured by Stabilizer Solutions, Inc. 205 South 28th St., Phoenix, AZ 85034; phone (602) 225-5900, (800) 336-2468; fax (602) 225-5902; website stabilizersolutions.com; or a comparable product by one of the following:
   1. Stabilizer Solutions, Phoenix, AZ (800) 336-2468
   2. Soil Stabilization Product Company, Inc. Merced, CA (800) 523-9992
   3. SoilTac by Soil Works, Inc. CA (760) 345-0771

B. Resin emulsion: Totally natural additive emulsion with high solids content formulated especially for use as a natural flexible pavement binder.
   1. Resin-stabilized DG shall cure to a water-insoluble, high strengths state, equal in strength to hot-mix asphalt concrete.
   2. Resin emulsion shall dry without affecting the color of the aggregate.
   3. Resin emulsion shall be added at an addition rate of 10%-12% during blending operations.
   4. Resin emulsion shall be non-hazardous, non-toxic, non-corrosive, and shall be water-soluble.

C. Water: Fresh, clean, and potable.

D. Seal coat: Resin emulsion.

E. Tack coat: Resin emulsion diluted with water.

2.4 DECOMPOSED GRANITE MIX (DG MIX)

A. Basis of Design: California Gold Fines

B. DG mix as supplied by manufacturer-approved blender with not less than 10% - 12% emulsion by dry weight of the aggregate.

C. Blend 12 to 16 lbs. (verify with manufacturer for exact blend) of Stabilizer per 1-ton of decomposed granite or crushed 3/8" or ¼" minus aggregate screenings. It is critical that

stabilizer be thoroughly and uniformly mixed throughout decomposed granite or crushed ¼" or 3/8" minus aggregate screenings.

D. Installed DG mixture shall meet the following requirements when tested in accordance with the Marshall Stability Test, ASTM D 1599-89. Mix blending facility shall submit test results for review and approval. Requirements for Marshall Stability Flow: Stability Minimum (pounds) shall equal 4,000 lbs.

2.5 EDGING

A. As noted on plans.

2.6 WEED BARRIER FABRIC

A. Basis-of-Design Product: Subject to compliance with requirements, provide Mirafi N-Series, Model 140N manufactured by Mirafi, Pendergrass, GA (706) 693 2226, www.mirafi.com.

B. Spun or woven, non-degrading geotextile fabric that blocks 95% of weed growth and is permeable to air, water, gases and fertilizer.
   1. Filter Fabric: Composite fabric geotextile consisting of woven, needle-punched polypropylene geotextile substrate bonded to a non-woven polypropylene fabric, weighing not less than 4.8 oz./sq. yd. (160 g/sq. m).

2.7 SOIL STERILANT

A. Soil Sterilant: Oxycil Ureabor, as manufactured by Best Products Division, Occidental Chemical Company, Lathop, CA.

2.8 HERBICIDE

A. Chemical herbicide shall be Surflan or Dacthol pre-emergent. All material shall have an integral dye so that it is evident which areas have been treated. It is the Contractor's responsibility to post warnings to indicate that the above chemicals are being applied.
   1. Chemical herbicide for control of actively growing weeds and grasses shall be Roundup or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine site and verify that conditions are suitable to receive work and that no defects or errors are present which would cause defective installation of product or cause latent defects in workmanship and function.

B. Review subgrade to verify that it has been graded correctly and compacted as required for installation of the decomposed granite.

C. Before proceeding with work, Contractor shall notify the Architect in writing of any unsuitable conditions and conflicts.

3.2 PROTECTION OF EXISTING CONDITIONS

A. Use every possible precaution to prevent damage, including staining, to existing conditions to remain such as structures, utilities, irrigation systems, plant materials and paving on or adjacent to the site of the work.

B. Provide barricades, fences or other barriers as necessary to protect existing conditions to remain from damage during construction.

C. Contractor is fully responsible for all costs associated with replacement of damage caused by his work.

3.3 LAYOUT

A. Establish lines and levels, locate and lay out by instrumentation and similar appropriate means for aggregate paving finish grades.

B. Staking: Provide a sufficient quantity of grade stakes as required to provide aggregate paving with smooth finish grades and positive drainage.

3.4 SUB-GRADE PREPARATION

A. Refer to Geotechnical report for subgrade preparation prior to placement of decomposed granite. Grade subgrade with uniform slope between points where elevations are given.

B. Subgrade shall be crowned in the middle, or have a 2% slope from one side to the other.

C. Grade sub-grade surface to within 0.05 foot of finish grade minus aggregate paving thickness.

D. Fill and compact any depressions and remove loose material to finish true to line and grade, presenting a smooth, compacted and unyielding surface.

E. Remove debris, loose dirt and other extraneous materials.

F. Ditches, drains and drain pipes shall be installed if necessary to protect of the pavement and base from cross flows of water. All water flow should be directed off of and away from the pavement and base.

3.5 INSTALLATION OF DG MIX

A. Edging materials must be in place prior to placing DG. The DG compacted surface should be no less than 1/8" above the edging material to assure proper drainage.

B. Install weed barrier fabric over compacted subgrade prior to installation of DG mix. Minimum thickness shall be 4".

C. Decomposed Granite (DG) to be installed in 2-inch nominal lifts to the desired overall thickness.

D. Placement: Place mix via a single, continuous operation.
   1. Use a self-propelled, mechanized spreading-and-finishing machine designed specifically for placement of resin emulsion mix.
   2. Machine shall be equipped with a screen or strike-off assembly capable of being accurately regulated and adjusted to a uniform depth.
   3. Small amounts of material may be placed and raked by hand, using asphalt rakes.

E. Provide a structural section of a minimum of 4" compacted thickness upon completion of final compaction. Verify required thickness on drawings.

F. DG surface shall be crowned in the middle or have a 2% cross slope, unless finish graded on the drawings.

G. If slope of surfaces to be paved exceed 4 percent, place material in an uphill direction. Do not allow placing equipment to run over un-compacted material.

H. Initial compaction: After mix placement, begin initial compaction as soon as mix will bear roller weight without undue displacement.
   1. If mix will not support compaction equipment due to excess moisture, delay initial compaction until mix achieves adequate stability to support compaction equipment.
   2. Use of non-heeled boots is required for anyone having to walk on resin DG during installation process.
   3. Perform initial breakdown compaction with self-propelled, 1-ton steel drum rollers in static mode only. Walk-behind vibratory plate compactors shall be used for edges and areas where a steel drum roller is not practical.
   4. On grades of 4% or steeper: Use static rollers, operate equipment at slow speeds and with the drive wheel forward to the uphill direction of work progress.
   5. Generally, no more than two passes are required for initial compaction.
   6. Warning: If the pavement begins to develop stress cracks, the pavement is being over-compacted and further compaction should be halted.
   7. Test paving surface for slope and smoothness after initial rolling, and correct deficiencies immediately so that finished surface will meet specified tolerances and requirements for smoothness.

I. Final Compaction:
   1. Begin final compaction as soon as possible after initial compaction has been completed.
   2. The purpose of the final compaction is to eliminate roller marks from the initial compaction and to create an aesthetically appealing pavement surface. The Architect shall be the judge of aesthetic considerations.
   3. Contractor may use a 1-ton steel drum roller or small plate compactor. Do not over roll.

3.6 TOLERANCES

A. In-Place compacted thickness:
   1. Compacted Sub-Grade Course: Maximum 1/2-inch plus, minus 0-inch.
   2. Aggregate Paving Surface Course: Maximum 3/16-inch plus, minus 0-inch.

B. Finished surface smoothness:
   1. Subgrade: +/- 0.08 foot.
   2. Compacted Sub-Grade Course: Maximum 3/8-inch in 10-feet.
   3. Aggregate Paving Surface Course: Maximum 3/16-inch in 10-feet in any direction.

3.7 REPLACEMENT OF DEFECTIVE PAVEMENT

A. Replace full depth of paving thickness in paving mixes that are contaminated, pavement that is cracked, or otherwise defective.
   1. Skin patching will not be permitted.

B. Edges of Replaced Pavement:
   1. Cut edges of pavement to be removed so that sides are vertical and oriented perpendicular and parallel to direction of traffic.
   2. Spray edges with a tack coat of resin emulsion.

C. Installation of replacement pavement:
   1. After applying tack coat, place pavement mix in areas where paving was removed in sufficient quantity to conform to elevation and tolerance requirements.
   2. Thoroughly compact DG mix so that cured patch meets all requirements set forth in this specification.
   3. Skin patching of an area that has been rolled will not be permitted.

3.8 FIELD QUALITY CONTROL

A. Density tests:
   1. Perform tests in accordance with ASTM D 2950.
   2. Perform tests within 48 hours after final compaction.
   3. Perform at least three tests, in areas specified by Architect.

B. Surface shall not vary more than 3/16 inch per 10 feet, except at intersections or changes of grade. Areas not meeting specified surface tolerance are to be corrected immediately after initial compaction.

C. DG course thickness: Correct areas not meeting specifications immediately after initial compaction.

D. Ground surfaces onaccessible routes, clear floor or ground spaces, and turning spaces for play areas shall comply with **CBC Section 11B-1008.2.6** as follows:
   1. Ground surfaces shall be inspected and maintained regularly and frequently to ensure continued compliance with **ASTM F 1951.**
   2. Ground surfaces located within use zones shall comply with **ASTM F 1292.**

3.9 PROTECTION

A. Protect pavement surface against equipment and traffic until pavement has cured sufficiently, a minimum of 72 hours, to support traffic without marring, rutting, tearing, distressing or damaging the pavement in any way. Utilize warning signs, barricades, and protection fencing to protect pavement from traffic.

B. All pavement installed must be protected by covering with plastic sheeting if unforeseen inclement weather occurs prior to complete curing.

C. Contractor is responsible for replacing damaged pavement, if damage was preventable, at his own expense.

3.10 CLEANING

A. Keep DG mix off of adjacent surfaces, including planting areas and pavements.

END OF SECTION

SECTION 321713 - PARKING BUMPERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Precast concrete parking bumpers and anchorage.

1.2 REFERENCE STANDARDS

A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.

B. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2023.

C. ASTM C150/C150M - Standard Specification for Portland Cement 2022.

D. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).

E. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete 2023.

PART 2 PRODUCTS

2.1 MATERIALS

A. Parking Bumpers: Precast concrete, conforming to the following:
   1. Nominal Size: 5.5 inches high, 7 inches wide, 4 feet long.
   2. Profile: Manufacturer's standard.

B. Dowels: As indicated on drawings.

C. Adhesive: Epoxy type.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install units without damage to shape or finish. Replace or repair damaged units.

B. Install units in alignment with adjacent work.

C. Fasten units in place with 2 dowels per unit.

END OF SECTION

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SECTION 321723.13 - PAINTED PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Parking lot markings, including parking bays, crosswalks, arrows, handicapped symbols, and curb markings.

B. Roadway lane markings and crosswalk markings.

C. "No Parking" curb painting.

1.2 RELATED REQUIREMENTS

A. Section 321216 - Asphalt Paving.

1.3 REFERENCE STANDARDS

A. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.

B. California MUTCD - Manual on Uniform Traffic Control Devices for Streets and Highways; State of California Department of Transportation (FHWA's MUTCD as amended for use in California); current edition.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver paint in containers of at least 5 gallons accompanied by batch certificate.

B. Deliver glass beads in containers suitable for handling and strong enough to prevent loss during shipment accompanied by batch certificate.

C. Store products in manufacturer's unopened packaging until ready for installation.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 MATERIALS

A. Line and Zone Marking Paint: MPI (APL) No. 97 Latex Traffic Marking Paint; color(s) as indicated.
   1. Parking Lots: Yellow.
   2. Handicapped Symbols: Blue.

B. Temporary Marking Tape: Preformed, reflective, pressure sensitive adhesive tape in color(s) required; Contractor is responsible for selection of material of sufficient durability as to perform satisfactorily during period for which its use is required.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Clean surfaces thoroughly prior to installation.
   1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.
   2. Completely remove rubber deposits, existing paint markings, and other coatings adhering to the pavement, by scraping, wire brushing, sandblasting, mechanical abrasion, or approved chemicals.

D. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application; after cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.

E. Establish survey control points to determine locations and dimensions of markings; provide templates to control paint application by type and color at necessary intervals.

F. Temporary Pavement Markings: When required or directed by Architect, apply temporary markings of the color(s), width(s) and length(s) as indicated or directed.
   1. After temporary marking has served its purpose, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method so that surface to which the marking was applied will not be damaged.
   2. At Contractor's option, temporary marking tape may used in lieu of temporary painted marking; remove unsatisfactory tape and replace with painted markings at no additional cost to Owner.

3.3 REQUIREMENTS

A. Accessible parking spaces serving a particular building or facility shall be located, and dispersed if serving more than one accessible entrance, on the shortest accessible routes to an entrance or to mulitple accessible entrances. **CBC Section 11B-208.3.1.**

B. Accessible parking spaces in a parking facility not serving a particular building or facility shall be located on the shortest accessible route to an accessible pedestrian entrance of the parking facility. **CBC Section 11B-208.3.1.**

C. Minimum number of required accessible parkng spaces shall be provided in accordance with **CBC Table 11B-208.2** for each parking facility provided.

D. For every six or fraction of six accessible parking spaces, at least one shall be an accessible van parking space. **CBC Section 11B-208.2.4.**

E. Accessible parking spaces and access aisles shall comply with **CBC Section 11B-502** and shall be dimensioned to the centerline of the marked lines as follows:
   1. Parking spaces and access aisles shall be marked according to **CBC Section 11B-502.2, 11B-502.3, and 11B-502.3.3.** Their surfaces shall comply with **CBC Section 11B-302** and shall be at the same level with slopes not steeper than 1:48 in any direction. **CBC Section 11B-502.4.**
   2. Parking spaces shall be 9' x 18' minimum and van parking spaces shall be 12' x 18' minimum with an adjacent access aisle of 5' x 18' minimum. Access aisles shall be placed on either side of the parking spaces except be located on the passenger side for van parking spaces. Van parking spaces shall be permited to be 9' x 18' minimum where the access aisle is 8' x18' minimum.
   3. Access aisles shall be marked by a blue painted borderline around their perimeter. The area within the blue borderlines shall be marked with hatched lines a maximum of 36" on center in a color contrasting with that of the aisle surface, perferably blue or white. Access aisle markings may extend beyond the minimum required length. **CBC Section 11B-502.3.3.**
   4. Access aisles (parking spaces as well - similar application) shall not overlap the vehicular way. **CBC Section 11B-502.3.4.**
   5. A vertical clearance of 8'-2" minimum shall be provided for accessible parking spaces, access aisles, and vehicular routes serving them. **CBC Section 11B-502.5**

F. At least one passenger loading zone shall be provided in every continuous 100 linear feet of loading zone space, or fraction thereof, complying with **CBC Section 11B-209 and 11B-503** as

follows:

1. Vehicle pull-up spaces shall be 8' x 20' minimum. Access aisles shall be 5' x 20' minimum and shall be adjacent and parallel to the vehicular pull-up spaces. They shall be the same level with slopes not steeper than 1:48 in any direction. **CBC Section 11B-503.4.**
2. Access aisles for passenger drop-off and loading zones shall be marked with a painted borderlines around their perimeter. The areas within the borderlines shall be marked with hatched lines a maxiumum of 36" on center in a color contrasting with that of the aisle surface. **CBC Section 11B-503.3.**
3. A vertical clearance of 9'-6" minimum shall be provided for vehicle pull-up spaces, access aisles, and a vehicular route serving them connecting a vehicular entrance and a vehicular exit. **CBC Section 11B-503.5.**

G. Bus loading zones and bus stops shall comply with **CBC Sections 11B-209 and 11B-810.2** as follows:

1. Boarding and alighitng areas shall be 8' x 5' minimum, with 8' measured perpendicular to the curb or vehicle roadway edge, and with 5' measured parallel to the vehicle roadway. Slopes in 8' direction shall be 1:48 maximum. Slopes in 5' direction shall be the same as that of the roadway, to the maximum extent practicable. **CBC Figure 11B-810.2.2.**
2. Bus shelters shall provide a minimum 30" x 48" clear floor or ground space (36" x 48" or 36" x 60" as applicable in an alcove), with slopes not steer than 1:48 in any direction, entirely within the shelter complying with **CBC Section 11B-305.**
3. Bus shelters shall be connected by an accessible route complying with **CBC Section 11B-402** to a boarding and alighitng area complying with **CBC Section 11B-810.2. CBC Figure 11B-810.3.**

3.4 INSTALLATION

A. Begin pavement marking as soon as practicable after surface has been cleaned and dried.

B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 35 degrees F or more than 95 degrees F.

C. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.

D. Comply with California MUTCD manual for details not shown.

E. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.

F. Apply uniformly painted markings of color(s), lengths, and widths as indicated on drawings true, sharp edges and ends.

1. Length Tolerance: Plus or minus 3 inches.
2. Width Tolerance: Plus or minus 1/8 inch.

G. Parking Lots: Apply parking space lines, entrance and exit arrows, painted curbs, and other markings indicated on drawings.

1. Mark the "International Symbol of Accessibility" (ISA) at indicated parking spaces.
2. Hand application by pneumatic spray is acceptable.

H. Symbols: Use a suitable template that will provide a pavement marking with true, sharp edges and ends, of the design and size indicated.

3.5 DRYING, PROTECTION, AND REPLACEMENT

A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.

B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.

C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.

D. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width tolerances; or show light spots, smears, or other deficiencies or irregularities.

E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.

F. Replace removed markings at no additional cost to Owner.

END OF SECTION

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SECTION 323001 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Picnic tables.

B. Benches.

C. Trash / Ash / Recycling Receptacles.

D. Bike racks.

E. Bike Lockers.

F. Bollards.

G. Chairs.

H. Tables.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Refer to Site Furnishings Legend on Sheet L0.1.

B. Samples: For each exposed finish.

C. Material Certificates: For site furnishings, signed by manufacturers.

D. Maintenance Data.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free of surface blemishes.

B. Steel and Iron: Free of surface blemishes.

C. Stainless Steel: Free of surface blemishes.

D. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard, corrosion-resistant-coated or noncorrodible materials; commercial quality, tamperproof, vandal and theft resistant, concealed, recessed, and capped or plugged.

E. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107; recommended in writing by manufacturer, for exterior applications.

F. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.

G. Galvanizing:
1. Zinc-Coated Tubing: External, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, polymer film. Internal, same as external or consisting of 81 percent zinc pigmented coating, not less than 0.3 mil thick.
2. Hot-Dip Galvanizing: According to ASTM A 123/A 123M, ASTM A 153/A 153M, or ASTM A 924/A 924M.

2.2 SITE FURNISHINGS

A. See drawings for “Site Furnishing Legend” on sheet L0.1 for additional site furnishing model numbers, including installation method and finishes.

B. Minimum material requirements specified in this section apply to other furnishing listed on drawings not found in this section.

2.3 PICNIC TABLES

A. Basis-of-Design Product: Subject to compliance with requirements, provide Dumor; Model 100-60PL, or an equal product by one of the following:
1. Landscape Forms.
2. Quickcrete
3. Columbia Cascade Company.
4. DuMor Inc.
5. Hess America
6. PW Athletic.
7. Sitecraft.
8. Urban Accessories, Inc.
9. Wabash.

B. Frame: Cast aluminum and steel tubing.

C. Seat:
1. Material:
a. Painted Steel: Perforated metal
b. Arms: None

D. Table Top:
   1. Material:
      a. Non-porous, man-made 100% acrylic resin solid surface material.
         1) Surface Shape: Round
         2) Color: As selected by Architect from manufacturer's full range.

E. Aluminum Finish: Color coated.
   1. Color: As selected by Architect from manufacturer's full range.

F. Steel Finish: Galvanized and powder coated.
   1. Color: As selected by Architect from manufacturer's full range.

2.4 BENCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide Dumor; Model XXXX, or an equal product by one of the following:
   1. Landscape Forms.
   2. Quickcrete
   3. Columbia Cascade Company.
   4. DuMor Inc.
   5. Hess America
   6. PW Athletic.
   7. Sitecraft.
   8. Urban Accessories, Inc.
   9. Wabash.

B. Frame: Cast aluminum and steel tubing.

C. Seat:
   1. Material:
      a. Painted Steel: Perforated metal
      b. Arms: None

D. Aluminum Finish: Color coated.
   1. Color: As selected by Architect from manufacturer's full range.

E. Steel Finish: Galvanized and powder coated.
   1. Color: As selected by Architect from manufacturer's full range.

2.5 TRASH / ASH / RECYCLING RECEPTACLES

A. Basis-of-Design Product: Subject to compliance with requirements, provide Quickcrete; Model XXXX, or an equal product by one of the following:
   1. Landscape Forms.
   2. Quickcrete

3. Columbia Cascade Company.
4. DuMor Inc.
5. Hess America
6. PW Athletic.
7. Sitecraft.
8. Urban Accessories, Inc.
9. Wabash.

B. Aluminum Finish: Color coated.
   1. Color: As selected by Architect from manufacturer's full range.

C. Steel Finish: Galvanized and powder coated.
   1. Color: As selected by Architect from manufacturer's full range.

D. Pre-cast concrete finish:
   1. Color:

2.6 BIKE RACKS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Columbia Cascade Cycloops, or an equal product by one of the following:
   1. Landscape Forms.
   2. Columbia Cascade Company.
   3. DuMor Inc.
   4. Hess America
   5. PW Athletic.
   6. Sitecraft.
   7. Urban Accessories, Inc.
   8. Wabash.

B. Frame: Cast aluminum and steel tubing.

C. Aluminum Finish: Color coated.
   1. Color: As selected by Architect from manufacturer's full range.

D. Steel Finish: Galvanized and powder coated.
   1. Color: As selected by Architect from manufacturer's full range.

2.7 BIKE LOCKER

A. Basis-of-Design Product: Subject to compliance with requirements, provide _____Model #XX, or an equal product by one of the following:
   1. Landscape Forms.
   2. Quickcrete
   3. Columbia Cascade Company.
   4. DuMor Inc.
   5. Hess America

6. PW Athletic.
7. Sitecraft.
8. Urban Accessories, Inc.
9. Wabash.

B. Frame: Cast aluminum and steel tubing.

C. Aluminum Finish: Color coated.
1. Color: As selected by Architect from manufacturer's full range.

D. Steel Finish: Galvanized and powder coated.
1. Color: As selected by Architect from manufacturer's full range.

2.8 BOLLARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Dumor; Model XX, or an equal product by one of the following:
1. Landscape Forms.
2. Quickcrete
3. Columbia Cascade Company.
4. DuMor Inc.
5. Hess America
6. PW Athletic.
7. Sitecraft.
8. Urban Accessories, Inc.
9. Wabash.

B. Frame: Cast aluminum and steel tubing.

C. Aluminum Finish: Color coated.
1. Color: As selected by Architect from manufacturer's full range.

D. Steel Finish: Galvanized and powder coated.
1. Color: As selected by Architect from manufacturer's full range.

2.9 CHAIRS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Dumor; Model XX, or a equal product by one of the following:
1. Landscape Forms.
2. Quickcrete
3. Columbia Cascade Company.
4. DuMor Inc.
5. Hess America
6. PW Athletic.
7. Sitecraft.
8. Urban Accessories, Inc.

9. Wabash.

B. Frame: Cast aluminum and steel tubing.
   1. Seat:

C. Material:
   1. Painted Steel: Perforated metal
   2. Arms: None

D. Table Top:

E. Aluminum Finish: Color coated.
   1. Color: As selected by Architect from manufacturer's full range.

F. Steel Finish: Galvanized and powder coated.
   1. Color: As selected by Architect from manufacturer's full range.

2.10 TABLES

A. Basis-of-Design Product: Subject to compliance with requirements, provide Dumor; Model XX, or an equal product by one of the following:
   1. Landscape Forms.
   2. Quickcrete
   3. Columbia Cascade Company.
   4. DuMor Inc.
   5. Hess America
   6. PW Athletic.
   7. Sitecraft.
   8. Urban Accessories, Inc.
   9. Wabash.

B. Frame: Cast aluminum and steel tubing.

C. Table Top:
   1. Material:
      a. Non-porous, man-made 100% acrylic resin solid surface material.
         1) Surface Shape: Round
         2) Color: As selected by Architect from manufacturer's full range.

D. Aluminum Finish: Color coated.
   1. Color: As selected by Architect from manufacturer's full range.

E. Steel Finish: Galvanized and powder coated.
   1. Color: As selected by Architect from manufacturer's full range.

2.11 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

B. Welded Connections: At exposed connections, finish surfaces smooth and blended so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

D. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

E. Factory Assembly: Assemble components in the factory to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Post Setting: Set cast-in support posts in concrete footing plumb or at correct angle and aligned and at correct height and spacing.

C. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings and fill annular space between post and concrete with nonshrink, nonmetallic grout mixed and placed to comply with anchoring material manufacturer's written instructions.

D. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout mixed and placed to comply with anchoring material manufacturer's written instructions.

END OF SECTION

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SECTION 323119 - TUBE STEEL FENCES AND GATES

PART1 GENERAL

1.1 SECTION INCLUDES

A. Tube steel fencing.

B. Tube steel gates.

C. Accessible gate hardware

1.2 RELATED REQUIREMENTS

A. Division 03 Section Cast-in-Place Concrete

B. Division 32 Section Concrete Paving

C. Division 32 Section Architectural Site Concrete

1.3 SUBMITTALS

A. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
   1. Prepare Project specific information, drawn accurately to scale. Shop Drawings shall not be reproductions of the Contract Documents or any standard printed data.
   2. Where installed metal fabrications are indicated to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis that has been signed and sealed by the qualified professional engineer who was responsible for the preparation.

B. Product data in the form of manufacturer's technical data, specifications, and installation instructions for fence and gate posts, fabric, gates, hardware and accessories specified in the section.
   1. Fence and gate posts, rails, and fittings.
   2. Gates and hardware, including accessible gate lever lockset.
   3. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has at least three years' experience and has completed at least five tube steel fence projects with same material and of similar scope to that indicated for this Project with a successful construction record of in-service performance.

B. Single-Source Responsibility: Obtain tube steel fences and gates, including accessories, fittings, and fastenings, from a single source.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for fences and gates shown on the Drawings in relation to the property survey and existing structures. Verify dimensions by field measurements.

PART 2 PRODUCTS

2.1 TUBE STEEL FENCE

A. All parts shall be tube steel. All posts, shall be tube steel meeting the requirements of ASTM A 500 grade B.787. All other tube steel shall meet the requirements of ASTM A 513. All posts shall have a welded post cap.
   1. Sizes shall be as noted on plans and details.
   2. Sizes shall be as noted below:

Item	O.D.	Wall Thickness
Line Post	Blade	per Bok Modern
Corner Post	Blade	per Bok Modern
Fence Top Rail	NONE	
Fence Bottom Rail	NONE	
Pedestrian Gate Post	2"x4"	per Bok Modern
Vehicular Gate Post	NONE	
Pedestrian Gate Rails, Frame and Braces	NONE	
Vehicular Gate Rails, Frame and Braces	NONE	
Vehicular Gate Bottom Rail	NONE	
Pedestrian Fence and Gate Pickets	NONE	
Vehicular Gate Pickets	NONE	

B. Infill Panels.
   1. Aluminum panels. Perforated Aluminum Sheet: AA5052-H32, Bok Modern pattern B21

C. Steel Finish: powder coated finish.

2.2 VEHICLE GATES

A. Gates shall be located as shown on the Drawings and sized to suit existing walkways and roadways. All vehicular gates shall have a minimum clear opening as designated on plans and details. Materials used shall be equal to or greater than that used in adjoining sections of fence and be compatible with the application.

B. Steel Finish: Powder coated finish

2.3 PEDESTRIAN GATES

A. Pedestrian gates shall have a box type frame provisions for locking hardware, kickplate/kickbox, drop rod and gate hardware.

B. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet (1.52 m) wide. Provide center gate stops and cane bolts for pairs of gates.

C. Steel Finish: Powder coat finish.

2.4 LOADING DOCK GATE

A. Loading dock gate shall have a box type frame, and provisions of manual lock and cane bolt.

B. Hinges shall be extra- heavy duty
1. Basis-of-Design Product: The design for hinging systems is based on “Guardian Series 2000” Antech Corporation 3431 East Lind Road, Tucson, AZ 85716, (800) 866-9115, or a comparable product.

C. Steel Finish: Galvanized

2.5 HARDWARE

A. Pedestrian Gate Hardware: Provide galvanized hardware and accessories for each gate according to the following:

B. Accessible Latch/Lockset: Locksets shall be heavy-duty with hinged, anti-friction, 1-inch throw latchbolt with anti-friction piece made of self-lubricating stainless steel. Provide locksets with interchangeable core cylinders. Provide double cylinder, keyed to match building exterior doors. Locksets to be furnished with thru-bolted hardware to attached through gate frame, round or square post stock. Lever handles must be of forged or cast brass, bronze or stainless steel construction.
1. Basis-of-Design Product: Schlage L9070T SPA 626 IC Core 20-740-626. For use with panic hardware use Schlage rim cylinder 20-057 ICX 626, IC Core 20-740-626.
2. Locksets to be furnished with thru-bolted hardware to attached through gate frame, round or square post stock. Lever handles must be of forged or cast brass, bronze or stainless steel construction

C. Kickplate: Smooth solid metal surface (12GA), to match frame material and finish, along the entire width of the gate, and minimum of 10” above the pedestrian surface to be provide at all accessible pedestrian gates.

D. All gate drop rod assemblies are to use a 1/2" diameter solid steel center stop. Provide a 12" steel sleeve. In asphalt areas secure sleeve in a 12" diameter by 18" deep concrete footing.

E. Pedestrian Gate Hinges:
   1. Locinox Mammoth-HD
      a. Color: Black(9005) , Silver (ZILV)

F. Exit Hardware: BHMA A156.3, Grade 1, Type 1 (rim exit device), with push pad actuating bar, suitable for exterior use.
   1. Basis of Design: Duprin 98L, 630 finish with rim cylinder.
   2. Function: 04 - Entrance by trim when latch bolt is released by key or set in a retracted position by key.
   3. Mounting Channel: Bent-plate channel formed from 1/8-inch- (3.2-mm-) thick, steel plate. Channel spans gate frame. Exit device is mounted on channel web, recessed between flanges, with flanges extending 1/8 inch (3.2 mm) beyond push pad surface.

G. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 1/2-inch- (12.7 -mm-) diameter, round steel bars, hot-dip galvanized after fabrication, unless otherwise shown on drawings. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in both open and closed positions.

H. Gate Keeper: Galvanized steel, duckbill type to auto-engage in open position and hold open. High Performance coating to match fence and gate color.

I. Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with **CBC Section 11B-404.**

J. The lever of lever actuated latches or locks for an accessible gate shall be curved with a return to within 1/2" of the (face of) gate to prevent catching on the clothing or persons. **California Referenced Standards code. T-24 part 12, Section 12-10-202, Item (F).**

K. Swing doors and gate surfaces within 10" of the finish floor or ground shall have a smooth surface on the push side extending the full width of th door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within 1/16" of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped. **CBC Section 11B-404.2.10**

L. The clear opening width for a door shall be 32" minimum. For a swinging doors it shall be measured between the face of the door and the stop, with the door open 90 degrees. There shall be no projections into it below 34" and 4" maximum projections into it between 34" and 80" above the finish floor or ground. Door closers and stops shall be permitted to be 78" minimum above the finish floor or ground. **CBC Section 11B-404.2.3**

M. Handles pulls, latches, locks, and other operable parts on accesisible doors shall comply with **CBC Section 11B-309.4** and shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. Operable parts of such hardware shall be 34" minimum and 44" maximum above finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usalbe from both sides. **CBC Section 11B-404.2.7**

N. The force for pushing or pulling open a door shall be as follows: **CBC Section 11B-404.2.9**
   1. Interior hinged doors, sliding or folding doors: **5 pounds(22.2N)** maxiumum. Required fire doors: the minimum opening force allowable by the DSA authority, not to exceed **15 pounds (67N)**. 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.
   2. The force required for activating any operable parts, such as lever hardware, or disengaging other devices shall be 5 pounds(22.2 N)maximum to comply with CBC Section 11B-309.4

O. Door closing speed shall be as follows: **CBC Section 11B-404.2.8**
   1. Closer shall be adjusted so that the required time to move a door from an open position of 90 degrees to a position of 12 degrees from the latch is **5** seconds min.
   2. Spring hinges shall be adjusted so that the required time to move a door from an open position of 70 degrees to the closed position is **1.5** seconds minimum.

P. Thresholds shall comply with **CBC Section 11B-404.2.5**

Q. Floor stops shall not be located in the path of travel and 4" maximum from walls. **DSA Policy 99-08**.

R. Hardware (including 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 Interpretation 10-08 DSA/AC (External), revised 4/28/09.** Such conditions must be clearly demonstrated and indicated in the specifications:
   1. Such hardware has a 'dogging' feature.
   2. It is dogged during the time the facility is open.
   3. Such 'dogging' operation is performed only by employees as their job function(non-public use).

S. Pair of doors: limit swing of one leaf to 90 degrees so that a clear floor space is provided beyond the arc of the swing for the wall-mounted tactile sign. **CBC Section 11B-703.4.2.1**

2.6 HORIZONTAL SLIDE GATES

A. Gate Configuration: Single leaf.
   1. Type: slide, with external roller assemblies.

B. Gate Opening Width: As indicated on drawings.
   1. Steel Frames and Bracing: Fabricate members from square tubing.
      a. Frame Members: Steel tubing as noted on details, with 1/8-inch (3.2-mm) wall thickness.
      b. Bracing Members: Steel tubing as noted on details, with 1/8-inch (3.2-mm) wall thickness.

C. Frame Corner Construction:
   1. Welded frame with panels assembled with bolted corner fittings.

D. Additional Rails: Provide as indicated, complying with requirements for fence rails.

E. Infill: Comply with requirements for adjacent fence.

F. Hardware: Latches permitting operation from both sides of gate, hangers, roller assemblies, and stops fabricated from galvanized steel.

G. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

H. Steel Finish: Powder coated finish

2.7 FINISHES

A. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

B. Surface Preparation: Clean surfaces according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   1. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

C. Primer Application: Apply zinc-rich epoxy primer immediately after cleaning, to provide a minimum dry film thickness of 2 mils (0.05 mm) per applied coat, to surfaces that will be exposed after assembly and installation, and to concealed surfaces.

D. Powder Coating: Immediately after cleaning, apply 2-coat finish consisting of epoxy primer and TGIC polyester topcoat, with a minimum total dry film thickness of not less than 8 mils (0.20 mm). Comply with coating manufacturer's written instructions.
   1. Color and Gloss: Metallic Statuary Bronze.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance.
   1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.

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

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 200 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, property monuments, property lines, and easements.

3.3 PERFORMANCE REQUIREMENTS

A. All gates shall be designed and constructed to withstand the weight of a 200 pound person standing at the mid-point on the lower rail without permanent deformation of any component members of the assembly.

B. Fabricator to provide structural calculations for each type gate verifying the performance requirements of this section.

3.4 ON THE JOB SITE

A. After the fence has been erected and is mechanically complete, wire brush field welds, dry wipe off all loose residue, spot prime with the Zinc Chromate all bare metal, bare spots and chips, and unpainted surfaces. Then spray a finish coat over the entire fence installation with one coat of industrial quality coating. Care shall be taken to keep paint off of sidewalks, wall, etc.

3.5 FABRICATION AND INSTALLATION

A. Fencing shall be welded and have smoothed, clean, slag free welds. Dimensions and installation shall be in accordance with the drawings.

B. The lever of lever actuated latches or locks for an accessible gate shall be curved with a return to within 1/2" of the (face of) gate to prevent catching on the clothing or persons. **California Referenced Standards code. T-24 part 12, Section 12-10-202, Item (F).**

C. Swing doors and gate surfaces within 10" of the finish floor or ground shall have a smooth surface on the push side extending the full width of th door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within 1/16" of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped. **CBC Section 11B-404.2.10**

3.6 POST SETTING

A. General: Comply with ACI 301 for cast-in-place concrete.

B. Materials: Portland cement complying with ASTM C 150, aggregates complying with ASTM C 33, and potable water for ready-mixed concrete complying with ASTM C 94.
   1. Concrete Mixes: Normal-weight concrete with not less than 3000-psi (20.7- MPa) compressive strength (28 days), 3-inch (75-mm) slump, and 1-inch (25-mm) maximum size aggregate.

C. All posts to be set in concrete as detailed on the drawings.

D. All posts to have concrete domed to shed water. All posts to be set to a maximum of 8 feet O.C. All post to be set plumb, in line, and to correct height. A Corner Post is required when line of fence direction changes 30 degrees or more.

E. All posts set in existing concrete slabs to be set in a 6 inch core drilled hole and set to a depth of 24 inches. All 6 inch gate posts set in existing concrete slabs are to be set in 12 inch square saw cut to a depth of 43 inches.

3.7 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by the manufacturer in writing for exterior applications.

3.8 GATE INSTALLATION

A. General: Install gates 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.

3.9 SITE CLEAN UP

A. The construction site shall be cleaned up and all accumulated debris removed by the Contractor.

END OF SECTION

SECTION 323353 - ARCHITECTURAL SITE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Concrete site walls.

B. Concrete retaining walls.(48" or less in height)

C. Concrete benches.

D. Light pole bases.

E. Other architectural site concrete as indicated.

1.2 RELATED REQUIREMENTS

A. Division 07 Section - Joint Sealants

B. Division 32 Section - Concrete Paving

C. Division 32 Section - Concrete Paving Joint Sealants

1.3 DEFINITIONS

A. Cast-in-Place Architectural Site Concrete: Non-building formed concrete that is exposed to view in completed exterior work and that requires concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.

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

C. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of cast-in-place architectural site concrete.

D. Reveal: Projection of coarse aggregate from matrix or mortar after completion of exposure operations.

1.4 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place architectural site concrete to attend, including the following:
      a. Contractor's superintendent.

b. Independent testing agency responsible for concrete design mixtures.
c. District's Representative(s).
d. Architect's Representative(s)
e. Architectural site concrete subcontractor.
f. Inspector of Record (IOR).
g. Subcontractor for any adjacent work

2. Review testing and inspection procedures, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction joints, forms and form-removal limitations, reinforcement accessory installation, concrete repair procedures, and protection of cast-in-place architectural site concrete.
3. Contractor to provide meeting minutes for pre-installation conference.

1.5 SUBMITTALS

A. Product Data: For each type of product.
1. Proprietary admixtures, pigments, curing compounds, hardeners, sealers, form-release agents, all accessory material, etc.: Indicate compatibility with other materials used.

B. Samples for Initial Selection: For each type of product, ingredient or admixture requiring color selection.
1. Submit manufacturer selected range of colors and products for review.
2. Provide custom colors or samples as required.
3. Upon selection of color submit 12"X12" sample of material in the specified color/finish for review by the Landscape Architect in addition to the specified mock-ups.

C. Design Mixtures: Submit proposed mix designs and test data for each class, color, application, and strength of concrete and for each method of placement.
1. Prepare mix designs on the basis of field experience (preferred) and/or trial mixes, in compliance with California Building Code (CBC), Section 1905A.3.
2. Prepare mix designs on the basis of field experience (preferred) and/or trial mixes, in compliance with California Building Code (CBC), Section 1905.3.
3. Mix designs shall be prepared and signed by a structural or civil engineer registered in the State of California.
a. Mix designs shall be reviewed by the Architect and Structural Engineer of Record (SEOR).
4. Identify for each mix design submitted the method by which proportions have been selected.
a. For mix designs based on field experience, include individual strength test results, standard deviation, and required average compressive strength calculations.
b. For mix designs based on trial mixtures, include trial mix proportions, test results, graphical analysis and show required average compressive strength face results. Provide gross weight and yield per cubic yard of trial mixes.
c. Indicate quantity of each ingredient per cubic yard of concrete.
d. Indicate type and quantity of admixtures proposed or required.
e. Indicate water to cement ratio by weight.
f. Measured slump.

g. Measured air content.
h. Provide shrinkage test results.
i. No fly ash will be permitted

5. Submit proposed alternate design mixtures for review by the Architect and SEOR(Strutural Engineer of Record) when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
6. Mix designs for each application must be from a single source for the duration of the project. Multiple venders or courses will not be permitted.
7. All mix designs must be wet stamped by a licensed Engineer.

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
1. Coordinate with and identify the details of the Contract Drawings on the shop drawings.
2. Comply with ACI 315, part B and CRSI requirements.

E. Formwork Shop Drawings: Show formwork construction including form-facing joints, rustications, construction and contraction joints, form joint-sealant details, form tie locations and patterns, inserts and embedments, cutouts, cleanout panels, and other items that visually affect cast-in-place architectural site concrete.
1. Engineering Responsibility: Formwork shop drawings shall be prepared by or under the supervision of a licensed professional engineer detailing fabrication, assembly, and support of formwork.
2. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.
3. Location of form ties and patterns are subject to approval of the Landscape Architect. For walls less than 18” high, ties to be located above and below wall face, whenever possible.
4. Align all form joints with reveal locations indicated on plans. Provide custom size and cut form boards as required.

F. Construction Joint Layout: Indicate proposed construction joints required to construct the structure. Submit dimensioned drawing indicating layout of construction joints, contraction (control) joints, dowelled joints, decorative scoring and placement sequence of concrete.
1. Location of construction joints are subject to approval of the Architect.
2. Construction joints locations should align with reveal locations as located per drawings.
3. Provide custom form boards as required for joint alignment noted per drawings.
4. Align all form joints with reveal locations indicated on plans. Provide custom size and cut form boards as required.

G. Placement Schedule: Submit concrete placement schedule before start of placement operations. Include locations of all joints including construction joints.

H. Samples: For each of the following materials:
1. Form-facing panel.
2. Form ties.

3. Form liners.
4. Coarse- and fine-aggregate gradations.
5. Chamfers and rustications.
6. Reveals
7. One quart sample of sand and fine aggregate
8. On quart sample of coarse aggregate

I. Qualification Data: For manufacturer (batch plant).

J. Welding Certificates: Submit certifications signed by AWS Certified Welding Inspector of prequalified welding procedures, qualifications of welding procedures unless prequalified, qualifications of welding operators and qualifications of welders.

K. Material Certificates: For each of the following:
1. Cementations materials.
2. Aggregates and sand.
3. Admixtures.
4. Form materials and form-release agents.
5. Steel reinforcement and accessories.
   a. Provide mill test certificates for all reinforcing steel, showing physical and chemical analyses. For steel that will be welded, include in the chemical analysis the percentages of carbon, manganese, copper, nickel, chromium, phosphorus and sulfur, and optionally, the percentages of molybdenum and vanadium.
6. Curing compounds.
7. Surface treatments.
8. Bonding agents.
9. Adhesives.
10. Semi rigid joint filler.
11. Joint-filler strips.

L. Material Test Reports: For the following, by a qualified testing agency:
1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

M. Field Quality-control Reports. Submit reports of all compressive strength, slump, shrinkage and air content tests required by the authorities having jurisdiction and as indicated.
1. Submit copies of delivery tickets complying with ASTM C 94 for each load of concrete delivered to the site. Tickets shall include all information required by the referenced standard.

N. Minutes of pre-installation conference.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with CBC Chapter 19A.

1. Chemical products field-applied to concrete shall comply with the air quality requirements of authorities having jurisdiction.

B. Industry Standards: Comply with the following unless modified by requirements in the Contract Documents.
   1. ACI 301, "Specifications for Structural Concrete".
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials".
   3. ACI 302.1R, "Guide for Concrete Floor and Slab Construction".
   4. ACI 303.1 "Specifications for Cast-in-Place Architectural Concrete".
   5. ACI 304R, "Guide for Measuring, Mixing, Transporting, and Placing Concrete".
   6. ACI 305R, "Hot Weather Concreting".
   7. ACI 306.1, "Standard Specification for Cold Weather Concreting".
   8. ACI 318, "Building Code Requirements for Structural Concrete".
   9. ACI 347, "Guide to Formwork for Concrete".
   10. ACI 318, "Building Code Requirements for Structural Concrete."
   11. ACI SP-66, "ACI Detailing Manual".
   12. CRSI, "Manual of Standard Practice".
   13. CRSI, "Placing Reinforcing Bars".

C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "NRMCA Quality Control Manual - Section 3, Certification of Ready Mixed Concrete Production Facilities."
   2. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
   3. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
   4. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations for Cast-in-Place Architectural Site Concrete: Obtain each color, size, type, and variety of concrete material and concrete mixture from single manufacturer with resources to provide cast-in-place architectural site concrete of consistent quality in appearance and physical properties for the duration of the project.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specification for Structural Concrete,"[Sections 1 through 5.] [Sections 1 through 5 and Section 6, "Architectural Concrete."]
   2. ACI 303.1, "Specification for Cast-in-Place Architectural Concrete."

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

G. Source Limitations for Concrete Paving: Obtain each color, size, type, and variety of concrete material and concrete mixture from single manufacturer with resources to provide concrete of consistent quality in appearance and physical properties. Secure all material required for the duration of the project as needed to ensure consistent quality in appearance

H. Welding Qualifications: Comply with CBC Chapter 17A.
   1. Qualify welding procedures and welding personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel" prior to performing any welding.
   2. Qualify welding inspection personnel according to AWS QC1, "Standard for AWS Certification of Welding Inspectors."

I. Welding Qualifications: Comply with CBC Chapter 17.
   1. Qualify welding procedures and welding personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel" prior to performing any welding.
   2. Qualify welding inspection personnel according to AWS QC1, "Standard for AWS Certification of Welding Inspectors."

J. Mockups: Before casting architectural site concrete, build mockups to verify selections made under Sample submittals and to fully demonstrate typical joints, surface finish, texture, tolerances, reveals edges, bulkhead or cold joints, standard of workmanship and completed product. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
   2. Build mockups full-size, matching architectural site concrete components indicated on the Drawings. Mock-ups shall be complete in every detail, including joints, reveals, chamfers, etc. Include complex joinery conditions where necessary to integrate to other Project components as indicated.
   3. Maintain accurate records of variables associated with each mockup to facilitate the matching of accepted mockups during actual construction.
   4. Demonstrate curing, cleaning, and protecting of cast-in-place architectural site concrete, finishes, and contraction and expansion joints, as applicable.
   5. Required Mock-up Types:
      a. Walls: Construct at least 6 linear feet by 4 foot height of finished concrete site walls for each color, finish, and mix design. Thickness of walls as noted on plans.
      b. As-Cast Retarder Finishes: Mockups shall clearly demonstrate a consistent depth-of-cut for retarder finishes for Architect's review.
   6. Mock-up Acceptance: Obtain Architect's approval of mockups before casting architectural site concrete.
      a. The mock-up acceptence shall be judged between a distance of 5 feet to 10 feet, at the Architects discretion.
      b. The Architect may reject mockups that, in the Architect's sole judgment, do not demonstrate an acceptable completed product, including, but not limited to, color, joint work, surface finish, texture, tolerances, and standard of workmanship
      c. The Architect may require modifications to mockups to obtain acceptable results.

d. The Architect may require modifications to mockup repairs to obtain acceptable results.
e. The Architect may require removal and reconstruction of mockups to obtain acceptable results. Multiple mock ups may be required.
f. Contractor shall provide additional mockups as required to obtain results acceptable to the Architect at no additional cost to the Owner.

7. Mockup Disposition: Accepted mockups shall not become part of the completed Project. Maintain mock-up on-site for the duration of construction and until all work has been accepted. Remove and legally dispose mockups after acceptance of final installed work. If sufficient permanent architectural site work has been completed, Contractor may submit a written request to Architect to transfer quality control for architectural site concrete from the accepted mockups to one or more designated portions of the permanent work.

1.7 PROJECT CONDITIONS:

A. Traffic Control: Maintain access for Owner's operations and for vehicular and pedestrian control required for construction activities.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
1. Label bundles with durable identification tags. Maintain reinforcement identification after bundles are broken.
2. Store reinforcement to avoid excessive rusting or fouling with grease, oil, dirt or other bond-weakening contaminants.
3. Avoid damaging applied coatings, if any, on steel reinforcement.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. General: Comply with Division 03 Section "Cast-in-Place Concrete" for formwork and other form-facing material requirements.

B. Form-Facing Panels for As-Cast or Exposed-Aggregate Finishes: Steel, glass-fiber-reinforced plastic, or other approved no absorptive panel materials that will provide continuous, true, and smooth architectural site concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

C. Form-Facing Panels for all exposed As-Cast and Exposed-Aggregate Concrete Finishes: Provide steel, glass-fiber-reinforced plastic, or overlain exterior-grade plywood panels, no absorptive, that will provide continuous, true, and smooth architectural site concrete surfaces, with no wood grain, honeycombing or patch transfer.
1. Faced plywood panels shall comply with, or be equivalent to, DOC PS 1, Structural I. Provide minimum 7-ply plywood and provide balance sheets for panels coated one-side only. Furnish in largest practicable sizes to minimize number of joints.

a. Smooth As-Cast Finish: High-Density Overlay (HDO). Provide one of the following panels, or comparable substituted product:
   1) Olympic Panel Products, "Multipour Concrete Form." Overlay Color: Buff.
   2) Pacific Laminate Products, "ProFace HDO." Overlay Color: White.
   3) Sylvan Products, LLC, "Armor Ply HDO" Overlay Color: Buff.

b. Retarder As-Cast Finish: Medium-Density Overlay (MDO), with mill-applied release agent and edge sealant. Provide one of the following panels, or comparable substituted product:
   1) Olympic Panel Products, "B-Matte 333 MDO Concrete Form." Overlay Color: Brown.
   2) Pacific Laminate Products, "ProFace MDO." Overlay Color: Black.
   3) Sylvan Products, LLC, "Armor Ply MDO" Overlay Color: Brown.

2. Curved Work: Kerf back of plywood form-facing panels, or use accepted flexible or curved forms for curved work with a radius of 100 feet or less to match finish provided by form material noted in items 1 and 2 above.

D. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will provide surfaces without gradual or abrupt irregularities that exceed specified formwork surface class.
1. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
2. Finished work is to be free of seams or form markings.

E. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

F. Form Liners: Units of face design, texture, arrangement, and configuration indicated. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent surface treatments of concrete.

G. Rustication Strips or Reveals: Wood, metal or rigid plastic, with sides beveled and back kerfed; nonstaining; in longest practicable lengths. Align reveals as shown on plans and with form seams.

H. Form Joint Sealant: Urethane or silicone elastomeric sealant complying with ASTM C 920, Type M or Type S, Grade NS that adheres to form joint substrates. Form joint sealant shall be compatible with form-facing panels.

I. Form Sealer: Penetrating, clear, polyurethane wood form sealer formulated to reduce absorption of bleed water and prevent migration of set-retarding chemicals from wood. Form sealer shall be compatible with form-facing panels. All seams and joints are to be sealed.

J. Form-Release Agent: Commercially formulated, colorless form-release agent that will not bond with, stain, or adversely affect architectural site concrete surfaces and will not impair subsequent treatments of those surfaces. Form-release agent shall be compatible with form-facing panels.
   1. Obtain written acceptance of form release agent from integral colored concrete pigment manufacturer.
   2. Form-release agents shall be non-staining.
   3. Formulate form-release agent with rust inhibitor for steel form-facing materials.

K. Surface Retarder (In Form): Chemical liquid set retarder, for application on form-facing materials, capable of temporarily delaying final hardening of newly placed concrete surface to depth of reveal specified.
   1. Provide GCP Applied Technologies Pieri "Euro-Tard" or accepted comparable substitute.

L. Surface Retarder (Top Surface): Chemical liquid set retarder, for application on top surface of formed applications to match finish at formed faces, capable of temporarily delaying final hardening of newly placed concrete surface to depth of reveal specified.
   1. Provide W. R. Grace "Top-Cast" or accepted comparable substitute.

M. Form Ties: Factory-fabricated, stainless steel or fiberglass color keyed to wall color snap ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish ties with tapered plastic tie cone spreaders that, when removed, will leave holes 3/4 inch in diameter on concrete surface.
   2. Furnish internally disconnecting ties that will leave no metal closer than 1-1/2 inches (38 mm) after exposing aggregate, from the architectural site concrete surface.
   3. Furnish glass-fiber-reinforced plastic ties, not less than 1/2 inch (13 mm) in diameter, of color selected by Architect from manufacturer's full range.
   4. Furnish ties with integral water-barrier plates to walls indicated to receive damp proofing or waterproofing.

N. Provide new forms specifically purchased for this project. Reuse of forms from past projects or contractors stock will not be accepted.

O. Provide custom form boards as required to align seams with reveals indicted on plans.

2.2 STEEL REINFORCEMENT AND ACCESSORIES

A. General: Comply with Division 03 Section "Cast-in-Place Concrete" for steel reinforcement and other requirements for reinforcement accessories.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed, unless otherwise indicated.

C. Low-Alloy-Steel Reinforcing Bars (for Welding): ASTM A 706/A 706M, Grade 60, deformed, unless otherwise indicated.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place; manufacture according to CRSI's "Manual of Standard Practice."
   1. Where legs of wire bar supports contact forms, use CRSI Class 2, stainless-steel bar supports.

E. Tie Wire: Minimum 16 ga. annealed wire, black, galvanized or coated finish to match rebar.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type II/V, unless white cement is required to achieve colors indicated.

B. Normal-Weight Aggregates: ASTM C 33, [Class 1N] coarse aggregate or better, graded. Provide aggregates from single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials].

C. Normal-Weight Aggregates: ASTM C 33, complying with building code. Provide aggregates from a single source. All aggregates shall be free of materials with deleterious reactivity to alkali in cement when tested in accordance with ASTM C 289.
   1. Comply with CBC section 1903A.3.
   2. Comply with CBC section 1903.3.
      a. Service Class, based on CBC Figure 1904A.2.2, "Weathering Probability Map":
      b. Severe and Moderate: Class 5S.
      c. Negligible: Class 2N.
   3. Maximum Coarse-Aggregate Size: 3/8 inch nominal. Maximum size shall also not be larger than 1/4 of the narrowest dimension between forms, 1/3 the depth of slab nor more than 3/4 of the minimum clear spacing between individual reinforcing bars.
      a. Gradation: Uniformly graded.
      b. Source: Reliance, San Gabriel, or Carrol Canyon

D. Normal-Weight Fine Aggregate: ASTM C 33 or ASTM C 144, manufactured or natural sand, from same source for Project, free of materials with deleterious reactivity to alkali in cement and free of materials which may cause staining and light in color
   1. Source: Reliance, Fosters or Corona.
   2. Color to be white to light with no dark material.

E. Water: Potable, complying with ASTM C 94/C 94M except free of wash water from mixer washout operations.

2.4 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. 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. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

C. Shrinkage-Reducing Admixture: Commercially formulated, shrinkage inhibitor capable of reducing initial shrinkage by 80% and long-term shrinkage by 50%. Provide product suitable for use with either air-entrained or non-air-entrained concrete as appropriate to structural member and project location.
   1. Products: Subject to compliance with requirements, provide one of the following(as required):
      a. Euclid Chemical Company (The), an RPM company; EUCON SRA, SRA+.
      b. Grace Construction Products, W. R. Grace & Co.; Eclipse Floor, Eclipse Plus.
      c. Sika Corporation; Control 40.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz. /sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Clear, Waterborne (Non-Colored Concrete): Provide products complying with ASTM C 309, Type 1, Class B, 18 to 25 percent solids, certified by curing compound manufacturer to not interfere with bonding of sealers, with no glossy finish and compatible with specified sealer. Provide products with not more than 100g/L volatile organic content.
   1. Products: Subject to compliance with requirements.

D. Clear, Waterborne (Colored Concrete): Provide products that are acceptable to concrete color pigment manufacturer complying with ASTM C 309, Type 1, Class B, 18 to 25 percent solids, certified by curing compound manufacturer to not interfere with bonding of sealers with no glossy finish and compatible with specified sealer. Provide products with not more than 100g/L volatile organic content.
   1. Products: Subject to compliance with requirements.

E. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
   1. For integrally colored concrete, curing compound shall be approved by color pigment manufacturer.
   2. For concrete indicated to be sealed, curing compound shall be compatible with sealer.

2.6 SEALERS AND WATER REPELLENTS

A. Penetrating Liquid Floor and Horizontal Surface Treatment (Sealer): Clear, chemically reactive, water-based lithium quartz water-based lithium materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces. Materials shall be compatible with concrete admixtures and shall be recommended by manufacturer for intended use. Provide products with 0g/L volatile organic content.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Sinak Corporation; Concrete Sealer HLQ 125.

2.7 JOINT DEVICES, FILLER MATERIALS AND OTHER ACCESSORY PRODUCTS

A. Joint Filler at Exterior Sealed Joints: ASTM D 1751
   1. Lightweight, nonstaining, polyethylene closed cell expansion joint filler
      a. Deck-O-Foam as manufactured by W.R.Meadows, Hampshire, Ill.
   2. Exterior Expansion- and Isolation-Joint-Filler Strips: See Division 32 Section "Concrete Paving Joint Sealants" for sealants for exterior joints at concrete pavements.

2.8 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of cast-in-place architectural site concrete proportioned on basis of laboratory trial mixture or field test data, or both, according to ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed design mixtures based on laboratory trial mixtures.
   2. Proportioning:
      a. The proportioning of ingredients shall be such that the concrete can be readily worked into forms and around reinforcement under the conditions of placement to be used, without segregation or excessive bleeding.
      b. When proportioning by weight of loose, dry material, 94 pounds of cement shall be considered 1 cubic foot.
      c. Fine aggregate volume shall be at least 35 percent, with a maximum of 50 percent, of the sum of the separate fine and coarse aggregate volumes.
      d. Total water content shall not exceed 35 gallons per cubic yard of concrete.
      e. Weighing equipment shall be accurate within 1 pound and shall be adjustable for varying aggregate moisture content.
      f. A beam auxiliary shall register any part of the last 100 pounds of each aggregate. The aggregate hopper shall have a volume adjustment.
   3. Prepare compressive strength data for both 7-day and 28-day strengths.
      a. The 7-day compressive strength shall be at least 60 percent of the required 28- day strength.
      b. The 28-day compressive strength shall be as indicated.
   4. Provide drying shrinkage test data at 28 days, from not less than 3 test specimens.

B. Proportion concrete mixtures as follows:
   1. Minimum Compressive Strength (28 Days): 3000 psi.

a. Provide the following minimum compressive strength (28 days) where required by high-pressure water or bush hammer finishing techniques: 4500 psi.
2. Maximum Water-Cementitious Materials Ratio: 0.50-0.60.
3. Slump Limit: 4 inches, plus or minus 1 inch, unless indicated otherwise.
4. Slump Limit (High-Range Water-reducing Admixture): 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture, plus or minus 1 inch, unless indicated otherwise.
5. Slump Limit (Plasticizing Admixture): 8 inches for concrete with verified slump of 2 to 4 inches before adding plasticizing admixture, plus or minus 1 inch, if required/unless indicated otherwise.

C. Air Content, Exterior Exposed Concrete: Provide the following air entrainment for all exposed concrete with a weathering probability of severe or moderate per CBC figure 1904.2.2/1904A.2.2.
1. Provide air entrainment of 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size, unless indicated otherwise.
2. Provide air entrainment of 6.0 percent, plus or minus 1.5 percent at point of delivery for 1-inch and 3/4-inchnominal maximum aggregate size, unless indicated otherwise.

D. Slump Limit: 4 inches (100 mm)] for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture], plus or minus 1 inch (25 mm), unless otherwise indicated.

E. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement. Limit total chloride-ion content in hardened concrete to 0.10 percent by weight of concrete when tested per AASHTO T 260 potentiometric titration.
2. Limit "drying shrinkage" after 28 days of curing hardened concrete to 0.045 percent of the original concrete volume.
3. Admixtures: Admixtures may only be used if they are incorporated into the accepted concrete mix designs. Use admixtures according to manufacturer's written instructions.
a. Use [water-reducing] or] [plasticizing] admixture in concrete, as required, for placement and workability.
b. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
c. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
d. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.9 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
1. Splices: Do not splice bars, unless indicated on the Drawings.
2. Staggered Splices: Stagger splices such that not more than one-half of the reinforcing bars are spliced at any location.

2.10 CONCRETE MIXING

A. Ready-Mixed Architectural Site Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M [and ASTM C 1116/1116M] and furnish batch ticket information.
   1. Clean equipment used to mix and deliver cast-in-place architectural site concrete to prevent contamination from other concrete.
   2. When air temperature is between 85 and 90 deg. F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg. F, reduce mixing and delivery time to 60 minutes.
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. General: Comply with the following, unless otherwise indicated:
   1. Conform to ACI 318, ACI 347 and CBC Section 1906.
   2. Conform to ACI 318, ACI 347 and CBC Section 1906A.

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

C. Geometry: Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117. Provide for necessary openings, inserts, anchorages, and other features indicated or required. Properly locate all elements.
   1. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
      a. Class A, 1/16 or 1/8 inch for smooth-formed finished surfaces.
      b. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.

D. Form Joints: Minimize form joints and make forms watertight to prevent leakage of concrete mortar. Locate form joints at exposed concrete symmetrically about center of panel and aligned with reveals, unless otherwise indicated. Align joints symmetrically at exposed conditions.
   1. Seal penetrations at form ties with form joint sealant to prevent cement paste leakage.
   2. Provide custom form boards as required to align with reveals.

E. Removal: Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where dismantling or stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Chamfers: Chamfered edges are not allowed.

3.2 EARTH FORMS

A. General: Unless indicated, placement of concrete directly against soil or earth (casting "neat") shall not be permitted only with the prior approval of the Structural Engineer of Record. Concrete placed directly against earth shall require a minimum increase in concrete thickness of 1" at vertical faces. For example, footings shall be 2" wider than indicated if both vertical faces are cast against earth.

B. Trimming and Cleaning: Hand trim sides and bottoms of soil forms and trenches. Remove loose soil, exposing undisturbed native soil, and prior to placing concrete.

3.3 CONSTRUCTED FORMWORK

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

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

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

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

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

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

G. Provide bracing and shores to ensure stability of formwork and accommodate all loads. Use form ties of sufficient strength and in sufficient quantities to prevent formwork spreading. Maintain principal shores to support concrete until required strength is achieved.

3.4 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install embedded accessories level, true-to-line and plumb in accordance with manufacturer's instructions.

2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
3. Provide reveals around embedded items such as light fixtures as shown on Drawings.

3.5 OPENINGS, DEPRESSIONS, RECESSES AND CHASES

A. Size and locate formed openings, depressions, recesses and chases to accommodate products to be applied to, built-into and/or pass-through concrete Work. Coordinate size, location and placement of inserts, embedded products, openings and recesses with Work of other sections. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.6 FORM RELEASE AGENTS

A. General: Provide either form materials with factory-applied non-absorptive liner or field-applied form coating. Field-applied coating shall be non-staining.
   1. Non-absorptive Liner: Rust on steel form surfaces is not acceptable.
   2. Field Applied Coating: Comply with manufacturer's written instructions. Obtain written acceptance of form release agent from integral colored concrete pigment manufacturer.
      a. Reapply coating to thoroughly cleaned and reconditioned formwork before each use.
      b. Verify compatibility of release agents with integrally-colored concrete and all subsequently applied curing compounds, coatings, applied finishes, etc. Do not apply release agent if items are non-compatible.
      c. Do not apply release agent where decorative wood graining is intended for concrete surface. Leave form face dry.

3.7 CONCRETE SURFACE RETARDERS

A. Coat contact surfaces of forms with surface retarder, according to manufacturer's written instructions, before placing reinforcement.

3.8 FORM LINERS

A. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and attach securely to prevent deflection and maintain stability of liners during concreting. Prevent form liners from sagging and stretching in hot weather. Seal joints of form liners and form liner accessories to prevent mortar leaks. Coat form liner with form-release agent.

3.9 REMOVING AND REUSING FORMS

A. General: Formwork for sides of walls, steps, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg. F for 72 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
   1. Schedule form removal to maintain surface appearance that matches accepted mockups.

2. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved its 28-day design compressive strength, but not less than 21 days after pour.
3. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
4. All formwork is to be new specifically purchased for this project.

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

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

3.10 STEEL REINFORCEMENT

A. General: Place and secure reinforcement as indicated. Comply with CRSI publications "Manual of Standard Practice" and "Placing Reinforcing Bars".
1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
2. Do not bend bars more than once.
3. Do not bend or straighten reinforcement in a manner injurious to the material, such as heating.
4. Do not use bars with kinks or bends not indicated.
5. Do not use bars with reduced cross-section due to corrosion or other cause.
6. Remove and replace all defective bars.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Space reinforcement as indicated. If not indicated, maintain clear spacing of not less than the bar diameter, 1-inch, or 1-1/3 times the maximum aggregate size, whichever is greater. Where parallel reinforcing is placed in more than one horizontal layer, place as many bars as possible in the outboard layer, maintaining the required lateral clearances and spacing's. Place bars in the inboard layer in direct vertical alignment with the bars of the outboard layer. Maintain not less than 1-inch or the maximum bar diameter in the inboard/outboard layers, whichever is greater, clear space between vertically stacked bars.

D. Accurately position, support, and secure reinforcement against displacement.
1. Maintain reinforcing steel positions during placement operations. Properly reset any reinforcement that is displaced by runways, workmen and other causes.

E. Locate and support reinforcement with bar supports to maintain minimum concrete cover as indicated or as required by ACI 318.

F. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

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

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

3.11 JOINTS

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

B. Construction or Cold Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Locate horizontal joints in walls and columns as indicated.
   3. Space vertical joints in walls as indicated and as may be directed by the Architect. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
   4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   6. Align joints with reveals indicated. Provide custom cut form boards as required.
   7. Do not place expansion material at cold joints.

C. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, walls and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
   2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
   3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.12 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, form-release agent, surface retarders, reinforcement, and embedded items is complete and that required inspections have been performed.
   1. Provide protective coatings, coverings and masking’s to protect adjacent Work.

2. Provide temporary runways and other appropriate equipment as necessary to access Work area and to avoid soiling or damage to existing Work.
3. Prevent run-off of concrete hydration water and water polluted by agents and chemicals from soiling existing surfaces or contaminating landscape areas.

B. Do not add water to concrete during delivery, at Project site, or during placement.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
2. If indicated in mix design accepted by the Architect, water added to concrete shall be observed by the Project Inspector, and shall be recorded on the delivery ticket.

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

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. Deposit concrete continuously between construction joints. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. No visible cold joints or lift lines are acceptable in the completed work.
3. Consolidate placed concrete with mechanical vibrating equipment according to ACI 303.1.
4. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. Do not permit vibrators to contact forms. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
5. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
6. Maintain reinforcement in position on chairs during concrete placement.
7. Screed slab surfaces with a straightedge and strike off to correct elevations.
8. Slope surfaces uniformly to drains where required.
9. Begin initial floating using bull floats or derbies to form a uniform and open-textured surface plane, before excess bleed water appears on the surface.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg. F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents.

4. Do not use chemical accelerators unless otherwise specified and accepted in design mixtures.

F. Hot-Weather Placement: Comply with ACI 305R and as follows:
1. Maintain concrete temperature below 90 deg. F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.13 FINISHES, GENERAL

A. Architectural Site Concrete Finishes: Match Architect's design reference sample, identified and described as indicated, to satisfaction of Architect.

B. Architectural Site Concrete Finishes: Match accepted mockups to satisfaction of Architect.

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

D. Maintain uniformity of special finishes over construction joints unless otherwise indicated.

3.14 AS-CAST FORMED FINISHES

A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Remove fins and other projections exceeding specified limits on formed-surface irregularities. Repair and patch tie holes and defects to match the accepted mockups. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections exceeding specified limits on formed-surface irregularities.

B. Smooth-Formed Finish is the general finish required for all formed integral-colored concrete, unless otherwise indicated. Rubbed finishes are unacceptable.

3.15 EXPOSED-AGGREGATE FINISHES

A. Retarder Finish: Remove formwork without damaging edges or reveals.
1. Ensure finish is even and no honeycombing or discoloration is apparent
2. Edges shall net be chipped or spalled

3.16 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 305R for hot-

weather protection during curing.

B. Begin curing cast-in-place architectural site concrete immediately after removing forms from concrete or after applying as-cast formed finishes to concrete, consistent with mockup preparation. Cure according to ACI 308.1, by one or a combination of the following methods that will not mottle, discolor, or stain concrete:
   1. Moisture Curing: Keep exposed surfaces of cast-in-place architectural site concrete continuously moist for no fewer 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 no fewer than seven days. Immediately repair any holes or tears during curing period; use cover material and waterproof tape.
   3. Curing Compound: Mist concrete surfaces with water. Apply curing compound 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.

3.17 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with the CBC and ACI 301.
   1. Comply with the requirements of Division 01 Section "Quality Control".
   2. Comply with the requirements of Division 01 Section "Quality Control-DSA".

B. Inspections:
   1. Steel reinforcement placement.
   2. Steel reinforcement welding.
   3. Headed bolts and studs.
   4. Verification of use of required design mixture.
   5. Structural concrete placement, including conveying and depositing.
   6. Curing procedures and maintenance of curing temperature.
   7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg. F and below and when 90 deg. F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M.
   a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
   b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
   a. Test one set of two field-cured specimens at 7 days and reserve one set of two specimens for testing at 56 days.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

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

3.18 DEFECTIVE CONCRETE

A. The following list includes, but is not limited to; concrete that will be deemed to be defective and non-conforming. All such concrete shall be removed and replaced with Work complying with the requirements of the Contract:
   1. Concrete not formed as indicated, not true to alignment indicated, not plumb where intended, not level where intended, not true to level or elevation intended.
   2. Concrete voided or honeycombed, including voids and honeycombs that have been cut, resurfaced or filled without prior approval of the Architect.
   3. Concrete with exposed reinforcement.
   4. Concrete with inadequate cover over reinforcement.
   5. Concrete with embedded foreign objects and debris, including sawdust, wood or metal shavings, nails, cans, trash, etc.
   6. Concrete that does not visually match the accepted mockups [or the designated design reference sample].
   7. Other non-conforming work.

B. All concrete deemed to be defective by the Architect or in non-conformance with the contract documents is to be removed and replaced from expansion joint or cold joint to expansion joint or cold joint at no cost to the owner. Repair defective concrete as directed by the Architect, at no cost to the Owner.

3.19 SEALERS AND REPELLENTS

A. General: Uniformly apply a continuous sealing coat of sealers or repellents to all exposed surfaces of architectural site concrete by power spray or roller according to manufacturer's written instructions.
   1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
   2. Do not apply to concrete that is less than 28 days old.

B. Penetrating Liquid Floor and Horizontal Surface Treatment (Sealer): Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
   1. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

C. Penetrating Liquid Wall and Vertical Surface Treatment (Sealer/Repellent): Prepare, apply, and finish penetrating liquid repellent treatment according to manufacturer's written instructions.

3.20 **ANTI-GRAFFITI COATING**

A. Refer to Section 099620 Permanante Non-Sacrificial Anti-Graffiti Coating.

B. Apply to all exposed architectual site concrete.

C. Apply compatilble sealer to exposed architectural site concrete prior to installation of Anti-Graffiti coating.

3.21 REPAIRS, PROTECTION, AND CLEANING

A. Patching or sacking of damaged or defective concrete as a determined by the Architect is not permitted. Remove and replace all damaged or defective concrete from joint to joint. Remove/Repair and cure damaged or defective finished surfaces of cast-in-place architectural site concrete when accepted by Architect. Match repairs to color, texture, and for any replaced work/uniformity of surrounding surfaces and to repairs on approved mockups.

B. Remove and replace cast-in-place architectural site concrete that does not match mockups accepted by Architect.

C. Protect corners, edges, and surfaces of cast-in-place architectural site concrete from damage; use guards and barricades.

D. Protect cast-in-place architectural site concrete from staining, laitance, and contamination during remainder of construction period.

E. Clean cast-in-place architectural site concrete surfaces after finish treatment to remove stains, markings, dust, and debris.

F. Wash and rinse surfaces according to concrete finish applicator's written instructions. Protect other Work from staining or damage due to cleaning operations.
   1. Do not use cleaning materials or processes that could change the appearance of cast-in-place architectural site concrete finishes.

END OF SECTION

SECTION 328400 - LANDSCAPE IRRIGATION

PART 1 GENERAL

1.1 SUMMARY

A. It is the intent of the specifications and drawings that the finished system is complete in every respect and shall be ready for operation satisfactory to the City.

B. The work shall include all materials, labor, services, transportation, and equipment necessary to perform the work as indicated on the drawings, in these specifications, and as necessary to complete the contract.

1.2 CONSTRUCTION DRAWINGS

A. All offsets, fittings, sleeves, etc. which may be required are not shown on the drawings. The Contractor shall carefully investigate the structural and finished conditions affecting the work and plan the work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.

B. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications. When an item is shown on the plans but not shown on the specifications or vice versa, it shall be deemed to be as shown on both. The Landscape Architect shall have final authority for clarification.

C. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the Landscape Architect as soon as detected. In the event this notification is not performed, the Irrigation Contractor shall assume full responsibility for any revision necessary.

1.3 QUALITY ASSURANCE

A. Provide at least one English speaking person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the manufacturer's recommended methods of installation and who shall direct all work performed under this section.

B. Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturer of articles used in this contract furnish directions covering points not shown in the drawings and specifications.

C. All local, municipal, and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications

shall not be construed to conflict with any of the above rules and regulations of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.

D. All materials supplied for this project shall be new and free from any defects. All defective materials shall be replaced immediately at no additional cost to City.

E. Secure the required licenses and permits including payments of charges and fees, give required notices to public authorities and verify permits secured or arrangements made by others affecting the work of this section.

1.4 SUBMITTALS

A. Water Pressure Test
   1. After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, submit to the City a written verification of the existing water pressure on the project at each of the points of connection shown.
   2. The water pressure test shall be performed to measure the dynamic water pressure at the point of connection at the maximum flow rate of the proposed irrigation system as shown on the point of connection note. Dynamic water pressure is when water is flowing through the point of connection. Static water pressure readings when water is not flowing, are not acceptable.
   3. Written dynamic water pressure test confirmation shall be made on the contractor's letterhead and include the flow rate during the test, the recorded water pressure, the date of the test and the time of the test.

B. Material List:
   1. After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, submit to the City a complete list of all irrigation system materials, or processes proposed to be furnished and installed as part of this contract.
   2. The submittal materials list shall include the following information:
      a. A title sheet with the job name, the contractor's name, contractor's address and telephone number, submittal date and submittal number.
      b. An index sheet showing the item number (e.g. 1,2,3, etc.); an item description (e.g. sprinkler head); the manufacturer's name (e.g. Hunter Industries); the item model number (e.g. I-40-ADV/36V); and the page(s) in the submittal set that contain the catalog cuts.
      c. The catalog cuts shall be one or two pages copied from the most recent manufacturer's catalog that indicate the product submitted. Do not submit parts lists, exploded diagrams, price lists or other extra information.
      d. The catalog cuts shall clearly indicate the manufacturer's name and the item model number. The item model number, all specified options and specified sizes shall be circled on the catalog cuts.

e. Submittals for equipment indicated on the legend without manufacturer names, or "as approved", shall contain the manufacturer, Class or Schedule, ASTM numbers and/or other certifications as indicated in these specifications.

3. Submittal materials list format requirements:
   a. Submittals shall be provided as one complete package for the project in electronic pdf format. Multiple partial submittals will not be reviewed.
   b. Submittal package shall have all pages numbered in the lower right hand corner. Page numbers shall correspond with submittal index.
   c. Re-submitted packages must be revised to include only the equipment being re-submitted. Equipment previously reviewed and accepted shall not be re-submitted in the materials list/index sheet or in the catalog cut sheet package.

C. Substitutions: If the Irrigation Contractor wishes to substitute any equipment or materials for those equipment or materials listed on the irrigation drawings and specifications, he may do so by providing the following information to the Landscape Architect or City's authorized representative for approval.
   1. Provide a written statement indicating the reason for making the substitution.
   2. Provide catalog cut sheets, technical data, and performance information for each substitute item.
   3. Provide in writing the difference in installed price if the item is accepted.

D. The Landscape Architect or City's authorized representative will allow no substitutions without prior written acceptance

E. No substitutions of pump manufacturers, distributors or assemblies will be accepted.

F. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.

G. The Landscape Architect or City's authorized representative will not review the submittal package unless provided in the format described above.

1.5 EXISTING CONDITIONS

A. Verify and be familiar with the locations, size, and detail of points of connection provided as the source of water, and electrical supply connection to the irrigation system.

B. Irrigation design is based on the available static water pressure shown on the drawings. Contractor shall verify static water on the project prior to the start of construction. Should a discrepancy exist, notify the Landscape Architect and City's authorized representative prior to beginning construction.

C. Prior to cutting into the soil, locate all cables, conduits, sewer septic tanks, and other utilities as are commonly encountered underground, and take proper precautions not to damage or disturb such improvements. If a conflict exists between such obstacles and the proposed work, the Contractor shall promptly notify the Landscape Architect and City who will arrange for relocations. The Contractor will proceed in the same manner if a rock layer or any other such

conditions are encountered.

D. Protect all existing utilities and features to remain on and adjacent to the project site during construction. Repair, at its own cost, all damage resulting from his operations or negligence.

E. The Irrigation Contractor shall coordinate with the General Contractor for installation of required sleeving as shown on the plans prior to paving operations.

F. Verify and be familiar with the existing irrigation systems in areas adjacent to and within the Project area of work.

G. Protect all existing irrigation systems, in areas adjacent to and within the project area of work, from damage due to his operations.

H. Notify City's Representative if any existing system is temporarily shut off, capped or modified. Provide 48-hour notice, prior to turning off or modifying any existing irrigation system.

I. Repair or replace all existing irrigation systems, in areas adjacent to and within the project area of work, damaged by the construction of this project. Adjacent irrigation systems shall be made completely operational and provide complete coverage of the existing landscaped areas. All repairs shall be complete to the satisfaction of the City's Representative.

J. Provide bore holes under any existing pavement or paving encountered for the required lateral, mainline and low voltage control wire sleeving. Bore holes under 2 inches in diameter and smaller shall be made with a BulletMole® underground boring tool as manufactured by Dimension Tools, LLC (Contact telephone number (888)-650-5554 or at www.bulletmole.com). Bore holes larger than 2 inches in diameter shall be made with an approved mechanical boring tool. No air jacking or hydraulic boring of any kind shall be allowed.

1.6 INSPECTIONS

A. The Contractor shall permit the Landscape Architect and City's authorized representative to visit and inspect at all times any part of the work and shall provide safe access for such visits.

B. Where the specifications require work to be tested by the Contractor, it shall not be covered over until accepted by the Landscape Architect, City's authorized representative, and/or governing agencies. The Contractor shall be solely responsible for notifying the Landscape Architect, City, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing. Should any work be covered without testing or acceptance, it shall be, if so ordered, uncovered at the Contractor's expense.

C. Inspections will be required for the following at a minimum:
   1. Pre-construction meeting.
   2. System layout.
   3. Pressure test of irrigation mainline (Four hours at 125 PSI or 120% of static water pressure, whichever is greater.) Mainline pressure loss during test shall not exceed 2 PSI.
   4. Coverage test of irrigation system. Test shall be performed prior to any planting.

5. Final inspection prior to start of maintenance period.
6. Final acceptance prior to turnover.

D. Site observations and testing will not commence without the field record drawings as prepared by the Irrigation Contractor. Record drawings must be complete and up to date for each site visit.

E. Work that fails testing and is not accepted will be retested. Hourly rates and expenses of the Landscape Architect, City's authorized representative, and governing agencies for re-inspection or retesting will be paid by the Irrigation Contractor at no additional expense to City.

1.7 STORAGE AND HANDLING

A. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installation work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Landscape Architect and City and at no additional cost to the City.

B. Exercise care in handling, loading, unloading, and storing plastic pipe and fittings under cover until ready to install. Transport plastic pipe only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load.

1.8 CLEANUP AND DISPOSAL

A. Dispose of waste, trash, and debris in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction. Bury no such waste material and debris on the site. Burning of trash and debris will not be permitted. Remove and dispose of rubbish and debris at frequent intervals or when ordered to do so by the City's authorized representative.

B. At the time of completion the entire site will be cleared of tools, equipment, rubbish and debris which shall be disposed of off-site in a legal disposal area.

1.9 TURNOVER ITEMS

A. Record Drawings:
1. Record accurately on one set of drawings all changes in the work constituting departures from the original contract drawings and the actual final installed locations of all required components as shown below.
2. The record drawings shall be prepared to the satisfaction of the City. Prior to final inspection of work, submit record drawings to the Landscape Architect or City's authorized representative.
3. All record drawings shall be prepared using AutoCAD 2022 drafting software and the original irrigation drawings as a base. No manual drafted record drawings shall be acceptable. The Contractor may obtain digital base files from the Landscape Architect or City's authorized representative.
4. If the Contractor is unable to provide the AutoCAD drafting necessary for the record drawings the irrigation designer does provide record drawing drafting as a separate service.

5. Prior to final inspection of work, submit record drawings plotted onto vellum sheets for review by the Landscape Architect or City's authorized representative. After acceptance by the Landscape Architect, City Inspector or City's authorized representative re-plot the record drawings onto reproducible Mylar sheets. The Contractor shall also provide record drawing information on a digital AutoCAD Release 2022 drawing file. All digital files shall be provided on a compact disc (CD) clearly marked with the project name, file descriptions and date.
    a. Record drawing information and dimensions shall be collected on a day-to-day basis during the installation of the pressure mainline to fully indicate all routing locations and pipe depths. Locations for all other irrigation equipment shall be collected prior to the final inspection of the work.
    b. Two dimensions from two permanent points of reference such as buildings, sidewalks, curbs, streetlights, hydrants, etc. shall be shown for each piece of irrigation equipment shown below. Where multiple components are installed with no reasonable reference point between the components, dimensioning may be made to the irrigation equipment. All irrigation symbols shall be clearly shown matching the irrigation legend for the drawings. All lettering on the record drawings shall be minimum 1/8 inch in size.
6. Show locations and depths of the following items:
    a. Point of connection (including water POC, backflow devices, master control valves, flow sensors, etc.)
    b. Routing of sprinkler pressure main lines (dimensions shown at a maximum of 100 feet along routing)
    c. Isolation valves
    d. Automatic remote control valves (indicate station number and size)
    e. Quick coupling valves
    f. Drip air relief and flush valves
    g. Routing of control wires where separate from irrigation mainline
    h. Irrigation controllers (indicate controller number and station count)
    i. Related equipment (as may be directed)

B. Controller Charts:
1. Provide one controller chart for each automatic controller. Chart shall show the area covered by the particular controller. The areas covered by the individual control valves shall be indicated using colored highlighter pens. A minimum of six individual colors shall be used for the controller chart unless less than six control valves are indicated.
2. Landscape Architect or City's authorized representative must approve record drawings before controller charts are prepared.
3. The chart is to be a reduced copy of the actual "record" drawing. In the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a readable size.
4. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils in thickness.

C. Operation and Maintenance Manuals:

1. Two individually bound copies of operation and maintenance manuals shall be delivered to the Landscape Architect or City's authorized representative at least 10 calendar days prior to final inspection. The manuals shall describe the material installed and the proper operation of the system.
2. Each complete, bound manual shall include the following information:
3. Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment including names and addresses of local manufacturer representatives.
    a. Operating and maintenance instructions for all equipment.
    b. Spare parts lists and related manufacturer information for all equipment.

D. Equipment:
1. Supply as a part of this contract the following items:
    a. Two (2) wrenches for disassembly and adjustment of each type of sprinkler head used in the irrigation system.
    b. Three 30-inch sprinkler keys for manual operation of control valves.
    c. Two keys for each automatic controller.
    d. Two quick coupler keys with a 1" bronze hose bib, bent nose type with hand wheel and two coupler lid keys.
    e. One valve box cover key or wrench.
    f. Six extra sprinkler heads of each size and type.
    g. For specified ball valves if required: One (1) 5-foot long valve handle, to fit the specified ball valves.
2. The above equipment shall be turned over to City's authorized representative at the final inspection.

1.10 COMPLETION

A. At the time of the pre-maintenance period inspection, the Landscape Architect, City's authorized representative, and governing agencies will inspect the work, and if not accepted, will prepare a list of items to be completed by the Contractor. Punch list to be checked off by contractor and submitted to Landscape Architect or City’s authorized representative prior to any follow-up meeting. This checked off list to indicate that all punch list items have been completed. At the time of the post-maintenance period or final inspection the work will be re-inspected and final acceptance will be in writing by the Landscape Architect, City's authorized representative, and governing agencies.

B. The City's authorized representative shall have final authority on all portions of the work.

C. After the system has been completed, the Contractor shall instruct City's authorized representative in the operation and maintenance of the irrigation system and shall furnish a complete set of operating and maintenance instructions.

D. Any settling of trenches which may occur during the one-year period following acceptance shall be repaired to the City's satisfaction by the Contractor without any additional expense to the City. Repairs shall include the complete restoration of all damage to planting, paving or other

improvements of any kind as a result of the work.

1.11 GUARANTEE

A. The entire sprinkler system, including all work done under this contract, shall be unconditionally guaranteed against all defects and fault of material and workmanship, including settling of backfilled areas below grade, for a period of one (1) year following the filing of the Notice of Completion.

B. Should any problem with the irrigation system be discovered within the guarantee period, it shall be corrected by the Contractor at no additional expense to City within ten (10) calendar days of receipt of written notice from City. When the nature of the repairs as determined by the City constitute an emergency (i.e. broken pressure line) the City may proceed to make repairs at the Contractor's expense. Any and all damages to existing improvement resulting either from faulty materials or workmanship, or from the necessary repairs to correct same, shall be repaired to the satisfaction of the City by the Contractor, all at no additional cost to the City.

C. Guarantee shall be submitted on Contractors own letterhead as follows:
   1. GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM
   2. We hereby guarantee that the sprinkler irrigation 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 defective material during the period of one year from date of filing of the Notice of Completion and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the City. We shall make such repairs or replacements within 10 calendar days following written notification by the City. In the event of our failure to make such repairs or replacements within the time specified after receipt of written notice from City, we authorize the City to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.
   3. PROJECT NAME:
   4. PROJECT LOCATION:
   5. CONTRACTOR NAME:
   6. ADDRESS:
   7. TELEPHONE:
   8. SIGNED:
   9. DATE:

PART 2 MATERIALS

2.1 SUMMARY

A. Use only new materials of the manufacturer, size and type shown on the drawings and specifications. Materials or equipment installed or furnished that do not meet Landscape Architect's, City's, or governing agencies standards will be rejected and shall be removed from the site at no expense to the City.

2.2 PIPE

A. Pressure supply line between the water meter and the backflow prevention device shall be type K copper, one size larger than backflow device.

B. Backflow prevention assemblies, and all other above grade assemblies, shall be constructed of threaded brass pipe and threaded brass fittings the same size as the backflow device, unless otherwise directed.

C. Pressure supply lines 2 inches in diameter and up to 3 inches in diameter downstream of backflow prevention unit shall be Class 315 solvent weld PVC. Piping shall conform to ASTM D2241.

D. Non-pressure lines 3/4 inch in diameter and larger downstream of the remote control valve shall be SCH 40 solvent weld PVC conforming to ASTM D1785.

2.3 METAL PIPE AND FITTINGS

A. Brass pipe shall be 85 percent red brass, ANSI, IPS Standard 125 pounds, Schedule 40 screwed pipe.

B. Fittings shall be medium brass, screwed 125-pound class.

C. Copper pipe and fittings shall be Type "K" sweat soldered, or brazed as indicated on the drawings.

2.4 PLASTIC PIPE AND FITTINGS

A. Pipe shall be marked continuously with manufacturer's name, nominal pipe size, schedule or class, PVC type and grade, National Sanitation Foundation approval, Commercial Standards designation, and date of extrusion.

B. All plastic pipe shall be extruded of an improved PVC virgin pipe compound in accordance with ASTM D2672, ASTM D2241 or ASTM D1785.

C. All solvent weld PVC fittings shall be standard weight Schedule 40 (and Schedule 80 where specified on the irrigation detail sheet, all mainline fittings shall be Schedule 80 PVC) and shall be injection molded of an improved virgin PVC fitting compound. Slip PVC fittings shall be the "deep socket" bracketed type. Threaded plastic fittings shall be injection molded. All tees and ells shall be side gated. All fittings shall conform to ASTM D2464 and ASTM D2466.

D. All threaded nipples shall be standard weight Schedule 80 with molded threads and shall conform to ASTM D1785.

E. All solvent cementing of plastic pipe and fittings shall be a two-step process, using primer and solvent cement applied per the manufacturer's recommendations. Cement shall be of a fluid consistency, not gel-like or ropy. Solvent cementing shall be in conformance with ASTM

D2564 and ASTM D2855.

F. When connection is plastic to metal, female adapters shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be non-lead base Teflon paste, tape, or equal.

G. All pressure mainlines installed with solvent weld PVC fittings shall be installed with concrete thrust blocking at all directional changes in the mainline routing. Concrete thrust blocking shall not be required when ductile iron fittings and mechanical restraints are specified.

2.5 BACKFLOW PREVENTION UNITS

A. The backflow prevention unit shall be of the manufacturer, size, and type indicated on the drawings.

B. The backflow prevention unit shall be installed in accordance with the requirements set forth by local codes.

C. The backflow enclosure shall be of the manufacturer, size, and type indicated on the drawings.

2.6 VALVES

A. Ball and Gate Valves:
1. Ball and gate valves shall be of the manufacturer, size, and type indicated on the drawings.
2. All ball and gate valves shall have a minimum working pressure of not less than 150 PSI and shall conform to AWWA standards.

B. Quick Coupler Valves:
1. Quick coupler valves shall be of the manufacturer, size, and type indicated on the drawings.
2. Quick coupler valves shall be brass with a wall thickness guaranteed to withstand normal working pressure of 150 psi without leakage. Valves shall have 1” female threads opening at base, with two-piece body. Valves to be operated only with a coupler key, designed for that purpose. Coupler key is inserted into valve and a positive, watertight connection shall be made between the coupler key and valve.

C. Automatic Control Valves:
1. Automatic control valves shall be of the manufacturer, size, and type indicated on the drawings.
2. Automatic control valves shall be electrically operated.
3. Provide Christy's valve ID tags for each remote control valve with valve number.

2.7 VALVE BOXES

A. Valve boxes shall be fabricated from a durable, weather-resistant plastic material resistant to sunlight and chemical action of soils.

B. The valve box cover shall be green in color and secured with a hidden latch mechanism or bolts.

C. Valve box extensions shall be by the same manufacturer as the valve box.

D. The plastic irrigation valve box cover shall be an overlapping type.

E. Automatic control valve, strainer, master valve, flow sensor, and gate valve boxes shall be 17"x11"x12" 'nominal' rectangular size. Valve boxes for drip valve assemblies shall be Jumbo valve boxes size as required to fit assemblies. Valve box covers shall be marked "RCV" with the valve identification number, or "STRAINER", "MV", "FS", "IRRIGATION GATE" "heat branded" onto the cover in 1-1/4 inch high letters / numbers.

F. Quick coupler valve boxes shall be 10" circular size. Valve box covers shall be marked with "QCV" "heat branded" onto the cover in 1-1/4 inch high letters.

2.8 AUTOMATIC CONTROLLER

A. Automatic controller shall be of the manufacturer, size, and type indicated on the drawings.

B. Controller enclosure shall be of the manufacturer, size, and type indicated on the drawings.

C. Controller shall be grounded according to local codes using equipment of the manufacturer, size, and type indicated on the drawings; or as required by local codes and ordinances.

2.9 ELECTRICAL

A. All electrical equipment shall be NEMA Type 3, waterproofed for exterior installations.

B. All electrical work shall conform to local codes and ordinances.

2.10 LOW VOLTAGE CONTROL WIRING

A. Remote control wire shall be direct-burial AWG-UF type, size as indicated on the drawings, and in no case smaller than 14 gauge.

B. Connections shall of the manufacturer, size, and type indicated on the drawings.

C. Common wires shall be white in color. Control wires shall be red (where two or more controllers are used, the control wires shall be a different color for each controller. These colors shall be noted on the "Record Drawings" plans located on controller door).

D. Ground wires shall be green in color or bare copper and in no case smaller than 6 gauge.

2.11 IRRIGATION HEADS, DRIP EMITTERS, AND INLINE DRIP TUBING

A. Irrigation heads, drip emitters, and inline drip tubing shall be of the manufacturer, size, type, with radius of throw, operating pressure, and discharge rate indicated on the drawings.

B. Irrigation heads, drip emitters, and inline drip tubing shall be used as indicated on the drawings.

2.12 DRIP IRRIGATION EQUIPMENT

A. Drip tubing equipment such as flush valves, wye strainers, and pressure regulators shall be of the manufacturer, size, and type indicated on the drawings.

2.13 MISCELLANEOUS EQUIPMENT

A. Landscape Fabric:
   1. Landscape fabric for valve box assemblies shall be 5.0- oz. weight woven polypropylene weed barrier. Landscape fabric shall have a burst strength of 225 PSI, a puncture strength of 60 lbs. and capable of water flow of 12 gallons per minute per square foot.
   2. Type: DeWitt Pro 5 Weed Barrier or approved equal.

B. Equipment such as flow sensors, rain sensors, wye strainers, and master valves shall be of the manufacturer, size and type indicated on the drawings.

PART 3 EXECUTION

3.1 SITE CONDITIONS

A. Inspections:
   1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
   2. Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.

B. Discrepancies:
   1. In the event of discrepancy, immediately notify the Landscape Architect or City's authorized representative.
   2. Do not proceed with installation in areas of discrepancy until all discrepancies have been resolved.

C. Grades:
   1. Before starting work, carefully check all grades to determine that work may safely proceed, keeping within the specified material depths with respect to finish grade.
   2. Final grades shall be accepted by the Engineer before work on this section will be allowed to begin.

D. Field Measurements:
   1. Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design. Contractor shall coordinate the installation of all irrigation materials with all other work.
   2. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions prior to proceeding with work under this section.

3. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities, which are caused by his operations or neglect.

E. Diagrammatic Intent:
1. The drawings are essentially diagrammatic. The size and location of equipment and fixtures are drawn to scale where possible. Provide offsets in piping and changes in equipment locations as necessary to conform with structures and to avoid obstructions or conflicts with other work at no additional expense to City.

F. Layout:
1. Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads, valves, backflow preventer, and automatic controller.
2. Layout irrigation system and make minor adjustments required due to differences between site and drawings. Where piping is shown on drawings under paved areas, but running parallel and adjacent to planted areas, install the piping in the planted areas.

G. Water Supply:
1. Connections to, or the installation of, the water supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to City.

H. Electrical Service:
1. Connections to the electrical supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to City.
2. Contractor shall make electrical connections to the irrigation controller. Electrical power source to controller locations shall be provided by others.
3. Contractor shall make electrical connections to the irrigation controller.

3.2 TRENCHING

A. Excavations shall be straight with vertical sides, even grade, and support pipe continuously on bottom of trench. Trenching excavation shall follow layout indicated on drawings to the depths below finished grade and as noted. Where lines occur under paved area, these dimensions shall be considered below subgrade.

B. Provide minimum cover of 18 inches on pressure supply lines 2 ½ inches and smaller.

C. Provide minimum cover of 18 inches for control wires within planters.

D. Provide minimum cover of 24 inches for control wires within sleeves below paving.

E. Provide minimum cover of 36 inches on pressure supply lines under vehicular travel ways.

F. Provide minimum cover of 12 inches for non-pressure lines.

G. Pipes installed in a common trench shall have a 4-inch minimum space between pipes.

3.3 BACKFILLING

A. Backfill material on all lines shall be the same as adjacent soil free of debris, litter, and rocks over 1/2 inches in diameter.

B. Backfill shall be tamped in 4-inch layers under the pipe and uniformly on both sides for the full width of the trench and the full length of the pipe. Backfill materials shall be sufficiently damp to permit thorough compaction, free of voids. Backfill shall be compacted to dry density equal to adjacent undisturbed soil and shall conform to adjacent grades.

C. Flooding in lieu of tamping is not allowed.

D. Under no circumstances shall truck wheels be used to compact backfill.

E. Provide sand backfill a minimum of 4 inches over and under all piping under paved areas.

3.4 PIPING

A. Piping under existing pavement may be installed by jacking, boring, or hydraulic driving. No hydraulic driving is permitted under asphalt pavement.

B. Cutting or breaking of existing pavement is not permitted.

C. Carefully inspect all pipe and fittings before installation, removing dirt, scale, burrs, and reaming. Install pipe with all markings up for visual inspection and verification.

D. Remove all dented and damaged pipe sections.

E. All lines shall have a minimum clearance of 4 inches from each other and 12 inches from lines of other trades.

F. Parallel lines shall not be installed directly over each other.

G. In solvent welding, use only the specified primer and solvent cement and make all joints in strict accordance with the manufacturer's recommended methods including wiping all excess solvent from each weld. Allow solvent welds at least 15 minutes setup time before moving or handling and 24 hours curing time before filling.

H. PVC pipe shall be installed in a manner, which will provide for expansion and contraction as recommended by the pipe manufacturer.

I. Center load all plastic pipe prior to pressure testing.

J. All threaded plastic-to-plastic connections shall be assembled using Teflon tape or Teflon paste.

K. For plastic-to-metal connections, work the metal connections first. Use a non-hardening pipe dope an all threaded plastic-to-metal connections, except where noted otherwise. All plastic-to-metal connections shall be made with plastic male adapters.

3.5 CONTROLLER

A. The exact location of the controller shall be approved by the Landscape Architect or City's authorized representative before installation. The electrical service shall be coordinated with this location.

B. The Irrigation Contractor shall be responsible for the final electrical hook up to the irrigation controller.

C. The irrigation system shall be programmed to operate during the periods of minimal use of the design area.

3.6 CONTROL WIRING

A. Low voltage control wiring shall occupy the same trench and shall be installed along the same route as the pressure supply lines whenever possible.

B. Where more than one wire is placed in a trench, the wiring shall be taped together in a bundle at intervals of 10 feet. Bundle shall be secured to the mainline with tape at intervals of 20 feet.

C. All connections shall be of an approved type and shall occur in a valve box. Provide an 18-inch service loop at each connection.

D. An expansion loop of 12 inches shall be provided at each wire connection and/or directional change, and one of 24 inches shall be provided at each remote control valve.

E. A continuous run of wire shall be used between a controller and each remote control valve. Under no circumstances shall splices be used without prior approval.

3.7 VALVES

A. Automatic control valves, quick coupler, gate, and ball valves are to be installed in the approximate locations indicated on the drawings.

B. Valve shall be installed in shrub areas whenever possible.

C. Install all valves as indicated in the detail drawings.

D. Valves to be installed in valve boxes shall be installed one valve per box.

E. Provide valve ID tags for each remote control valve with valve number.

3.8 VALVE BOXES

A. Valve boxes shall be installed in shrub areas whenever possible.

B. Each valve box shall be installed on a foundation of 3/4 inch gravel backfill, 3 cubic feet minimum. Valve boxes shall be installed with their tops 1/2 inch above the surface of

surrounding finish grade in lawn areas and 2 inches above finish grade in ground cover areas.

3.9 IRRIGATION HEADS AND DRIP EMITTERS

A. Irrigation heads and drip emitters shall be installed as indicated on the drawings.

B. Spacing of heads shall not exceed maximum indicated on the drawings.

C. Riser nipples shall be of the same size as the riser opening in the sprinkler body.

3.10 BACKFLOW PREVENTION UNITS

A. Backflow Prevention Units shall be installed as indicated on the drawings. The backflow prevention unit shall be installed in accordance with the requirements set forth by local codes.

B. The exact location of the backflow device shall be approved by the Landscape Architect or City's authorized representative before installation.

C. The contractor shall be responsible for the testing and certification of the backflow device for proper operation. Testing and certification shall be performed by a state qualified backflow tester.

3.11 MISCELLANEOUS EQUIPMENT

A. Install all assemblies specified herein according to the respective detail drawings or specifications, using best standard practices.

B. Quick coupler valves shall be set approximately 18 inches from walks, curbs, header boards, or paved areas where applicable.

C. Install devices such as rain sensor, flush valves, master valves, and flow sensors as indicated on the drawings and as recommended by the manufacturer.

3.12 FLUSHING THE SYSTEM

A. Prior to installation of irrigation heads, the valves shall be opened and a full head of water used to flush out the lines and risers.

B. Irrigation heads shall be installed after flushing the system has been completed.

3.13 ADJUSTING THE SYSTEM

A. Contractor shall adjust valves, align heads, and check the coverage of each system prior to coverage test.

B. If it is determined by the Landscape Architect or City's authorized representative that additional adjustments or nozzle changes will be required to provide proper coverage, all necessary changes or adjustments shall be made prior to any planting.

C. The entire system shall be operating properly before any planting operations commence.

D. Automatic control valves are to be adjusted so that the irrigation heads, drip emitters and inline drip tubing operate at the pressure recommended by the manufacturer.

3.14 TESTING AND OBSERVATION

A. Do not allow or cause any of the work of this section to be covered up or enclosed until it has been observed, tested and accepted by the Landscape Architect, City, and governing agencies.

B. The Contractor shall be solely responsible for notifying the Landscape Architect, City, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing.

C. When the sprinkler system is completed, the Contractor shall perform a coverage test of each system in its entirety to determine if the water coverage for the planted areas is complete and adequate in the presence of the Landscape Architect.

D. The Contractor shall furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from the plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate, without bringing this to the attention of the Landscape Architect. This test shall be accepted by the Landscape Architect and accomplished before starting any planting.

E. Areas to be maintained for the formal maintenance period shall start maintenance at the same time, as directed by the Landscape Architect, City, and governing agencies. Partial areas will not be released into maintenance prior to completion of items listed in the pre-maintenance review. The maintenance period may not be phased.

F. If, after the maintenance review, the irrigation systems are not accepted by the Landscape Architect, the contractor shall reimburse the Architect for additional site visits, or additional time required to review work. All additional time will be billed at the Architect’s hourly rate and will be paid for by the contractor at no additional cost to the City.

G. Final inspection will not commence without record drawings as prepared by the Irrigation Contractor.

3.15 MAINTENANCE

A. During the maintenance period the Contractor shall adjust and maintain the irrigation system in a fully operational condition providing complete irrigation coverage to all intended plantings.

3.16 COMPLETION CLEANING

A. Clean up shall be made as each portion of the work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be swept, and any damage sustained on the work of others shall be repaired to original conditions.

END OF SECTION

SECTION 329119 - LANDSCAPE GRADING

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Weeding.

B. Finish grading for planting areas.

1.2 RELATED REQUIREMENTS

A. Division 31 Section Site Clearing

B. Division 31 Section Earthwork

C. Division 32 Section Decomposed Granite Surfacing

D. Division 32 Section: Landscape Work

1.3 DEFINITIONS

A. Finish Grading: finish grading shall consist of adjusting and finishing soil surfaces with site or imported topsoil, raking grades to a smooth, even, uniform plane. Remove and legally dispose of all extraneous matter off site. Facilitate natural run-off water and establish grades and drainage indicated as part of the contract work.

B. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 3/4-inches (19 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

C. Finish Grading: Finish grading shall consist of finishing surfaces by raking smoothly and evenly to facilitate natural run-off water, and by removing and disposing of extraneous matter.

D. Sub-grade: The surfaces upon which additional specified materials are to be placed, prepared, or constructed.

E. Rough Grade: The establishment of grades to required tolerances.

F. Finish Grade: Spot elevations (grades) are indicated based on the best available data. Contract Civil Drawings are referenced to provide additional site grading information. It is intended that constant slopes are maintained between spot elevations.

G. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 EXISTING UTILITIES

A. Stake and mark the location of existing utilities before commencing work.

B. Retain and protect in operating condition all active utilities traversing the site designated to remain.

1.6 QUALITY ASSURANCE

A. Finish grade shall conform to contours, grades, lines, and shapes, as indicated on Contract 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 no ridges or water pockets.

C. Finish landscape grade tolerance shall be 0.04-feet plus-or-minus from finish elevations indicated on site drawings.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS:

A. Topsoil: A natural, fertile, friable soil, free from stones, roots, clods larger than 1" in diameter, noxious seeds, weeds, subsoil, undesirable insects, plant disease or any other natural objects detrimental to normal plant growth.
   1. Silt plus clay content of the import soil shall not exceed 20% by weight with a minimum 95% passing 2.0-millimeter sieve.
   2. Total pore space content on a volume/volume basis shall be at least 15 percent at field capacity.
   3. Permeability rate shall be not less than one inch per hour or more than 20 inches per hour.
   4. The sodium absorption ratio (SAR) shall not exceed 6 and the electrical conductivity (ECE) shall not exceed 2.0 milliohms per centimeter at 25 degrees centigrade.
   5. Soluble boron shall be no greater than 1.0 part per million (mg/l).
   6. Soil pH range shall be 6.0 - 7.9.
   7. Maximum concentration of soluble chloride shall be 150 parts per million.
   8. Maximum concentration of heavy metals shall not exceed the following when the pH is between 6 and 7:
      a. Arsenic: 1 ppm
      b. Cadmium: 1 ppm
      c. Chromium: 5 ppm

d. Cobalt: 1 ppm
e. Lead: 15 ppm
f. Mercury: 0.5 ppm
g. Nickel: 2.5 ppm
h. Selenium: 1.5 ppm
i. Silver: 0.25 ppm
j. Vanadium: 1.5 ppm

9. Petroleum hydrocarbons shall not exceed 100 mg/kg dry soil.
10. Aromatic volatile organic hydrocarbons shall not exceed 2 mg/kg dry soil.

B. Obtain imported topsoil from approved local sources.

C. All topsoil to be used for planting, regardless of whether import or on-site in origin, shall be tested as described in Part 3 of Section 329300.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Verification of conditions: Prior to commencing the finish grading, review the installed work of other trades and verify that their work is complete.
1. Rough Grading: Grading in planting areas (except raised planter areas) shall be established to within plus or minus 0.10 foot prior to beginning of finish grading.

B. Import topsoil only when necessary to supplement site soil to achieve grades shown on Drawings, or if site soil is unsuitable for planting.

3.2 PREPARATION:

A. Weeding: Before finish grading, weeds and grasses shall be dug out by the root or sprayed with an herbicide and disposed of off-site. This procedure is outlined in Section 329300-Landscape Work.

B. Remove debris, roots, branches, weeds, stones, in excess of 1/2-inch (13 mm) in size and clumps of earth that do not break up. Before and during finish grading, remove weeds and grasses, including roots, and dispose off-site.

C. Remove soil contaminated with petroleum products and legally dispose off-site.

3.3 INSTALLATION:

A. General: When rough grading and weeding have been completed, and the soil has dried sufficiently to be readily worked, lawn and planting areas shall be graded to the elevations indicated on the Drawings.
1. Grades indicated on Drawing are grades that will result after thorough settlement and compaction of the soil.

2. Grades not otherwise indicated shall be uniform finish grades and, if required, shall be made at the direction of the Architect.
3. Finish grades shall be smooth, even, and a uniform plane with no abrupt change of surfaces.
4. Soil areas adjacent to buildings shall slope away from the building to allow a natural run-off of water, and surface drainage shall be directed as indicated on the drawings by remodeling surfaces to facilitate the runoff water at 2% minimum grade.
5. Low spots and pockets shall be graded to drain properly.

B. Drainage: Finish grade with proper slope to drains.
1. Flow lines, designated or not, shall be graded and maintained to allow free flow of surface water.
2. If any drainage problems arise during construction period due to Contractor's work (such as, but not limited to, low spots, slides, gullies and general erosion), the Contractor shall be responsible for repairing these areas to a condition equal to their original condition, and in so doing shall prevent further drainage problems from occurring.

C. Prior to placing backfill, remove rock, aggregate base, concrete, and deleterious materials to a depth of 18 inches below soil grade in planter areas. Cross-rip subsoil of friable soil to a depth of 12-inches.
1. Place a minimum of [15-inches] of topsoil backfill in planters.
2. Refer to Section 329300 “Landscape Work” for soil materials.

D. Toe of slope: To prevent soil creep or erosion across pavement, where pavement (walk, curb, etc.) is at the toe of a slope, finish grade is to level out or swale slightly at least 12-inches before reaching pavement.

E. Moisture Content: The soil shall not be worked when the moisture content is so great that excessive compaction occurs, nor when it is so dry that dust may form in the air or that clods do not break readily. Water may be applied, if necessary, to provide moisture content for tilling and planting operations. It is the Contractor’s responsibility to control dust that is spread as a result of grading operations.

F. Grades: The finish grade in areas to be planted with turf shall be 1-inch below grade of adjacent pavement, walks, curbs, or headers. Finish grade in shrub areas shall be 1 1/2-inches below adjacent surfaces. Exceptions may be made when drainage conditions require flush grades, as directed by the Architect.

G. Compaction: Soils in planted areas shall be loose and friable, yet firm enough that no settling occurs from normal foot traffic or irrigation.

3.4 FIELD OBSERVATION:

A. It is the Contractor's responsibility to contact the Architect 48 hours or two working days in advance of each agreed observation or conference.

B. Schedule for On-Site Reviews: at completion of finish grading and prior to any planting operations.
    1. See “Site Observation” in Part 3 of Section 329300-Landscape Work to coordinate inspections and review of work.

END OF SECTION

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SECTION 329300 - LANDSCAPE WORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Soil Prep and Fertilization.

B. Planting Operation.

C. Planting Materials.

D. Topsoil and Planter Mix.

E. Agronomic Testing.

F. Drainage Materials.

G. Jute Mesh and Erosion Control.

H. Mulching.

I. Tree stabilization.

J. Edgings.

K. Root Barriers.

1.2 RELATED REQUIREMENTS

A. Division 31 Section Site Clearing

B. Division 32 Section Finish Grading

C. Division 32 Section Landscape Irrigation

D. Division 32 Section Landscape Maintenance

E. Division 33 Section Storm Drainage Utilities

1.3 REFERENCE STANDARDS

A. American Association of Nurserymen, Inc. (AAN)
   1. American Standard for Nursery Stock, latest edition (ANSI).

1.4 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum laced as recommended by ANSI Z60.1.

C. Clump: Where three or more young trees were planted in a group and have grown together as a single tree having three or more main stems or trunks.

D. 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 type and size of exterior plant required.

E. Finish Grade: Elevation of finished surface of planting soil.

F. Sub-grade Elevations: Excavation, filling and grading required to establish elevations is shown on drawings. Coordinate all work with grading contractor in order to arrive at rough grades that will allow tolerance for topsoil in planting areas, soil amendments and ornamental mulch as required in other sections of this specification. Contractor to assume tolerance of rough grades established at ± 0.09 feet (less than 1 tenths of a foot)

G. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

H. Multi-Stem: Where three or more main stems arise from the ground from a single root crown or at a point right above the root crown.

I. Planting Soil: Native or imported topsoil; mixed with soil amendments.

J. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

K. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

L. Pruning: As designated on contract drawings. Items not specifically indicated or specified, but normally required to conform with such work, are considered part of the work.

1.5 SUBMITTALS

A. WITHIN 30 DAYS OF START OF THE ROUGH GRADING OPERATIONS:
   1. Submit a certificate indicating all plant material has been secured for the project and is available.
   2. Submit documentation that all plant material has been ordered in accordance with Article 1.6 of this section.

B. CERTIFICATION: Submit the following:
   1. Certificates of inspection as required by governmental authorities when transporting materials into the state.
   2. Bulk Materials: Submit a certificate of delivery for all material in containers or bulk.

C. TEST REPORTS: Submit the following:
   1. Agronomic Soils Laboratory Test Report(s) including required amendments and maintenance recommendations.

D. PRODUCT DATA: Submit the following:
   1. In accordance with Division 1 Section "Submittal Procedures", submit complete manufacturer descriptive literature and specifications for proprietary materials and any additional items required by the Architect. Prior to start of construction and submittals; furnish to the Architect the list of items to be submitted and reviewed.
      a. Soil Amendments (as identified in Agronomic Soils Report).
      b. Fertilizer (as identified in Agronomic Soils Report).
      c. Plant Tablets.
      d. Stakes and Guys.
      e. Tree Ties and Vine Ties.
      f. Mulch.
      g. Edging Material.
      h. Filter Fabric.
      i. Drainage Materials.
      j. Accessory Material.
      k. Other soil additives per Agronomic Soils Report.
      l. Rock mulch.
      m. Submit other data substantiating that materials comply with specified requirements. Such certificates may be tags, labels, and/or manufacturers literature. All submittals shall be reviewed and accepted by the Architect before contractor begins work.
      n. Substitution Request
         1) If any plant specified is not obtainable, submit a written substitution request to the Architect during the bidding period.
         2) Substitutions of plant material will not be permitted unless accepted in advance in accordance with the provisions of Division 1 Section "Product Requirements."
         3) The Contractor is responsible for contract growing all required plant material for to project to ensure availability in the size and requirements of the project.
         4) All substitution requests for any material must be made during the bid process. No substitution requests will be permitted after the bid process or during.
      o. With submittal of Bid Documents, submit complete list of plant materials to be provided, including unit prices for plants and for installation. Include:
         1) Quantity.

2) Size.
3) Botanical Name.
4) Plant Unit Price.
5) Installation Unit Price.

2. PLANTING SCHEDULE: Submit proposed planting schedule at least two months prior to planting any materials, indicating dates for each type of landscape work coinciding with normal seasons for such work. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. If dates need to be revised after acceptance of planting schedule, document reasons for delays and submit for acceptance.
3. Submit two photos of each tree shrub and groundcover with a person in the image to be used on the project to the architect for review. Photos are to be of the actual material tagged, secured and to be used for the project at the sourced nursery. No plants may be delivered or planted prior to approval by Architect.

1.6 QUALITY ASSURANCE

A. QUALIFICATIONS

1. Nursery Qualifications: Regularly engaged, for the preceding ten years, in the production of planting materials equivalent in species and size to those required.
   a. Stocked, and having a demonstrated ability to provide plant materials required within the constraints of the accepted construction schedule.
   b. Landscaper's Qualifications: Regularly engaged and specializing, for the preceding ten years, in the installation and maintenance of planting materials equivalent in species and size to those required.
      1) Capable of furnishing a verifiable list of not less than five projects of equivalent type successfully completed within the preceding two years.
      2) Subcontracts: Landscape work to a single firm specializing in landscape installation.
2. Pre-Installation Conference: Schedule in advance of beginning work of this section. Arrange for attendance by Owner, Architect, and landscaping subcontractor. Review intent of Contract Documents and resolve conflicts. Prepare minutes of conference and distribute to attendees within five (5) days.
3. Source Quality Control
   a. General: Comply with regulations applicable to shipping of landscape materials.
   b. Analysis and Standards: All materials shall be of standard, approved and first-grade quality and shall be in prime condition when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original unopened container bearing the manufacture's guaranteed analysis. The Contractor shall supply the Architect with a sample of all materials accompanied by analytical data from an approved laboratory source illustrating compliance of bearing the manufactures guaranteed analysis.
4. Soil-Testing Laboratory Qualifications: An 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.

5. Topsoil 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; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of topsoil.
    a. Report suitability of topsoil for plant growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.
6. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 3/4-inches (19 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
    a. Obtain topsoil only from naturally, well drained sites where topsoil occurs in a depth of not less than 4"; do not obtain from bogs or marshes. All topsoil is to be tested and analyzed by an independent laboratory before delivery to site, as indicated in Article 3.3.
7. Contractor shall provide the Architect with location of soil, crops previously planted on such soil within the last two years, and the USGS soil survey classification and name.
8. Trees, Shrubs and Plants: Provide trees, shrubs and plants of quantity, size, genus, species and variety shown and scheduled for landscape work and complying with recommendations and requirements of ANSI Z60.1-1980 "American Standard for Nursery Stock". Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free from disease, insects, insect eggs, larvae and defects such as knots, sun-scald, injuries, abrasions, overlapping surface roots, or disfigurement. Central leaders of all trees shall be intact, undamaged, with evenly spaced lateral branches.
    a. 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 (150 mm) above the ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above the ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.
9. Label all trees and shrubs with securely attached waterproof tag bearing legible designation of botanical and common name. Where formal arrangements and consecutive order of trees is shown, select stock for uniform height/spread, and label with number to assure symmetry in planting.
10. Stock Review: The Architect will review trees and shrubs at site before planting with requirements for genus, species, variety, size and quality. The Architect retains right to further review trees and shrubs 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 the work. Remove rejected vegetation immediately from project site. Contractor shall request review of such stock by the Architect by delivering notice, in writing, 72 hours in advance.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver exterior plants freshly dug.

B. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

C. Packaged Materials: Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.
   1. Protect plants from sun or drying winds. Protect and maintain plants that cannot be planted immediately upon delivery.
   2. Do not drop plant material.
   3. Do not pick up container planter material by stems or trunks.
   4. Protect from wind.
   5. Water as required.
   6. Do not prune trees and shrubs before delivery except as approved by Architect. Do not bend or bind trees or shrubs in such manner as to damage bark, break branches or destroy natural shape. Provide protective covering during delivery, and provide protection on site from traffic, pedestrians, and deleterious effects of climate while planting operations are in progress. Dropped or damaged stock will not be accepted.
   7. Deliver trees and shrubs after preparations for planting have been completed and plant immediately after approval of plant materials locations. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture. Do not remove container grown stock from containers until planting time.
      a. Do not pick up plants by stems or truck. Handle planting stock by root ball.
      b. Do not remove container - Grown stock from containers before time of planting.
      c. Water root systems of exterior plants stored onsite with a fine-mist spray.
      d. Water as often as necessary to maintain root systems in a moist condition.
   8. Plant material shall not be stored on the jobsite for more than 48 hours before planting. Contractor shall schedule nursery deliveries in sub-groups as necessary to comply with this requirement.
   9. Deliver accessory materials in manufacturer's original, unopened packaging with identifying labels affixed and legible in accordance with state law. Deliver plants with identifying tags affixed. Contractor shall notify Architect 48 hours in advance of plant material delivery for observation. Review plants with Landscape Architect to confirm that they are the plants which had previously been tagged and supplied. The Architect reserves the right to reject the following:
      a. Plant materials not identifiable as previously selected.
      b. Materials not accompanied by required certificates.
      c. Plant materials where damage to rootball, trunks, or desiccation of leaves has been caused by inadequate protection during delivery.
      d. Plant material not matching the form, shape, or growth habit required for the design intent of the Project.

e. Horticultural or visual defects in material.
f. Plant material pruned prior to delivery.
g. Plant material with detrimental pests.

1.8 PROJECT CONDITIONS

A. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required.
1. Planting Restrictions: Coordinate planting periods with maintenance periods to provide required maintenance from date of substantial completion.
a. Plant or install materials during normal planting seasons for each type of landscape work required.
2. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed without having detrimental effects on the plant material, or finished product.
3. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns unless otherwise acceptable to Architect.
a. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.
4. Contractor shall verify locations of all existing utilities, whether shown on plans or not. The Contractor shall notify members of Underground Service Alert (U.S.A.) two (2) working days in advance of performing any excavation work by calling the toll-free number 1-800-227-2600
5. After determining location of underground utilities, perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
6. When conditions detrimental to plant growth are encountered, such as rubble fill, hardpan condition, adverse drainage conditions, or obstructions, notify the Architect before planting. Remove all material deemed unsuitable for plant growth as directed by the Architect.
7. No landscape materials may be planted before an irrigation operation and coverage test is completed by the Architect.
8. No landscape materials may be planted before finish grade is reviewed by the Architect.
9. Existing Trees:
a. Prior to the beginning of any clearing, grubbing, trenching, or excavation on site, the general contractor, grading contractor, project arborist, landscape contractor, and the Architect shall meet in a pre-construction conference to discuss grading near existing trees.
b. The contractor shall protect all existing trees and shrubs scheduled to remain against injury or damage, including cutting, breaking or skinning of roots, trunks or branches. No blasting of rock shall occur in any area adjacent to existing trees without prior written consent of the Architect.
c. No trees or shrubs are to be removed, trimmed, or cut without prior approval of the Architect.

d. Prior to the beginning of the clearing and grading phase of the project, a continuous, temporary, six foot (6') high chain link fence shall be erected around the drip line of all trees scheduled to remain, unless otherwise specified by the Architect. The temporary fencing shall be erected prior to commencing any other work on the project. No construction activity shall be allowed within the limits of this fencing unless directed by the Architect. The temporary fencing shall remain in place during the entire construction period and shall not be removed until directed by the Architect.
e. Grading beneath trees to be saved shall be given special attention. Every effort shall be made to avoid creating conditions adverse to the tree's health. The natural ground within the drip lines of trees to be preserved shall remain as undisturbed as possible. Grading within the protected root zone of trees to be preserved will not be permitted unless specifically approved by the Architect prior to beginning of proposed grading.
f. If during construction or grading (grading, excavation, etc.) tree roots of 2" in diameter or greater are encountered, work shall stop immediately and a Certified Arborist, approved in advance by the Architect, shall be contracted for a root inspection. Root cutting of any roots over 2" in diameter must have prior approval from the Architect. All cuts are to be made with appropriate equipment, as to not affect the plant material.
g. Major roots one inch (1") or greater in diameter encountered within the drip line of the tree in the course of excavation or trenching shall not be cut and shall be kept moist and covered with earth as soon as possible. Shredding of roots or damaged caused by trenching or grading equipment is not permitted.
h. Roots one half inch (1/2") to one inch (1") in diameter which are severed shall be trimmed cleanly and covered with earth as soon as possible.
i. All trenching beneath the drip line of trees to remain shall be done with hand tools only. No mechanical trenching or excavation is allowed within the drip line of existing trees at any time, or where roots are encountered outside the dripline of the tree.
j. Branches interfering with construction but not designated for removal may be removed only as directed by the Architect.
k. Any pruning, cutting, or trimming of any trees will be performed by an International Society of Arboriculture Certified Arborist or certified tree worker or in accordance with the National Arborist Association and/or International Society of Arboriculture pruning standards. Cutting of 2" diameter limbs or greater or major dead wooding shall require approval of the Architect.
l. Trees or shrubs scheduled to remain and damaged by construction operations shall be repaired by the contractor in a manner acceptable to the Architect. Damaged trees and shrubs shall be repaired promptly to prevent progressive deterioration. Repair or replacement of trees and shrubs shall be at the contractor's expense as determined by the Architect. Contractor shall be held fully liable for damage caused to trees and shall be assessed fees based on the International Society of Arboriculture "Guide for Plant Appraisal", as determined by the project Arborist; fees will be assessed for: 1) any injury to the trunk, limbs, or root system, and (2) for the value of any tree requiring removal subsequent to injury or treatment that varies from these Specifications.

m. A permit from the City Arborist may be required prior to pruning or removing any trees, as required by applicable codes or ordinances.
n. Parking of vehicles, equipment or storage of materials under the drip line of existing trees shall not occur at any time.
o. Wash all existing and new trees weekly to remove dust and debris during construction.

1.9 SCHEDULING

A. Within 30 days after the commencement of initial grading, furnish documentation to the Architect that all plant material has been secured for the project and is available. Contractor shall be responsible for payments and deposits required by the grower or plant consultant to secure, maintain, and grow plant material indicated on the Contract Drawings.

1.10 WARRANTY

A. Special Warranty: Warrant all plant material in writing where installer agrees to repair or replace plantings and accessories that fail in materials, workmanship or growth within specified warranty period.
1. Failures include, but not limited to, the following:
a. Death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, abuse by owner.
b. Structural failures including plantings falling or blowing over including during high wind events.
c. Faulty operation of tree stabilization edgings tree grates.
d. Deterioration of metals, metal finishes and other materials beyond normal weathering.
e. Material not thriving.
f. Warranty periods begin from date of final completion:
1) Trees, vines, shrubs: One year.
2) Ground cover and turf: One year.
2. Warrant plant material, installed, or relocated under the contract, in writing, for a period of one year (after beginning of maintenance period) against defects including death, and unsatisfactory growth, except for defects resulting from neglect, abuse or damage by others.
3. Remove and replace trees, shrubs or other plants found to be dead, yellowing, defoliating, or in unhealthy condition, or other defective materials during warranty period at no additional cost to the Owner. Replace trees and shrubs, which in the opinion of the Architect, are in unhealthy condition at end of warranty period. The Architect shall be the sole judge as to the condition of the material. All replacement materials and installation shall comply with the drawings and specifications. Another inspection may be conducted at end of warranty period to determine acceptance or rejection.
4. Upon receipt of written notice from Owner of the loss of any warranted plant materials during the warranty period, the subject plant materials shall be promptly replaced with the same species originally planted, and of a size closely approximating the size of the plant, if normal growth had occurred since the original planting. Replacements shall be subject to

the requirements of this specification.

5. When plants are replaced, advise the Owner, in writing, of the new establishment maintenance period equal to the one year.
6. Plant material must be replaced within ten (10) days of written notification, and shall be installed in accordance with these specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design is based on the use of products manufactured by the following.
   1. Fore Sight Products, Inc., Commerce City, CO, 800-925-5360.
   2. Agrono-Tec Seed Co., Wildomar, CA, 800-543-4109.
   3. Aguiñaga Fertilizer Co., Inc., Irvine, CA, 949-786-9558.
   4. Ecology Controls, S&S Seeds, Camarillo, CA, 805-684-0436.
   5. Gail Materials, Corona, CA, 951-664-6106.
   6. KRC Rock, San Marcos, CA, 800-427-0572.
   7. Landscape Forms, represented by David Silverman & Associates, 818-541-6691.
   8. Mirafi, Inc., Charlotte, NC 800-438-1855, represented by James Heidt & Associates, Montrose, CA, 818-248-9677/800-233-0512.
   9. NDS Drainage Products, 800-726-1998.
   10. Quality Turf, Temecula, CA, 800-721-4800.
   11. Pacific Sod, Camarillo, CA, 800-762-3027.
   12. Permaloc Corporation, Holland, MI, 616-399-9600.
   13. S&S Seeds, Camarillo, CA, 805-684-0436.
   14. Soil and Plant Laboratory, Inc., Orange, CA, 714-282-8777.
   15. Southern California Organic Fertilizer Company, El Monte, CA, 714-750-3830.
   16. Southland Sod Farms, Port Hueneme, CA, 805-488-3585.
   17. Stabilizer, Inc., Phoenix, AZ, 602-952-8009/800-336-2468.
   18. V.I.T. Company, Escondido, CA, 760-480-6702.
   19. West Coast Turf, Las Vegas, NV, 800-649-8873.
   20. Whitecap, Inc., Santa Ana, CA, 714-258-3300.
   21. Whittier Fertilizer, Pico Rivera, CA, 310-699-3461.
   22. EPIC Plastics, Cerritos, CA, 562-403-3848.
   23. Wallace Labs, El Segundo, CA, 310-615-0116.
   24. Whittier Fertilizer, Pico Rivera, CA, 562-699-3461.
   25. Materials shall be the products of one manufacturer and shall be either the ones upon which the design is based, or the products of manufacturer accepted in advance. No substitutions will be permitted.

2.2 SOIL

A. TOPSOIL: Site to be rough graded to elevations shown on Civil Drawings. Topsoil will be required behind curb areas and in planting area. Provide on-site, import, or non-processed topsoil in planting areas as needed to complete rough grading which is fertile, friable, and natural loam in accordance with Article 2.3. Topsoil shall be from agricultural sources, surface

soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 3/4-inch in any dimension, and other extraneous or toxic matter harmful to plant growth.

B. All topsoil to be used for planting, regardless of whether import or on-site in origin, shall be tested as described in Part 3 of this Section.

2.3 SOIL AMENDMENTS

A. On Grade:
1. The initial application of fertilizers and amendments to be tilled into the soil during soil preparation operations shall be established after soil testing has been conducted by Contractor. An estimated quantity is indicated below for bid purposes only. This estimated quantity does not include mulching, fertilizer tablets, additional topsoil necessary to meet specified grades and fertilizer applications for after planting. After soils analysis recommendations are made to the Architect quantifying the actual amount of amendments required and recommendations have been accepted by the Architect, the Contractor shall, without delay, determine any cost impacts whether credit, no change, or addition, to the Contract Amount. As an integral part of the bid for Landscape Work, provide a Lump Sum bid amount for fertilizers and amendments as described below.
2. Application Rates (FOR BID PURPOSES ONLY):
   a. Sixty (60) lbs. of Tri-C Humate per 1,000 square feet.
   b. Nineteen (19) lbs. of 6-20-20 fertilizer per 1,000 square feet.
   c. Six (6) cubic yards of Aguiñaga GPS2, nitrogen stabilized compost per 1,000 square feet.
   d. 50-lbs Agricultural Gypsum, per 1,000 square feet.
3. Actual amendment rates and type shall be per soil test recommendations.
4. Imported Topsoil
   a. Provide natural, fertile, friable soil free from stones, noxious weeds, seeds, roots, subsoil or other material detrimental to normal plant growth. Topsoil acidity range (pH) shall be between 6.5 and 7.5 containing a minimum of 4 percent and a maximum of 25 percent organic matter.
   b. Reuse surface soil stockpiled onsite. Verify suitability of stockpiled surface soil to produce top soil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
      1) Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain top soil displaced from naturally well drained sites where topsoil occurs at least 4 inches deep; do not obtain from [agricultural land], bogs or marshes. Obtain soil from local sources acceptable to the Architect.
      2) Silt plus clay content of soil shall not exceed 15 percent by weight with a minimum 95 percent passing a 2 millimeter sieve.
   c. Obtain imported topsoil from local sources acceptable to the Architect.

d. Silt plus clay content of soil shall not exceed 15 percent by weight with a minimum 95 percent passing a 2-millimeter sieve.

5. Soil Amendments:
   a. Organic soil amendment shall be Aguinaga GPS2.
      1) Particle Size:
         (a) 90-100 percent passing 6.35 mm standard sieve.
         (b) 80-100 percent passing 4.75 mm standard sieve.
      2) Salinity: The saturation extract conductivity shall not exceed 6.5 milliohms/centimeter at 25 degrees Centigrade as determined by saturation extract method.
      3) Iron Content: Minimum 0.08 percent dilute acid soluble iron on dry weight basis.
      4) Actual organic content shall be a minimum of 280 pounds (lbs.) per cubic yard.
6. Fertilizers
   a. Tri-C Humate. Provide per manufacturers specification.
   b. Fertilizer Tablets: Fertilizer Tablets: The following is to be used in the planting of container grown material. Follow manufacturer's application rates.
      1) Best-Paks "20-10-5" fertilizer packets. Packets to be made up of a minimum of 20% Nitrogen, 10% Phosphorus, 5% Potash. Use 1 Pak per 1-gallon container, (G.C.), 3 Paks per 5 G.C., 9 Paks per 15 G.C. and 12 Paks per boxed specimen. Evenly distribute as shown in details.
   c. Commercial Fertilizer: First Quality Commercial Fertilizer, as specified in Agronomic Soils Report.
   d. Related Materials:
      1) Pre-Planting Herbicide: Phydura, or equal.
      2) Pre-Emergent Weed Control: Ronstar-G, Treflan, Eptam, Vegitex, or equal.
      3) Peat Moss: Sphagnum peat moss, Canadian or European variety, free from alkali.
      4) Soil Sulfur: First quality commercial grade.
      5) Ferrous Iron Sulfate: Chelated first quality commercial grade.
      6) Agricultural Gypsum: First quality commercial grade.
      7) Best "Ammonium Phosphate" 16-20-0 with net less than 16% total nitrogen, 20% available phosphoric acid and 0% soluble potash.
      8) Good Humus.
      9) Root Hormone: Super Thrive.

2.4 PLANT MATERIALS

A. Quality: Provide trees, shrubs, and other plants of size, form, genus, species and variety shown and scheduled for landscape work and complying with recommendations and requirements of ANSI Z60.1 "American Standard for Nursery Stock".

B. Deciduous Trees: Provide trees of height and caliper scheduled or shown and with branching configuration recommended by ANSI Z60.1 for type and species required. Provide single stem trees except where special forms are shown or listed.
   1. Lateral scaffolds shall be radially distributed around the trunk. The lateral branch shall be no more than 2/3 the diameter of the trunk. Trunk to be measured 1" above the branch (lateral scaffold).
   2. The minimum acceptable length of the most recent season's shoot growth for slow growing trees shall be not less than 8"; for fast growing trees not less than 12".
   3. The minimum acceptable height of trees is 6'-0" when planted, or as determined by Architect.
   4. Needle Leafed and Broad Leafed Evergreen Trees: Provide evergreens of sizes shown or listed. Where dimensions are shown, they indicate minimum spread for spreading and semi-spreading type evergreens and height for other types, such as globe, dwarf, cone, pyramidal, broad upright, and columnar. Provide normal quality evergreens with well-balanced form complying with requirements for other size relationships to the primary dimension shown.
      a. The minimum acceptable height of trees is 6'-0" when planted, or as determined by Architect.
   5. Multi-Trunk Trees: Provide sizes shown or listed. Tree is to have a minimum of three (3) dominant trunks with appropriate caliper size and adequate spread.
   6. Shrubs: Provide shrubs of the size shown and with not less than the minimum number of canes required by ANSI Z60.1 for type of shrub required. Provide container grown stock.
   7. Ground Cover: Provide plants established and well-rooted in removable containers, in flats, or integral peat pots and with not less than minimum number and length of runners required by ANSI Z60.1 for the size shown or listed.
   8. Vines: Provide vines with good, well-established root systems within the container, and devoid of any abrasions, and or damage to stem.

2.5 MISCELLANEOUS LANDSCAPE MATERIALS:

A. Tree Stakes: Provide stakes of sound new lodgepole pine 2 inch minimum diameter for 15 gallon to 24 inch box size trees; 3 inch minimum diameter for 36 inch box and larger. Lodge pole minimum height, as indicated on Contract Drawings. Stakes shall have been treated with copper napthanate or ACQ (alkaline) or Ca-B (copper azole) to a minimum wood depth of 1/16". All stakes shall be free of knots larger then 1/2" in diameter, holes and other defects.

B. Tree Straps: Provide VIT black tree straps. Tree straps shall be attached to tree stake as shown in staking detail on the plans, color to be black.
   1. VIT "Cinch-Tie" for 24-inch box size and smaller tree.
   2. VIT "Cinch-Belt" for 36-inch box size and larger tree.

C. Vine Ties: Plastic vine ties, as specified on plans.

D. Guying Materials
   1. At On-Grade Planting:

a. Anchor System: Duckbill Earth Anchor System, as manufactured by MacLean Civil Products, Inc.
   1) Tree sizes, 15 Gallon to 24-in box: Model 40 DTS.
   2) Tree sizes, 36-inch box to 48-inch box: Model 68 DTS.
   3) Tree sizes, 60-inch and larger: Model 88 DTS.
b. Hose: White neoprene hose, 3/4-inch diameter, covering the entire length of wire rope.

E. Headers and Edging
1. Aluminum Edging
   a. As noted in details.

F. Mulch
1. Cobble Mulch:
   a. Type and size as indicated on drawings.
   b. All aggregate rock shall be washed twice by Contractor and shall be clean prior to installation.
2. Bark Mulch:
   a. Mulch shall be shredded bark mulch, as manufactured by Whittier Fertilizer, Pico Rivera, CA.
      1) Mulch shall consist of shredded bark mulch with a particle range of 2-3/4-inch to 1-inch in size.
3. Weed Control Fabric: Place Mirafi Mirascape landscape fabric below rock mulch or as shown on drawings. Overlap all seams 12" minimum and pin down every 36" typical. Mirascape fabric available from: Towns & Associates, 800-222-6036

G. Root Control Barriers: High-density polyproylene root control planter. Acceptable products include:
1. Deep Root; Deep Root Corporation.
2. Size as specified on drawings.

H. Drainage Materials
1. Gravel in raised planters on structural slab and in pots shall be clean, coarse 3/8-inch to 3/4-inch diameter.
2. Gravel for tree drainage shall be 3/4" diameter coarse clean gravel.
3. Synthetic filter membrane cover over drainage course shall be woven synthetic fabrics.
   a. Model 140N, as manufactured by Mirafi.
4. Drain Pipe at trees: 4-inch diameter PVC perforated(within gravel), and non-perforated PVC drain pipe(stand pipe) with PVC adaptor connected to 4-inch ABS female reciever with 4-inch black ABS cleanout plug.

I. Sand: Washed plaster sand.

J. Jute Netting: A uniform open plan weave, single jute yarn not varying in thickness by more than 1/2 of its normal diameter, in rolled strips approximately 50 to 75 yards long and 50 to 60

inches wide. Contractor shall submit sample for approval prior to installation.

K. Weed Control: Phydura, or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected, and Architect has reviewed and accepted materials as defined within the section.

3.2 SITE OBSERVATION SCHEDULE

A. General: Notify Landscape Architect at least 5 days in advance when requesting on-site reviews.

B. Prior to commencement of site visits, items noted in previous observation reports shall have been either completed or remedied, unless such compliance has been waived. Failure to complete prior tasks or failure to prepare adequately for scheduled observations shall obligate Contractor to reimburse Architect for additional hourly services, plus transportation costs

C. Schedule For On-Site Reviews by the Landscape Architect:
1. Pre-construction conference with general contractor, grading contractor, landscape contractor, project arborist and landscape architect to discuss grading and protective measures to be followed in the vicinity of existing trees, or existing structures.
2. Review of soil sampling and fine grading prior to installation of any planting material.
3. At completion of finish grading, and roto-tilling
4. Review of irrigation coverage prior to installation of any planting material.
5. At completion of fine grading and at delivery of plant materials, together with plant layout; prior to excavating pits.
6. Review of drainage system, standpipes, and plant material locations.
7. After planting pits have been excavated, but prior to backfilling. Provide one sample plant pit mock up for review.
8. After initial planting operations (One tree with each type of specified staking shall be approved prior to planting of trees).
9. Stake all tree locations for review.
10. See "Final Review and Acceptance" at the end of Part 3 in this Section for final site observations and acceptance of work.

3.3 TESTING

A. Planting Soil: Agronomic Soil Testing
1. Test shall be paid for by the Contractor. Testing lab shall be:
a. Wallace Labs, El Segundo, CA

b. Waypoint Analytical, Anaheim, CA
c. Agronomic Soils Testing
    1) Take six samples of site soil at a depth of 6 to 12 inches, within proposed planting areas, after completion of final grading and prior to weed control and soil preparation.
    2) Take samples to agronomic soils testing laboratory indicated above for soil evaluation.
    3) Request testing for fertility and suitability analysis with written recommendations for soil amendment, fertilizer and chemical conditioners, application rates for soil preparation, planting backfill mix, pot-soil mix, hydro-spray, and post-maintenance fertilization programs.
    4) Soils report recommendations shall take precedence over the amendment and fertilizer application rates specified in this section.
    5) Submit testing laboratory's interpretation, recommendations, and comments to Architect within 14 days after the completion of rough grading.
d. Furnish a soils analysis of import soil, and organic soil amendment prior to backfill.
    1) Submit soil testing laboratory's findings to Architect within 5 days prior to backfilling.
e. Take six additional soil samples after completion of planting in the soil preparation and backfill mix areas, to be determine effectiveness to amendments prior and during planting. Submit to the testing laboratory the original amendment specification with previously issued bulletins for soil amendments and installation procedures. Re-apply necessary amendments based on recommendation of new soils test.

3.4 PREPARATION

A. Final Grades
1. Finished grading shall insure proper drainage of the site. Conform to Division 31 Section "Earthwork" and Division 32 Section "Landscape Grading."
2. The following areas shall be graded so that the final grades shall be established below adjacent paved areas, sidewalks, valve boxes, headers, clean outs, drains, manholes, etc. before placement of mulch as follows:
    a. Shrub/Groundcover Areas: 2-1/2 inches.
    b. Turf areas: 1-inch.
    c. Surface drainage shall be away from all building foundations, 2% minimum.
    d. Dispose of excess or unacceptable soil from the site at no expense to the Owner.
    e. Verify that final grades have been established prior to beginning planting operations.
3. Parking Lot Planters and areas adjacent to hardscape.
    a. All aggregate base rock, lime-treated soil, soil sterilents, and other non-organic materials shall be removed from all parking lot planter areas down to the level of native soil. Scarify native soil to a depth of 12 inches and backfill planters to

specified finish grade with native or approved topsoil and amend as specified.

b. Remove all concrete overpours or any material that may prohibit the placement of plant material, irrigation, grates, root barriers, or any other conflicting material.

4. Lightweight soil mix shall be sampled after mixing and delivery to the site, but prior to filling planters. Submit the original lightweight soil specification to the testing laboratory with previous bulletins for lightweight soil mix. Provide 1-quart of lightweight soil mix for every 65 cubic yards for organic and fertility analyses. Fertility analysis, recommendations and interpretations shall be furnished by the testing laboratory to ensure all specified amendments have been provided. Lightweight soil is to be used only in locations indicated on the Contract Drawings and as approved by the Architect.
5. Protect planting areas from compaction by foot, trucks and heavy equipment.

3.5 PLANTING BED ESTABLISHMENT

A. Preparation Of Planting Area

1. Cross-rip on-grade planting areas to a minimum depth of 12 inches minimum 2 perpendicular directions. Remove stones over ½ inch (13mm) in any dimension and sticks, roots, rubbish and other deleterious matter per Division 32 "Landscape Grading".
2. Where additional soil is needed, place the top 15” with topsoil. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil.
3. Leach soil prior to amending.
4. After approximate finished grades have been established and soil has been leached, soil shall be conditioned and fertilized in the following manner: Soil condition shall, at the rate specified in the approved soils test recommendations, be uniformly spread and cultivated thoroughly by means of mechanical tiller into the top eight inches (6”) of soil.
5. Broadcast soil amendments uniformly over surface of the area to be treated. Roto-till the top eight (8) inches of planting areas to evenly distribute the amendments and conditioners into the soil.
6. Retest as required to verify leaching was successful. All soil areas shall be compacted and settled by application of irrigation to a minimum depth of six (6) inches prior to any plant materials being installed.
7. At time of planting, the top 8 inches of all areas to be planted shall be free of stones, stumps, or other deleterious matter one 1/2 inch in diameter or larger, and shall be free from all debris, or similar objects that would be a hindrance to planting and maintenance.
8. Weed Eradication:
    a. Manually remove all existing vegetation in planting areas and dispose of it offsite.
    b. Fertilize planting areas with urea 30-0-0 commercial fertilizer at the rate of 0.5 pounds per 1000 square feet.
    c. Water planting areas thoroughly and continuously(by irrigation system, hand/hose, water truck, or other) for a period of 3 consecutive weeks, or until the weed seed have germinated. As accepted in advance by the Landscape Architect, employ a specific watering duration and frequency program designed to germinate residual weed seeds.
    d. Discontinue watering process for 2 days. Then apply a non-selective broad spectrum systemic herbicide for perennial weeds.(applications minimum) The type of herbicide to be used shall be determined by a licensed pest control applicator. If annual weeds

are present, use straight contact herbicide in accordance with pest control applicator's recommendations.

1) Do not use a pre-emergent herbicide.

e. Allow sufficient period of time to ensure that weeds are dead. Follow herbicide manufacturer's directions.

f. Water planting areas thoroughly and continuously (by irrigation system, hand/hose, water truck or other)for a period of 3 weeks. A shorter watering period may be permissible at the discretion of the Landscape Architect. Discontinue watering process for 1 day prior to the second application of the herbicide spraying.(2 applications minimum) Re-apply the spraying operation with straight contact weed killer in accordance with pest control adviser's recommendations.

1) Do not use a pre-emergent herbicide.

2) Avoid irrigation for a minimum of 4 days for effective final weed kill.

g. Clear desiccated weeds from the area.

h. Water Planting areas thoroughly and continuously for 3 consecutive days to saturate upper layers of soil prior to planting operations.

i. Allow planting area soil surface to dry out for I day only prior to the planting application. Exercise care to not allow the soil surface to be either super-saturated with water or bone dry prior to the planting installation. Ensure moderate residual moisture within the top 1/4 inch of the soil surface.

j. The hydraulic equipment used for pesticide applications shall consist of an ISO-gallon minimum capacity fiberglass tank with complete mechanical agitation. The pump capacity shall be 10 gallons per minute while operating at a pressure of 100 pounds. Per square inch.

k. Distribution lines shall be large enough to carry the volume of water necessary for even, chemical distribution. The spray nozzle must cover a IS-foot swath, with a minimum output of 5 gallons per minute at 80 pounds per square inch.

9. Pre-emergent Weed Control: Immediately after planting, apply pre-emergent weed control to planted areas which will not be seeded.

10. Excavation For Trees And Shrubs

a. Excavate pits, beds, and trenches as shown in details on the drawings.

B. Preparation for Lawn Areas: Limit preparation to areas which will be planted promptly after preparation.

1. Prepare planting area as described in 3.05 A.

2. Fine grade lawn areas to smooth, even surface with loose, uniformly fine texture. Roll, rake and drag lawn areas, remove ridges and fill depressions, as required to meet finish grades. Establish smooth uniform surface. Limit fine grading to areas which can be planted immediately after grading.

3. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.

4. Restore lawn areas to specified conditions if eroded or otherwise disturbed after fine grading and prior to planting.

3.6 JUTE MESH

A. Make check slots before the netting is rolled out. Dig a narrow trench across the slope perpendicular to the direction of the flow. Fold jute, the same length as the trench, and press together. Location of check slots shall be a maximum of 50 feet apart.

B. Installation: Roll netting parallel to slope contours. The netting shall completely cover all areas as indicated on Contract Drawings. Overlaps shall be ample and well stapled.
   1. Lay netting smoothly, and in continuous contact with the soil surface at all points.
   2. Install without stretching. Where one roll of netting ends and a second roll starts, the up slope piece shall be brought over the buried end of the second roll so that there is a 12-inch overlap. Where two or more widths of netting are applied, side by side, the overlap shall be not less than 3 inches.
   3. Staple overlapping edges that run parallel to the direction of the flow at 2-inch intervals. Outside edges, centers, and overlaps on banks shall be stapled across the slope at 6-inch intervals.
   4. Top dress jute netting area with a thin layer of topsoil. After the top dressing, the yarns shall still be visible.
   5. Spread loose topsoils over outside edges of netting to allow for smooth entry of water.
   6. Clods that hold the jute off the ground shall be stamped into the soil. Force jute netting down into depressions and hold there with a staple.
   7. Install plant material through netting.
   8. Maintenance: Maintain jute netting until work on the Project has been completed and accepted and during the 90-day maintenance period. Maintenance shall consist of the repair of eroded areas and the repair or replacement and re-stapling of loose or undermined netting. Replace damaged planting materials as required.
   9. Install jute netting in all areas of 30 percent slope or greater.

3.7 PLANTING

A. General
   1. Actual planting shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted practice, as approved by the Architect.
   2. Only as many plants as can be planted and watered on that same day shall be distributed in a planting area.
   3. Container shall be opened and plants shall be removed in such a manner that the ball of earth surrounding the roots is not broken and they shall be planted and watered as herein specified immediately after removal from the containers. Containers shall not be opened prior to placing the plants in the planting area.

B. Layout individual tree and shrub locations and areas for multiple plantings. Stake locations and outline areas and secure acceptance by the Architect before start of planting work. Make minor adjustments as may be requested.

C. Excavation for Trees and Shrubs:

1. Excavate pits, beds and trenches as shown in details on the Drawings.
2. Roughen and score edges of planting pit to eliminate any glazing of the sides of the pit.
3. Field Samples: Prior to planting, prepare one plant pit with standpipe, gravel, filter fabric, and root barriers for each tree size to be reviewed by the Architect.
4. Do not cover standpipes.
5. Excavation for planting shall include the stripping and stockpiling of all acceptable topsoil encountered within the areas to be excavated for trenches, tree pits, plant pits, and planting beds.

D. Container Removal
1. Cut containers on two sides with an acceptable cutter. Do not cut containers with spade or ax. Do not injure the rootball.
2. Carefully remove plants from containers without injury or damage to rootball.
3. After removing plants, superficially cut edge roots with knife on three sides.
4. For plants with sensitive roots, place container intact in flat pit 1½ times the size of a standard plant pit. Insert blades of sharp, needle-nose shears into a drain hole and cut the container bottom away. Remove bottom from pit. Follow with a cut down one side of the container from top to bottom. Repeat cut on opposite side. Fill plant pit with prepared plant pit mixture. Carefully remove the detached pieces.

E. Box Removal:
1. Remove bottom of planting boxes before planting.
2. Remove sides of box without damage to rootball after positioning plant and partially backfilling.

F. Planting Trees and Shrubs: Set container-grown stock, plumb and in center of pit or trench. Set top of rootball 2-inches above finish grade at trees, 1-inch above finish grade at shrubs, or as indicated on Contract Drawings. Do not use plant, if root system has severely kinked or circling roots, or if rootball is cracked, disturbed or broken. If root system is healthy, loosen spiraling roots and set in plant pit.

G. Planting pit shall be backfilled with the following soil conditioner and organic amendment, per cubic yard:
1. Application Rates, (FOR BID PURPOSES ONLY)as determined by contractor's soils tests:
   a. Potassium Sulfate - 0-0-50, ¼-pound
   b. Single Superphosphate - 0-20-0, ¼-pound
   c. Ammonium Sulfate - 21-0-0, ¼-pound
   d. Compost - 15% by volume
   e. Agricultural Gypsum - 1.5 pounds
   f. Good Humus - 15% by volume
2. Final amendments and rates are to be determined by Agronomic Soils Test.

H. When set, place additional fill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately 1/2-full, place appropriate number of fertilizer tablets and complete backfill operations.

I. After backfilling, an earthen basin shall be constructed around each plant. Each basin shall be as indicated on the Contract Drawings. Basin shall be of a size suitable for the individual plant. In no case shall the basin for fifteen (15) gallon plant be less than four (4) feet in diameter; a five (5) gallon plant less than three (3) feet in diameter. The basins shall be constructed of amended backfill materials, and shall not be constructed for trees in turf areas.

J. Repeat watering until no more is absorbed.

K. Apply pre-emergent herbicide as per manufacturer's recommendations to all shrub and ground cover planting areas after planting.

L. Mulch all planted areas that do not receive jute netting, other than lawn areas, at not less than 3" thickness of mulch.
   1. Areas greater than 30% slope shall be protected with jute mesh.

M. Equally space and align trees and shrubs in both directions where designated on Contract Drawings.

N. Pull bark mulch away from the rootballs of all plants to insure proper air circulation.

O. Prune, thin out and shape trees and shrubs in accordance with standard horticultural practices. Prune trees and other plantings only if required. Pruning shall be limited to remove injured wigs and branches, and to compensate for loss of roots during transplanting, but never exceed 1/3 of the branch structure. Never prune without prior review with Architect.

P. Prune shrubs to retain natural character. Unless directed by the Architect, do not prune leaders or apices of any plant material. Do not prune into balled or boxed forms without prior written approval of the Architect.

Q. Remove and replace excessively pruned or malformed stock resulting from improper pruning.

R. Planting Ground Cover
   1. Space plants as shown or scheduled.
   2. Dig holes large enough to allow for spreading of roots and compact area around plant. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water. Water thoroughly after planting, taking care not to cover crowns of plants with wet soils.
   3. Mulch areas between ground cover plants with not less than 2" deep mulch.

S. Miscellaneous Landscape Work: Install headers and edgings where shown. See appropriate details.

T. Planting Vines: Plant in accordance with details. Attach vine to vertical elements with vine ties as per manufacturer's recommendations.

U. Tree Staking and Guying: Stake or guy all trees per landscape details, and tie with tree ties as specified. Remove all nursery stakes from trees unless directed otherwise by the Architect.

Immediately after planting, stake and guy all trees in accordance with details indicated on Contract Drawings. One tree of each size shall be staked and guyed, and reviewed by Architect prior to continue work.

V. Hardpan Conditions
   1. Where hardpan exists, whether it is in the form of caliche, rock or other impervious matter, and it is within the top 2½ feet of soil, or within the plant pit, use powered equipment to break through completely at each plant location to allow drainage and root growth. Remove hardpan at least 1½ feet greater than the rootball diameter of plant. Backfill with soil mix as specified.
   2. Where hardpan is within the first 12-inches of soil, it shall be completely penetrated for all trees and shrubs.

3.8 CLEANUP AND PROTECTION:

A. During landscape work, keep pavements clean and work area in an orderly condition. Haul away and remove all debris from landscape areas, and do not leave any clippings, and or other material from landscape planting and/or maintenance period.

B. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and/or other trades. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape work as directed.

C. Powerwash all pavement and flatwork as necessary to remove all staining and tire marks and provide a clean surface.

3.9 FINAL REVIEW & ACCEPTANCE

A. General: Notify Landscape Architect at least 5 days in advance when requesting on-site reviews.

B. Final Site Observation requirements:
   1. Punch list at substantial completion.
   2. Final review of grading, irrigation and planting (to begin Maintenance Period).
   3. Final acceptance of project (at end of Maintenance Period).
   4. Refer to Division 32 Section "Landscape Maintenance."
   5. The maintenance period will not begin until all punchlist items are resolved and acceptance is provided by the architect in writing.
   6. Where observed work does not comply with the Plans and Specifications, replace rejected work and continue specified maintenance period until reinspected by the Landscape Architect and determined to be acceptable. All replacement materials and installations shall be in accordance with the Plans and Specifications. Remove rejected work and materials immediately from project. Prior to the date of final observation, Contractor shall provide the Landscape Architect with all Record Drawings in accordance with the Plans and Specifications.

3.10 GUARANTEE AND REPLACEMENT

A. Guarantee: All plant material and other materials installed under the Contract shall be guaranteed against any and all poor, inadequate or inferior materials and/or workmanship or improper maintenance, as determined by the Landscape Architect, and shall be replaced by the Contractor at his expense. Warranty periods are as follows:
   1. Trees, vines, and shrubs: One Year
   2. Groundcover and Turf: One Year
   3. Replacement: Any materials found to be dead, missing, or not in a satisfactory or healthy condition during the maintenance period shall be replaced immediately. The Landscape Architect shall be sole judge as to the condition of material. Material to be replaced within the guarantee period shall be replaced by the Contractor within five (5) days of written notification by the Landscape Architect. All replacement materials and installations shall comply with the Plans and Specifications. Any plant missing due to suspected theft shall be replaced by the Contractor. If the Contractor suspects that theft may be a problem, the Contractor shall provide written documentation to the Landscape Architect that security on this site needs to be intensified.
   4. The Contractor may relieve himself of theft responsibility if after the security notice, with no result, a written notice to the Landscape Architect shall be given that plant material will not be replaced for theft or vandalism due to lack of site security being maintained. This procedure may take place only during the Landscape Maintenance Period.

END OF SECTION

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SECTION 331416 - SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe and fittings for site water lines including domestic water lines.

B. Water pipe for site conveyance lines.

C. Pipe valves.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete for thrust restraints.

B. Section 211100 - Facility Fire-Suppression Water-Service Piping.

C. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.

D. Section 312323 - Fill: Bedding and backfilling.

1.3 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.

C. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2022.

D. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 2021a.

E. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 2023.

F. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets 2020.

G. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.

H. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service 2023.

I. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 60 In. (100 mm through 1500 mm) 2022.

J. Local Water Agency: Cucamonga Valley Water District.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with utility company requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.1 WATER PIPE

A. Copper Tubing: ASTM B88, Type K, Annealed:
   1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
   2. Joints: Compression connection or AWS A5.8M/A5.8, BCuP silver braze.

B. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service " in large letters. Coordinate with Section 312316.13.

2.2 VALVES

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Gate Valves Up To 3 Inches:
   1. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, post indicator, valve key, and extension box.

2.3 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 312316.13.

B. Cover: As specified in Section 312316.13.

2.4 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type specified in Section 033000.

B. Backflow Preventer: as required by Cucamonga Valley Water District.

C. Meter: as required by Cucamonga Valley Water District.

D. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service" in large letters. Coordinate with Section 312316.13.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to beginning work, verify that building service connection and municipal and site water main size, location, and invert are as indicated.

3.2 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.3 TRENCHING

A. See the section on trenching for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide thrust restraint bearing on subsoil, size as indicated.

D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.4 INSTALLATION - PIPE

A. Install pipe to indicated elevation to within tolerance of 5/8 inches.

B. Install ductile iron piping and fittings to AWWA C600.

C. Route pipe in straight line.

D. Install pipe to allow for expansion and contraction without stressing pipe or joints.

E. Install trace wire 6 inches above top of pipe; coordinate with Section 312316.13.

3.5 SERVICE CONNECTIONS

A. Provide water service to utility company requirements with reduced pressure backflow preventer and water meter with bypass valves.

3.6 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Pressure test water piping as required by the local water agency and in accordance with AWWA C-605 for PVC or AWWA C-600 for ductile iron pipes.

C. Water piping and appurtenances shall be disinfected in accordance with AWWA C-651.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

END OF SECTION

SECTION 333113 - SITE SANITARY SEWERAGE GRAVITY PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sanitary sewerage drainage piping, fittings, and accessories.

B. Connection of building sanitary drainage system to municipal sewers.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete for cleanout base pad construction.

B. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.

C. Section 312323 - Fill: Bedding and backfilling.

1.3 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.4 REFERENCE STANDARDS

A. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 2021a.

B. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2021.

C. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2023.

D. Local Water Agency: Cucamonga Valley Water District.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating pipe, pipe accessories .

PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS

A. Provide products that comply with applicable code(s).

B. Plastic Pipe: ASTM D1785, Schedule 40, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter of less than 3 inches, bell and spigot style solvent sealed joint end.

C. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.2 PIPE ACCESSORIES

A. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Sewer Service " in large letters. Coordinate with Section 312316.13.

2.3 BEDDING AND COVER MATERIALS

A. Pipe Bedding Material: As specified in Section 312316.13.

B. Pipe Cover Material: As specified in Section 312316.13.

PART 3 EXECUTION

3.1 GENERAL

A. Perform work in accordance with applicable code(s).

3.2 **EXAMINATION**

A. Prior to beginning work, verify that building service connections, municipal and site storm main size, location, and invert are as indicated.

3.3 TRENCHING

A. See Section 312316.13 for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.4 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
   1. Plastic Pipe: Also comply with ASTM D2321.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

D. Connect to building sanitary sewer outlet and municipal sewer system , through installed sleeves.

E. Install trace wire 6 inches above top of pipe; coordinate with Section 312316.13.

3.5 INSTALLATION - CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Establish elevations and pipe inverts for inlets and outlets as indicated.

D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.6 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 014000.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

C. Pressure Test: Test in accordance with Greenbook Section 306-7.8.2.4.

D. Infiltration Test: Test in accordance with Greenbook Section 306-7.8.2.3.

3.7 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

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SECTION 334211 - STORMWATER GRAVITY PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Storm drainage piping, fittings, and accessories.

B. Connection of drainage system to public storm drain system.

C. Catch basins, Plant area drains, and Paved area drainage.

1.2 RELATED REQUIREMENTS

A. Section 312316 - Excavation: Excavating of trenches.

B. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.

C. Section 312323 - Fill: Bedding and backfilling.

1.3 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.4 REFERENCE STANDARDS

A. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2021.

B. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2023.

C. Standard Specifications for Public Works Construction (Greenbook); current edition.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating pipe, pipe accessories, and other drain components as indicated.

C. Field Quality Control Submittals: Document results of field quality control testing.

D. Project Record Documents:
   1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.1 **STORM DRAINAGE PIPE MATERIALS**

A. Plastic Pipe: ASTM D3034, Type PSM, Poly Vinyl Chloride (PVC) material; inside nominal diameter of less than 15 inches, bell and spigot style solvent sealed joint end.

B. Cast in Place Concrete: Greenbook Section 201-1.

2.2 PIPE ACCESSORIES

A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

B. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Storm Sewer Service " in large letters. Coordinate with Section 312316.13.

2.3 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 312316.13.

B. Cover: As specified in Section 312316.13.

PART 3 EXECUTION

3.1 **EXAMINATION**

A. Prior to beginning work, verify that building service connection and municipal and site utility water main size, location, and invert are as indicated.

3.2 TRENCHING

A. See Section 312316.13 - Trenching for additional requirements.

B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.3 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
   1. Plastic Pipe: Also comply with ASTM D2321.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

D. Connect to building storm drainage system, foundation drainage system, and utility/municipal sewer system.

E. Install continuous trace wire 6 inches above top of pipe; coordinate with Section 312316.13.

3.4 INSTALLATION - CATCH BASINS, TRENCH DRAINS AND CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated.

E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

F. Prefabricated trench drains:
   1. Excavate; prepare substrate and supports according to the manufacturer's printed installation instructions.
   2. Install prefabricated trench drain system according to the manufacturer's printed installation instructions.
   3. Expansion, Construction, and Control Joints: Do not locate trench drain system on an expansion, construction or control joint in concrete or pavement. Where concrete or pavement joints running transverse to direction of flow cross the trench drain system, locate concrete or pavement joints and trench drain system joints so that both coincide.
   4. Concrete Trench Support: 3000 pounds per square inch compressive strength, minimum.
      a. Provide support on all sides of trench in minimum thickness recommended by trench drain system manufacturer.
      b. Screed and finish top edge of concrete flush with top surface of trench drain system.
      c. Do not use secondary edge finishing tools.

3.5 FIELD QUALITY CONTROL

A. Perform field inspection in accordance with Section 014000 - Quality Requirements.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
   1. Air Pressure Test: Test in accordance with Greenbook Section 306-7.8.2.4.
   2. Water Infiltration Test: Test in accordance with Greenbook Section 306-7.8.2.3.

3.6 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION